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Preface

The Agency for Healthcare Research and Quality (AHRQ), through its Evidence-Based Practice Centers (EPCs), sponsors the development of evidence reports and technology assessments to assist public- and private-sector organizations in their efforts to improve the quality of health care in the United States. The reports and assessments provide organizations with comprehensive, science-based information on common, costly medical conditions and new health care technologies. The EPCs systematically review the relevant scientific literature on topics assigned to them by AHRQ and conduct additional analyses when appropriate prior to developing their reports and assessments.

To bring the broadest range of experts into the development of evidence reports and health technology assessments, AHRQ encourages the EPCs to form partnerships and enter into collaborations with other medical and research organizations. The EPCs work with these partner organizations to ensure that the evidence reports and technology assessments they produce will become building blocks for health care quality improvement projects throughout the Nation. The reports undergo peer review prior to their release.

AHRQ expects that the EPC evidence reports and technology assessments will inform individual health plans, providers, and purchasers as well as the health care system as a whole by providing important information to help improve health care quality.

We welcome comments on this evidence report. They may be sent by mail to the Task Order Officer named below at: Agency for Healthcare Research and Quality, 540 Gaither Road, Rockville, MD 20850, or by e-mail to **epc@ahrq.gov.**

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Structured Abstract

Objective: Despite the broad range of continuing medical education (CME) offerings aimed at educating practicing physicians through the provision of up-to-date clinical information, physicians commonly overuse, under-use, and misuse therapeutic and diagnostic interventions. It has been suggested that the ineffective nature of CME either accounts for the discrepancy between evidence and practice or at a minimum contributes to this gap. Understanding what CME tools and techniques are most effective in disseminating and retaining medical knowledge is critical to improving CME and thus diminishing the gap between evidence and practice. The purpose of this review was to comprehensively and systematically synthesize evidence regarding the effectiveness of CME and differing instructional designs in terms of knowledge, attitudes, skills, practice behavior, and clinical practice outcomes.

Methods: We formulated specific questions with input from external experts and representatives of the Agency for Healthcare Research and Quality (AHRQ) and the American College of Chest Physicians (ACCP) which nominated this topic. We systematically searched the literature using specific eligibility criteria, hand searching of selected journals, and electronic databases including: MEDLINE®, EMBASE®, the Cochrane Database of Systematic Reviews, The Cochrane Central Register of Controlled Trials (CENTRAL), the Cochrane Database of Abstracts of Reviews of Effects (DARE), PsycINFO, and the Educational Resource Information Center (ERIC®). Two independent reviewers conducted title scans, abstract reviews, and then full article reviews to identify eligible articles. Each eligible article underwent double review for data abstraction and assessment of study quality.

Results: Of the 68,000 citations identified by literature searching, 136 articles and 9 systematic reviews ultimately met our eligibility criteria. The overall quality of the literature was low and consequently firm conclusions were not possible. Despite this, the literature overall supported the concept that CME was effective, at least to some degree, in achieving and maintaining the objectives studied, including knowledge (22 of 28 studies), attitudes (22 of 26), skills (12 of 15), practice behavior (61 of 105), and clinical practice outcomes (14 of 33). Common themes included that live media was more effective than print, multimedia was more effective than single media interventions, and multiple exposures were more effective than a single exposure. The number of articles that addressed internal and/or external characteristics of CME activities was too small and the studies too heterogeneous to determine if any of these are crucial for CME success. Evidence was limited on the reliability and validity of the tools that have been used to assess CME effectiveness. Based on previous reviews, the evidence indicates that simulation methods in medical education are effective in the dissemination of psychomotor and procedural skills.

Conclusion: Despite the low quality of the evidence, CME appears to be effective at the acquisition and retention of knowledge, attitudes, skills, behaviors and clinical outcomes. More research is needed to determine with any degree of certainty which types of media, techniques, and exposure volumes as well as what internal and external audience characteristics are associated with improvements in outcomes.

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Appendixes and Evidence Tables for this report are provided electronically at http://www.ahrq.gov/downloads/pub/evidence/pdf/cme/cme.pdf**.**

Executive Summary

Introduction

Continuing medical education (CME) is defined as educational activities that serve to maintain, develop, or increase the knowledge, skills, performance, and relationships a physician uses to provide services for patients, the public, or the profession. Despite the broad range of CME aimed at educating practicing physicians, researchers have found that physicians commonly overuse, under use, and misuse therapeutic and diagnostic interventions. It has been suggested that CME may not be effective enough to significantly narrow the gap between what is done in clinical practice and what should be done based on current evidence. Understanding what CME tools and techniques are most effective in disseminating and retaining medical knowledge is critical to improving the effectiveness of CME and thus diminishing the gap between evidence and practice.

To date, relatively little has been done to comprehensively and systematically synthesize evidence regarding the effectiveness of CME and the comparative effectiveness of differing instructional designs for CME in terms of impact on knowledge, attitudes, skills, practice behavior, and clinical practice outcomes. Review of evidence elucidating the value of CME (and ways the activities could be improved, if appropriate) could yield tremendous value to policy makers and professional organizations seeking to make recommendations regarding the optimal delivery of medical care.

The American College of Chest Physicians (ACCP) recognized the potential value of identifying and synthesizing the evidence in this area, and nominated this topic to the Evidence-based Practice Center (EPC) Program of the Agency for Healthcare Research and Quality (AHRQ). In response to this request by the ACCP, the Johns Hopkins EPC performed a systematic review to address the following key questions (KQ) pertaining to the effectiveness of CME:

- KQ1 Is there evidence that particular methods of delivering CME are more effective in: a) imparting knowledge to physicians, b) changing physician attitudes, c) acquiring skills, d) changing physician practice behavior, or e) changing clinical practice outcomes?
- KQ2 Do changes in knowledge, attitudes, skills, practice behavior, or clinical practice outcomes produced by CME persist over time (greater than or equal to 30 days)?
- KQ3 What is the evidence from systematic reviews about the effectiveness of simulation methods in medical education outside of CME?
- KQ4 Which characteristics of the audience by themselves or in combination with other characteristics influence the effectiveness of certain educational techniques?
- KQ5 Which external factors by themselves or in combination with other factors reinforce the effects of CME in changing behavior?
- KQ6 What is the reported validity and reliability of the methods that have been used for measuring the effects of CME in terms of: a) imparting knowledge, b) changing attitudes, c) acquiring skills, d) changing practice behavior, or e) changing clinical practice outcomes?

Methods

To answer these questions, we identified primary literature on the effectiveness of CME and systematic reviews on the effectiveness of simulation techniques in medical education by running searches through February 2006 of the following databases: MEDLINE®, EMBASE®, the Cochrane Database of Systematic Reviews, The Cochrane Central Register of Controlled Trials (CENTRAL), the Cochrane Database of Abstracts of Reviews of Effects (DARE), PsycINFO©, and the Educational Resource Information Center (ERIC®). Additionally, we searched by hand the references of included articles and the table of contents of selected journals from February 2005 through February 2006.

Two independent reviewers conducted title scans in a parallel fashion. If either reviewer felt that a title was potentially eligible, it was promoted to abstract review. The abstract review phase was designed to identify studies reporting on the effects of CME or simulation on clinical practice in terms of knowledge, attitudes, skills, practice behaviors, or clinical outcomes. Abstracts were promoted to full article review if both reviewers agreed the abstract met our specific inclusion criteria.

Each included article underwent double review by our investigators for data abstraction and assessment of study quality. For all articles containing original data, reviewers extracted information on study characteristics (e.g., study participants, sample size, study setting, evaluation methods, and study design), CME characteristics, and outcomes. We assessed which of 16 CME methods were employed (see Table 1 in full report), such as lecture, discussion group, academic detailing, etc. – most incorporated more than one method. We also rated interventions on the extent to which the CME activity incorporated 9 adult learning principles, such as enabling learners to be active contributors to their learning, relating the curriculum to learner's current experiences, etc. The study quality form was based on the Jadad criteria. For reviews that applied to KQ 3, reviewers abstracted information on: characteristics of the review; outcomes evaluated and type of objective; meta-analyses conducted; summary of results; conclusions; and quality of the review.

We graded the quantity, quality, and consistency of the available evidence addressing KQs 1, 2, and 3 by adapting an evidence grading scheme recommended by the GRADE Working Group. We applied evidence grades to bodies of evidence on each type of objective (i.e., knowledge, attitudes, skills, practice behaviors, and clinical outcomes).

Results

Key Question 1: Is there evidence that particular methods of delivering CME are more effective in: a) imparting knowledge to physicians, b) changing physician attitudes, c) acquiring skills, d) changing physician practice behavior, or e) changing clinical practice outcomes?

Key Question 2: Do changes in knowledge, attitudes, skills, practice behavior, or clinical practice outcomes produced by CME persist over time (greater than or equal to 30 days)?

Knowledge Outcomes

- A total of 39 studies addressed 41 knowledge objectives. Only 28 of those studies had a control group.
- Seventy-eight percent of the 28 studies with an adequate control group demonstrated that CME activities were effective at improving knowledge with the majority (68 percent) of these studies demonstrating long-term improvements in knowledge.
- The studies were heterogeneous, making it difficult to determine how results differed according to media type, educational technique, or number of exposures.
- The only recognized trends regarding differences by media type were that combine multimedia interventions (e.g., use of live and print media) were better than a single media intervention and that print interventions were either not beneficial or very weak in their ability to improve knowledge. We defined "media" as the method through which the CME activity is delivered.
- When these studies were reviewed according to educational technique, it appeared that multiple techniques that most commonly included case-based learning were more likely to improve knowledge when compared to a single technique. Case-based learning is an educational technique where actual or authored clinical cases are created to highlight learning objectives; clinical material is presented and followed with questions usually determined by the instructor.
- The evidence also suggested that multiple exposures produced better knowledge gains than a single exposure to content. Exposure was defined as one session versus more than one. An additional session could have used print media, computer media, a repeat live performance, or audio tape.

Attitudinal Outcomes

- A total of 35 studies addressed 45 attitude objectives. Thirty one of the studies had a control group.
- Seventy-one percent of the 31 studies with an adequate control group demonstrated that CME activities were effective at improving attitudes, such as attitudes regarding use of screening tests or clinical management options. The majority (68 percent) of these studies demonstrated long-term improvements in attitudes.
- The studies were heterogeneous, again making it difficult to determine how results differed according to media type, educational technique, or number of exposures.
- The only recognized trends regarding differences by media type were that multimedia interventions were better than a single media intervention and that print interventions were either not beneficial or very weak in their ability to improve attitudes.
- The only recognized trend regarding differences by educational technique was that use of multiple techniques that most commonly include case-based learning seemed to be more likely to improve attitudes than use of a single technique.

- The evidence suggested a trend toward multiple exposures being of greater benefit for attitudinal change then a single exposure, although it must be pointed out that all seven studies that evaluated a single exposure indeed demonstrated improvements in attitudes.

Skill Outcomes

- Twelve (80 percent) of the 15 studies that reported skill outcomes involved cognitive skills (i.e., ability to apply knowledge), with the remaining three involving psychomotor skills (i.e., procedures or physical examination techniques). Little can be said about the effectiveness of CME for psychomotor skills given the paucity of data in this area.
- Seven (47 percent) of the 15 studies reporting skill outcomes had an evaluation beyond 30 days after the CME activity. Six of seven studies addressed the long-term effect of CME on cognitive skills and five of the six demonstrated a positive effect.
- Given the dominance of live methods (seven live, four print, two video, two audio, three Internet/computer) among the studies that met their skill objectives, the data suggested that live methods had the greatest impact on the effectiveness of CME regarding skill-related outcomes. Given the paucity of data and the varied results, little can be said about the relative effectiveness of other CME media methods on skills. Based on the limited data, it is difficult to draw conclusions on particular media methods that have an impact on skill long-term.
- Given the limited number of studies, the wide variety of techniques described, and the conflicting results, it is difficult to draw conclusions about the educational techniques that have the greatest short- and long-term effects on skills.
- Most of the studies that met their skill objectives had multiple exposures to the CME activity as did most of the studies that evaluated the long-term effect on skills.

Practice Behavior Outcomes

- A total of 105 studies evaluated the impact of CME on short- and long-term physician practice behavior objectives, and 61 (58 percent) of the studies met practice objectives. Fifty studies with evaluation duration greater than 30 days met objectives, suggesting not only short-term, but also long-term CME effectiveness.
- Most studies that evaluated the impact of different types of CME media found that use of single live media had both a short- and long-term effect on practice behavior objectives, and that single print media is ineffective. Most of the studies suggested that multimedia-based CME have both a short- and long-term effect on practice behavior objectives.
- Of the studies evaluating the short- and long-term impact of different types of CME techniques on practice behavior objectives, most reported mixed results for a single technique, and overall effectiveness for use of multiple techniques. The use of multiple techniques may be advantageous over the use of a single technique.
- Most studies evaluating the short- and long-term impact of different volumes of exposure to CME on practice behavior objectives suggested that both single and multiple exposures are effective overall.

Clinical Outcomes

- Thirty-seven studies evaluated the impact of CME on clinical outcomes.

- Only one of the 37 studies measured short-term clinical outcomes and it suggested an inconclusive effect. Three of the studies did not report the time at which clinical outcomes were measured.
- Of the 33 studies that measured long-term clinical outcomes, 14 (42 percent) were successful in demonstrating a beneficial effect of CME.
- When evaluating the impact of different types of CME media on long-term clinical outcomes, the use of multiple media was more effective than use of single media in six of the seven studies that made this comparison.
- Of the five studies that compared clinical outcomes with use of single versus multiple educational techniques in CME, three showed that multiple techniques were superior to a single technique.
- In four (57 percent) of the seven studies that evaluated the impact of a single CME exposure on clinical outcomes, the CME objective was met. However, insufficient data were available on whether multiple CME exposures produce better clinical outcomes than single exposure CME.

Key Question 3: What is the evidence from systematic reviews about the effectiveness of simulation methods in medical education outside of CME?

- Eight reviews evaluated the role of simulation in skill acquisition, while two reviews evaluated the role of simulators in knowledge acquisition. Simulation methods used in these reviews included computer simulations (e.g., learning cardiovascular physiology), virtual reality (e.g., learning laparoscopic procedures), standardized patients (e.g., learning effective communication), and manikins (e.g., learning physical diagnosis).
- Overall, the direction of evidence pointed to the effectiveness of simulation training, especially in psychomotor skills (i.e., procedures or physical examination techniques) and communication skills.
- The strength of the evidence was considered low, due to the small number of appropriate studies, the scarcity of quantitative data, and a number of study limitations.

Key Question 4: Which characteristics of the audience by themselves or in combination with other characteristics influence the effectiveness of certain educational techniques?

- Thirteen studies examined the influence of audience characteristics on the educational intervention. These included such characteristics as age, gender, practice setting, and years in practice, among others.
- The small and heterogeneous studies available did not allow us to reach definitive conclusions regarding the influence of audience characteristics on the effectiveness of CME.

Key Question 5: Which external factors by themselves or in combination with other factors reinforce the effects of CME in changing behavior?

- Five studies examined the influence of external factors on the educational intervention. The small and heterogeneous studies available did not allow us to reach definitive conclusions regarding the influence of external factors on the effectiveness of CME.

Key Question 6: What is the reported validity and reliability of the methods that have been used for measuring the effects of CME in terms of: a) imparting knowledge, b) changing attitudes, c) acquiring skills, d) changing practice behavior, or e) changing clinical practice outcomes?

- Forty-five of 136 articles (33 percent) reported the validity and/or reliability within the study population of at least one evaluation method for assessing the effectiveness of CME, for a total of 61 methods. Validity refers to the degree to which a method truly measures what it is intended to measure. Reliability refers to the consistency or reproducibility of measurements.
- Of the 61 evaluation methods with validity or reliability reported, 29 evaluation methods were drawn from previous studies, and 24 were created for the current studies. For eight methods, the source was unclear. Authors frequently did not report reliability testing within the new study population for methods found to be reliable in other populations.
- Of 61 evaluation methods with validity or reliability reported, 16 (26 percent) included descriptions of validity alone, 28 (46 percent) included descriptions of reliability alone, and nine (15 percent) had descriptions of both validity and reliability. For six methods (10 percent), the methods were described as valid and/or reliable, but the specific type of validity or reliability was not reported.
- The most common type of outcome evaluated by valid and/or reliable evaluation methods involved practice behaviors, for 31 out of 61 methods (51 percent). Knowledge or cognitive skills were evaluated by 15 methods (24 percent). Attitudes were evaluated by seven methods (12 percent). Skills were evaluated by 11 methods (18 percent). Clinical outcomes (with or without practice behaviors) were evaluated by 8 methods (13 percent).
- Among these 61 methods, content validity (i.e., the degree to which an instrument accurately represents the skill or characteristic it was designed to measure) was the most commonly reported type of validity (27 percent).
- Among these 61 methods, inter-rater reliability (28 percent) and internal consistency (23 percent) were the most common types of reliability reported. Inter-rater reliability is the degree to which measurements are the same when obtained by different persons. Internal consistency is a measure of how well items reflecting the same construct yield similar results.

Discussion

Conclusions

Overall, despite the generally low quality of the evidence, most of the studies reviewed suggested that CME is effective, at least to some degree, in not only achieving, but also in maintaining the objectives studied. Despite the wide variety of CME techniques, media, and exposures used, and the heterogeneity of the studies, we found common themes among studies which applied across objectives. For example, when assessing the effectiveness of CME across domains, print media seemed to be less effective than live media, and multimedia activities generally seemed more effective than single media. In addition, interactive techniques seem to be more effective than non-interactive ones, and multiple exposures to the CME activity seem to be more effective than a single exposure. Thus, the evidence supports consideration of these attributes of effective educational interventions when designing a CME course.

We evaluated the effect of simulation methods in medical education by conducting a review of systematic reviews. Although we found that simulation training generally was effective, especially in the dissemination of psychomotor skills (e.g., procedures or physical examination techniques), studies which examined simulation did not review outcomes along the entire continuum of domains (i.e., knowledge through clinical outcomes), and were heterogeneous enough that few other conclusions could be drawn.

We also studied whether certain internal (audience) and external characteristics or factors may affect the effectiveness of CME. We found that the small and heterogeneous studies available did not allow us to reach definitive conclusions regarding the influence of audience characteristics or external factors on the effectiveness of CME.

Limitations

This review has several important limitations. The heterogeneous nature of the studies precludes a quantitative summary of the effectiveness of CME. The educational interventions studied targeted different types of audiences, using multiple types of objectives across diverse content areas. This makes it difficult to generalize results from one field of CME to another.

Furthermore, we cannot draw firm conclusions about the effectiveness of CME because of the generally low quality of study designs, the variable quality of reporting in studies, and the lack of valid and reliable CME evaluation tools. Although we used a comprehensive search strategy, we cannot rule out some degree of publication bias. The review does point out a lack of standardization of approaches to CME research in general, including the lack of standardization for definitions of controls. The CME literature in general lacks standardization of terminology related to media type, educational techniques, and exposure volume, which makes it difficult to determine the impact of these factors on the effectiveness of CME.

Future Research Implications

- Educators should develop strategies for identifying and prioritizing the gaps in our knowledge about CME that should be the focus of further research.

- More randomized controlled studies of CME should be performed with clear definition of intervention and control groups and measurement of effectiveness at multiple points post-intervention. Such studies should focus on high priority areas given the resource limitations that educators face in conducting research on CME.
- To advance such research on CME, leaders in medical education could develop a national agenda on what is needed most to improve the effectiveness of CME.
- In developing a national agenda for research on CME, educational leaders should establish a clear definition of what constitutes CME. For example, does quality improvement or practice improvement alone constitute CME?
- Future research on CME should include development of more standardized approaches to describe CME interventions, media, techniques, and exposure volumes.
- Further studies should examine emerging methods of CME such as Internet-based CME that could be available to clinicians at the point of care.
- Future research on CME should be based on a sound conceptual model of what influences the effectiveness of CME.

Evidence Report

Chapter 1. Introduction

Continuing medical education (CME) was initiated by the American Academy of General Practice, which has required CME for membership since 1947.[1] The American Medical Association (AMA) presently defines continuing medical education as "educational activities that serve to maintain, develop, or increase the knowledge, skills, and professional performance and relationships a physician uses to provide services for patients, the public, or the profession."[2] The AMA defines the content of CME as "that body of knowledge and skills generally recognized and accepted by the profession as within the basic medical sciences, the discipline of clinical medicine, and the provision of health care to the public."[2] In 1971 New Mexico became the first state to require CME credit for relicensure. Physicians commonly spend an average of 50 hours per year in CME activities geared toward improving their performance and optimizing their care of patients. Participation in CME is not voluntary as, in 41 states, it is a requirement for continued physician licensure and is often a requirement for hospital credentials and participation in many managed care plans. This has led to the proliferation of CME offerings aimed at providing physicians with the CME credits they require.

Despite the broad range of CME offerings aimed at educating the nation's practicing physicians through the provision of up-to-date clinical information, researchers have found that physicians commonly overuse, underuse, and misuse therapeutic and diagnostic interventions.[3] Some medical educators have suggested that CME may not be effective enough to significantly narrow the gap between what is done in clinical practice and what should be done based on current evidence. Understanding what CME tools and techniques are most effective in disseminating and retaining medical knowledge is critical to improving the effectiveness of CME and thus diminishing the gap between evidence and practice.

To date, relatively little has been done to comprehensively and systematically synthesize evidence regarding the effectiveness of CME and the comparative effectiveness of differing instructional designs for CME and their impact on knowledge, attitudes, skills, practice behavior, and clinical practice outcomes. Review of evidence elucidating the value of CME (and ways the activities could be improved, if appropriate) could yield tremendous value to policy makers and professional organizations seeking to make policy recommendations regarding the optimal delivery of medical care. Such a review could have particular significance in light of the American Board of Medical Specialties (ABMS) recently initiated robust Maintenance of Certification (MOC) program that requires evidence of self-directed learning which is commonly accomplished through attendance at CME activities.[4] In addition, as the National Institutes of Health (NIH) and the Agency for Healthcare Research and Quality (AHRQ) place more emphasis on translating scientific knowledge into clinical practice,[5] educators will need to apply evidence-based approaches to CME that will support translating knowledge into practice. Furthermore, the published literature demonstrates a large gap between recommended processes of care and those delivered.[6] Effective CME is required to help fill that gap.

The American College of Chest Physicians (ACCP) recognized the potential value of identifying and synthesizing the evidence in this area, and nominated this topic to the Evidence-based Practice Center Program (EPC) of AHRQ. In response to this request by the ACCP, the Johns Hopkins EPC performed a systematic review to address the following key questions pertaining to the effectiveness of CME:

1. Is there evidence that particular methods of delivering CME are more effective in: a) imparting knowledge to physicians, b) changing physician attitudes, c) acquiring skills, d) changing physician practice behavior, or e) changing clinical practice outcomes?
2. Do changes in knowledge, attitudes, skills, practice behavior, or clinical practice outcomes produced by CME persist over time (greater than or equal to 30 days)?
3. What is the evidence from systematic reviews about the effectiveness of simulation methods in medical education outside of CME?
4. Which characteristics of the audience by themselves or in combination with other characteristics influence the effectiveness of certain educational techniques?
5. Which external factors by themselves or in combination with other factors reinforce the effects of CME in changing behavior?
6. What is the reported validity and reliability of the methods that have been used for measuring the effects of CME in terms of a) imparting knowledge, b) changing attitudes, c) acquiring skills, d) changing practice behavior, or e) changing clinical practice outcomes?

Chapter 2. Methods

The ACCP requested an evidence report to review and synthesize published literature regarding the effectiveness of CME, the comparative effectiveness of instructional designs for CME, and their impact on imparting knowledge, changing attitudes, acquiring skills, changing practice behavior, and changing clinical practice outcomes. Our EPC established a team and a work plan to develop the evidence report. The project consisted of recruiting technical experts, formulating and refining the specific questions, performing a comprehensive literature search, summarizing the state of the literature, constructing evidence tables, synthesizing the evidence, and submitting the report for peer review.

Topic Development

The topic for this report was nominated in a public process. At the beginning of the project, we recruited a panel of external technical experts to give input on key steps including the selection and refinement of the questions to be examined. The panel included external experts who have strong expertise in CME (see Appendix A[a]).

We worked with the technical experts and representatives of AHRQ and ACCP to develop the Key Questions that are presented in the Scope and Key Questions section of Chapter 1 (Introduction). Based on the feedback from the technical experts, AHRQ, ACCP, and our team members, we expanded the preliminary questions to include knowledge, attitude, skills, practice behavior, and clinical outcomes and to address potential synergies between learning methods. We refined Key Question 3 to focus on the effectiveness of simulation methods used in medical education. Additionally, we added Key Question 6, which assesses the validity and reliability of tools used to evaluate the effectiveness of CME. The Key Questions focus on the effectiveness of CME in (1) imparting knowledge, (2) changing attitudes, (3) acquiring skills, (4) changing practice behaviors, or (5) changing clinical practice outcomes. We considered any test of physician or CME participant knowledge as knowledge. Attitudes were limited to physician or CME participant attitudes; attitudes could include physician attitudes toward a medical topic, physician comfort level, or satisfaction with the course. Skills were divided into cognitive skills (ability to apply knowledge) and psychomotor skills (e.g., procedures or physical examination techniques). Practice behavior referred to any type of physician behavior. We defined clinical outcomes as any change in patient health status, health-related behavior of patients, or attitudes of the patients about the physicians toward whom the CME intervention was directed. Thus, in addition to direct measures of health status such as blood pressure and fasting blood glucose, we also included indirect measures such as patient satisfaction, medication adherence, and smoking cessation.

Search Strategy

Searching the literature included the steps of identifying reference sources, formulating a search strategy for each source, and executing and documenting each search. Additionally, we

[a] Appendixes cited in this report are provided electronically at http://www.ahrq.gov/clinic/tp/cmetp.htm.

searched for medical subject heading (MeSH) terms that were relevant to CME. We used a systematic approach for searching the literature, with specific eligibility criteria, to minimize the risk of bias in selecting articles for inclusion in the review. The systematic approach was intended to help identify gaps in the published literature.

Our comprehensive search plan included electronic and hand searching. Beginning in February of 2006 we ran searches of the following databases: MEDLINE®, EMBASE®, the Cochrane Database of Systematic Reviews, The Cochrane Central Register of Controlled Trials (CENTRAL), the Cochrane Database of Abstracts of Reviews of Effects (DARE), PsycINFO©, and the Educational Resource Information Center (ERIC®), to identify primary literature on the effectiveness of CME and systematic reviews on the effectiveness of simulation techniques in medical education.

Hand searching for possibly relevant citations took several forms. From our electronic search, we identified the 13 journals (see Appendix B[a]) that were most likely to publish articles on this topic (i.e., these journals had the highest number of abstracts and articles included in the review). We scanned the table of contents of each issue of these journals for relevant citations from February 2005 through February 2006. For the second form of hand searching, reviewers received eligible articles and flagged references of interest for the team to compare to the existing database.

Search strategies, specific to each database, were designed to enable the team to focus available resources on articles most likely to be relevant to the Key Questions. Initially, we developed a core strategy for MEDLINE®, accessed via PubMed®, based on an analysis of the MeSH terms and text words of key articles identified a priori. The PubMed® strategy formed the basis for the strategies developed for the other electronic databases (see Appendix C[a]).

The results of the searches were downloaded and imported into ProCite® version 5 (ISI ResearchSoft, Carlsbad, CA). We used the duplication scan feature in ProCite® to delete citations already retrieved. From ProCite®, the articles were uploaded to SRS 3.0 (TrialStat! Corporation, Ottawa, Ontario, Canada), a Web-based software package developed for systematic review data management. Additionally, this database was used to store citations in portable document format (PDF) and to track the search results at title review, abstract review, article inclusion/exclusion, and data abstraction levels. A list of excluded articles is presented in Appendix D[a].

Study Selection

After the electronic databases were searched, citations were downloaded into ProCite®, and uploaded to the SRS 3.0 tracking system. The study team scanned all titles. Two independent reviewers conducted title scans in a parallel fashion. For a title to be eliminated at this level, both reviewers had to indicate that it was ineligible. If the two reviewers did not agree on the eligibility of an article, it was promoted to the next level (see Appendix E[a], Title Review Form). The title review phase was designed to capture as many studies as possible reporting on the effectiveness of CME or as many systematic reviews reporting on the effectiveness of simulation in medical education. All titles that were thought to address the above effectiveness issues were promoted to the abstract review phase.

The abstract review phase was designed to identify studies reporting on the effects of CME or simulation in medical education on clinical practice in terms of knowledge, attitudes, skills,

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[a] Appendixes cited in this report are provided electronically at http://www.ahrq.gov/clinic/tp/cmetp.htm.

practice behaviors, or clinical outcomes. All articles with abstracts meeting these criteria were kept for further review. Abstracts were reviewed independently by two investigators. Abstracts concerning the effectiveness of CME were excluded if both investigators agreed that the article met one or more of the following exclusion criteria: (1) not written in English; (2) contained no human data; (3) no original data and did not apply to Key Question 3; (4) was a meeting abstract, editorial, commentary, or letter; (5) did not include at least 15 fully trained physicians or less than 50 percent of the CME participants were fully trained physicians and there was not a separate analysis for fully trained physicians; (6) did not include training or education; (7) did not evaluate an educational activity; (8) published prior to 1981; (9) not conducted in the United States or Canada; (10) did not apply to a Key Question; (11) did not include data from a concurrent or historical comparison group; or (12) involved quality improvement without an educational activity. Since CME accreditation from the Accreditation Council for Continuing Medication Education began in 1981, we decided to limit our review to studies published after that date. We decided to exclude studies not conducted in the United States or Canada because we felt that the medical education systems in other countries could be very different from and not relevant to CME in the United States. To qualify for Key Question 6, an abstract must also address at least one of the other key questions.

Abstracts concerning the effectiveness of simulation in medical education were excluded if both investigators agreed that the article met one or more of the following exclusion criteria: (1) not written in English; (2) contained no human data; (3) was not a systematic review (i.e., identified a question, described a search strategy, described eligibility criteria, and synthesized results either quantitatively or qualitatively); (4) was a meeting abstract, editorial, commentary, or letter; (5) did not include medical students or physicians-in-training; (6) did not include medical training or education; (7) did not evaluate an educational activity; (8) did not involve simulation, virtual reality, manikins, or standardized patients; (9) published prior to 1990; (10) did not apply to Key Question 3; (11) included only fully trained physicians or CME; or (12) did not report separately on the effects of simulation. The decision to limit our review to reviews published after 1990 was based partly on when simulation began to be used in medical education and partly on a desire to focus on reviews that are not too out-of-date. The cut-off date for inclusion in this review was February 2006. Differences in opinions regarding abstract inclusion or exclusion were resolved through consensus adjudication. At this level of inclusion/exclusion, the reviewers were also asked to identify which Key Questions the article might apply to if the article was eligible.

Because of the broad array of potentially eligible articles obtained at the abstract review phase, full articles initially selected for review underwent another independent parallel review by investigators to determine if they should be included for full data abstraction. At this phase of the review, investigators determined which of the Key Questions each article addressed (see Appendix E, Article Inclusion/Exclusion Form). If articles were still deemed to have applicable information, they were included in the final article review. Differences in opinions regarding article inclusion or exclusion were resolved through consensus adjudication.

Data Extraction

The purpose of the article review was to confirm the relevance of each article to the research questions, to determine methodological characteristics pertaining to study quality, and to collect evidence that addressed the research questions. Articles eligible for full review could address one or more of the Key Questions. We used standardized forms for data extraction to minimize the risk of bias in how data were extracted from eligible studies and to maximize consistency in identifying all pertinent data available for synthesis. Additionally, we developed definitions and created examples, which were reviewed by the study team, to enhance the consistency of data extraction.

Each article underwent double review by study investigators for full data abstraction and assessment of study quality. For all data abstracted from studies, we used a sequential review process. In this process, the primary reviewer completed all data abstraction forms. The second reviewer confirmed the first reviewer's data abstraction forms for completeness and accuracy. Reviewer pairs were formed to include personnel with both clinical and methodological expertise. A third reviewer re-reviewed a random sample of articles by the first two reviewers to ensure consistency in the classification of the articles. Reviewers were not masked to the articles' authors, institution, or journal.[7] In most instances, data were directly abstracted from the article. If possible, relevant data were also abstracted from figures. Differences in opinion were resolved through consensus adjudication. For assessments of study quality and the reporting of adult learning principles, each reviewer independently judged study quality and reporting and rated items on quality assessment and adult learning principles forms (see Appendix E, Data Abstraction Review Forms). The second reviewer provided the assessment of study quality and reporting of adult learning principles used in this report.

All information from the article review process was entered into the SRS 3.0 database by the individual completing the review. Reviewers entered comments into the system whenever applicable. The SRS 3.0 database was used to maintain and clean the data, as well as to create detailed evidence tables and summary tables (see Appendix F and Summary Tables).

Data Abstracted to Assess the Effectiveness of CME (Key Questions 1 and 2)

For all articles containing original data, reviewers extracted information on general study characteristics, CME activity characteristics, and outcomes. The general study characteristics abstracted included study participants, sample size, study setting, evaluation methods, and study design. Data abstracted to the CME activity forms included: intervention or control; number assigned and number analyzed per group; description of group; timing of the educational exposure (i.e., single or multiple exposures); media utilized (i.e., the method through which the CME activity is delivered; see Table 1 for definitions); technique or educational method used (see Table 2 for definitions); whether the intervention was designed for individuals or practice settings; average time spent in the CME activity; average duration of the educational intervention; the number of days/week exposed to the CME activity; length of time from the end of the CME activity to the last evaluation period; whether the CME activity was accredited; and whether the CME activity was a part of a quality improvement project. Reviewers used the outcomes form to abstract data regarding: the main outcome measure; the type of objective (knowledge, attitudes, skills, practice behaviors, and clinical outcomes); whether the learning objectives were met; a qualitative summary of the results; and the author's overall conclusions. For whether learning objectives were met, reviewers were instructed to mark "yes" if most of the measures showed improvement, "no" if most of the measures showed a lack of improvement, "mixed results" if the results were mixed, "no control group" if there was not an appropriate control group to answer the question appropriately and "unclear" if the results were unclear.

Additionally, each reviewer independently completed a study quality form and a reporting of adult learning principles form. The study quality form was based on the Jadad criteria[8] to assess randomization, blinding, and withdrawals, and included additional questions regarding power calculations. On the reporting of adult learning principles form, reviewers assessed how well the article reported the extent to which the CME activity incorporated adult learning principles, such as enabling learners to be active contributors to their learning, relating the curriculum to learners' current experiences, and tailoring the curriculum to learners' past experiences (Romsai Boonyasai, personal communication). The questions on the reporting of adult learning principles form was derived from a review of adult education.[9]

Table 1. Definitions of media methods

Media method	Definition
Live	Any CME activity that is conducted in-person
Computer-based, off-line	Any CME activity that is conducted on the computer, but is not conveyed through the Internet (e.g., CD-ROM)
Internet, real-time (e.g., streaming)	Any CME activity that is conducted real-time via the Internet
Internet, not real-time	Any CME activity that is conducted via the Internet, but is not conducted in real-time
Video	Any CME activity that uses a videotape to convey its message
Audio	Any CME activity that uses an audiotape to convey its message
Handheld	Any CME activity that involves handheld materials (e.g., laminated card)
Print	Any CME activity that is conducted via educational printed materials or readings

Table 2. Definitions of techniques/educational methods

Technique/Educational method	Definition
Academic detailing	Detailing provided by an institution or hospital
Audience response systems	Addresses knowledge objectives. Used in combination with live lectures or discussion groups, these are computerized feedback tools that allow the teacher/instructor to pose a question to a large group and receive immediate feedback from each learner which is collated and presented on a screen. Instructor may choose to alter content based on audience response
Case-based learning	Addresses higher order knowledge and skill objectives. Actual or authored clinical cases are created to highlight learning objectives; clinical material is presented and followed with questions usually determined by the instructor
Clinical experiences	Addresses skill, knowledge and attitudinal objectives. Generally refers to a preceptorship or observership with an expert, as in attending a specialty clinic or operating room
Demonstration	Addresses skill and or knowledge (knows how) objectives; can be presented live, or with video or audio. Teacher determines amount and pace of content
Discussion group	Addresses knowledge, especially application or higher order knowledge, or affective objectives; usually requires preparation with readings, or another experience, such as viewing a videotape, or a role play. Can be facilitated by instructor, but group often determines content
Feedback	The provision of information about an individual's performance to learners
Lecture	Presentation of knowledge content; live, video, audio or slide presentation available online. Teacher/instructor determines amount and pace of content
Mentor/Preceptor	Addresses higher order cognitive, skill and affective objectives. Learner is paired with a mentor who may observe, review documentation of performance, advise, coach, and facilitate learning
Point of care	Addresses knowledge and higher order cognitive objectives (decision-making). Information which is provided at the time of clinical need, integrated into chart or electronic medical record
Problem-based learning or team-based learning	Addresses higher order knowledge objectives, metacognition and some skill (group work) objectives. A clinical scenario is presented to a team, who identify the learning objectives, assign information-seeking tasks, and return to share information and answer questions about the case. Can be facilitated or non-facilitated
Programmed learning	Addresses knowledge objectives. Content is delivered in sequential steps, which are tested with the learner, before moving to the next, usually more complicated step. Pace is determined by the learner, but objectives are set by the program (teacher). Can be delivered in text or online
Readings	Presentation of knowledge content or background for attitudinal objectives. Requires learner to complete; can be done at learner's pace. Teacher/instructor directed or self-directed (e.g., journals, newsletters, searching online)
Role play	Addresses skill, knowledge and affective objectives. Learners assume role of patients and/ or clinicians in practicing focused encounters around training problems, usually when standardized patients are unavailable. Encounter may be recorded and reviewed or followed with a discussion group. Rarely used as sole method of education
Simulation (other than standardized patient or role-play)	Addresses knowledge and skill objectives; ability to simulate potentially addresses higher order integrative objectives, such as responding to an emerging clinical situation, understanding the unfolding of a protein structure, working in teams. Technology can be used for simulation training of procedures, as in endoscopy virtual reality trainers or anesthesia simulators. Includes also models, such as joint injection and suture. Requires active participation of learner; can use multiple learners in some scenarios
Standardized patient	Addresses skill and some knowledge and affective objectives. Usually used for communication skills training and assessment, the standardized patient or simulated patient is trained in a specific patient scenario and presentation of a clinical problem. Encounter may be audio or videotaped and timed. Review offers opportunity for reflection and "replay" of the scenario
Writing/Authoring	Addresses knowledge and affective objectives. Can include authoring test items and participation in test development. Journaling is used frequently for affective objectives, and may be followed with discussion groups or review with a mentor

Data Abstracted from Systematic Reviews on the Effectiveness of Simulation in Medical Education (Key Question 3)

We abstracted data from systematic reviews that evaluated the effectiveness of simulation in medical education (see Appendix E, Data Abstraction Review Forms). Data from systematic review articles were abstracted regarding the types of simulation and comparisons included in the review; types of healthcare professionals included in the review; exclusion criteria; search strategies (types of searches and end date of search); number of articles in the review; outcomes evaluated and the type of objective; meta-analyses conducted; summary of results; subgroup analyses, sensitivity analyses, and meta-regressions conducted; and overall conclusions. Definitions for the types of simulations are presented in Table 3 (Elizabeth Hunt, MD, Director, JHH Simulation Center, personal communication).

Each reviewer also independently completed a study quality form. The study quality form was based off of the QUORUM statement[10] and assessed the reporting of the study question, search methods, inclusion/exclusion criteria, analysis, quality assessment, and conclusions. Additional questions regarding assessment of publication bias were included.

Table 3. Definitions of simulation types

Simulation type	Definition
Full simulation	Whole room or whole patient simulations
Partial task simulation	The use of products to learn or practice a specific skill, such as intubation heads, central venous line chests, intraosseous line legs, or umbilical artery cannulation trainers
Computer simulation	The use of computer programs that allow the student to practice decision making skills, specific knowledge sets such as Advanced Cardiac Life Support (ACLS) trainers and trauma management trainers
Virtual reality	The use of advanced computerized technology to allow students to learn or practice how to perform cardiac catheterizations, colonoscopies, bronchoscopies, ureteroscopies, laparoscopic surgery, hysteroscopy, arthroscopy, ocular surgery, intravenous line placement, etc.
Standardized patient	The use of individuals trained to play the roles of patients, family members, or others to allow students to practice physical exam skills, history taking skills, communication skills, etc.
Role play	Participants play roles of patients, family members, or others to allow practice of communication skills, etc.

Data Abstracted to Assess the Influence of Audience Characteristics and/or External Factors on the Effectiveness of CME (Key Questions 4 and 5)

For studies addressing the influence of audience characteristics and/or external factors (Key Questions 4 and 5), an audience characteristics/external factors form (see Appendix E, Data Abstraction Review Forms) was completed. Data abstracted to this form included the audience characteristic or external factor that was being analyzed, whether a primary goal of the study was to assess the effects of this audience characteristic or external factor, any covariates used in the analysis, and a qualitative summary of the results. Additionally, reviewers abstracted data regarding general study characteristics, CME activity characteristics, outcomes, study quality, and the reporting of adult learning principles.

Data Abstracted to Assess the Validity and/or Reliability of Tools (Key Question 6)

Data regarding validity and reliability of methods used to assess the effectiveness of CME (Key Question 6) were abstracted to a validity/reliability of tools form (see Appendix E, Data Abstraction Review Forms). Articles need not have used the specific terms “validity” or “reliability” to be included in Key Question 6. If authors did not label the specific type of validity or reliability reported, we classified the type based on the definitions from Reed et al.[11] Articles that used a previously validated/reliable method were included if the authors described the method as valid/reliable or described a process or statistic used for psychometric testing. Reviewers also abstracted data regarding general study characteristics, CME activity characteristics, outcomes, study quality, and the reporting of adult learning principles.

Quality Assessment

Article quality was assessed differently for clinical trials and systematic reviews. The dual, independent review of article quality judged articles on several aspects of each study type’s internal validity. Quality assessment of trials was based on the Jadad criteria[8] and included: (1) appropriateness of the randomization scheme, (2) appropriateness of the blinding, and (3) description of withdrawals and drop-outs. For each trial, we created a score between 5 (high quality) and 0 (low quality). Two questions regarding power calculations were added to this form, however, the answers to these questions did not factor into the quality score.

The quality of each systematic review was assessed using criteria based off the QUORUM statement[10]: (1) whether the question being addressed by the review was clearly stated; (2) comprehensiveness of search methods used and described in the report; (3) whether inclusion/exclusion criteria were clearly defined and appropriate; (4) whether analyses were conducted to measure variability in efficacy; (5) whether study quality was assessed and done appropriately (using validated instruments); (6) whether differences in how outcomes were reported and analyzed across studies were taken into consideration; (7) whether the study methodology was reproducible; and (8) whether conclusions were supported by the data presented. Additional questions regarding assessment of publication bias were included.

Data Synthesis

For each Key Question, we created a set of detailed evidence tables containing all information extracted from eligible studies. The investigators reviewed the tables and eliminated items that were rarely reported. For Key Questions 1 and 2, the results were categorized and sorted based on the media method used, educational technique used, and the amount of exposure. Media methods were categorized into single print media (i.e., the CME activity used only print methods), single live media, single Internet media, other single media, multiple media (i.e., the CME activity used more than 1 media methods), and single vs. multiple media (i.e., the CME activity for one group used only 1 media method and the CME activity for the another group used more than 1 media methods). Educational techniques were categorized into single educational techniques (i.e., the CME activity used only 1 educational technique), multiple educational techniques (i.e., the CME activity used more than 1 educational techniques), single vs. multiple, and other/not reported. The amount of exposure was categorized into single exposure (i.e., the CME participants were exposed to the activity on only 1 occasion), multiple exposures (i.e., the CME participants were exposed to the activity on multiple occasions), single vs. multiple exposures, and other/not reported. Investigators used the resulting versions of the evidence tables to prepare the text of the report and selected summary tables.

For Key Question 6, the data were grouped according to similar evaluation methods to facilitate evaluating validity and reliability of these methods.

Data Entry and Quality Control

Initial data were abstracted by investigators and entered directly into Web-based data collection forms using SRS® 3.0 (TrialStat! Corporation, Ottawa, Ontario, Canada). After a second reviewer reviewed data, adjudicated data were re-entered into the Web-based data collection forms by the second reviewer. Second reviewers were generally more experienced members of the research team, and one of their main priorities was to check the quality and consistency of the first reviewers' answers. In addition to the second reviewers checking the consistency and accuracy of the first reviewers, a lead investigator examined a random sample of the reviews to identify problems with the data abstraction. If problems were recognized in a reviewer's data abstraction, the problems were discussed at a meeting with the reviewers. In addition, research assistants used a system of random data checks to assure data abstraction accuracy.

Rating the Body of Evidence

At the completion of our review, we graded the quantity, quality and consistency of the best available evidence addressing Key Questions 1, 2, and 3 by adapting an evidence grading scheme recommended by the GRADE Working Group.[12] We applied evidence grades to bodies of evidence on each type of objective (i.e., knowledge, attitudes, skills, practice behaviors, and clinical outcomes). We assessed the strength of the study designs with randomized controlled trials considered best, followed by non-randomized controlled trials, and observational studies. To assess the quantity of evidence, we focused on the number of studies with the strongest design. We also assessed the quality and consistency of the best available evidence, including assessment of limitations to individual study quality (using individual quality scores), certainty regarding the directness of the observed effects in studies, precision and strength of findings, and availability (or lack thereof) of data to answer the Key Question. We classified evidence bodies pertaining to Key Questions 1, 2, and 3 into four basic categories: (1) "high" grade (indicating confidence that further research is very unlikely to change our confidence in the estimated effect in the abstracted literature); (2) "moderate" grade (indicating that further research is likely to have an important impact on our confidence in the estimates of effects and may change the estimates in the abstracted literature); (3) "low" grade (indicating further research is very likely to have an important impact on confidence in the estimates of effects and is likely to change the estimates in the abstracted literature); and (4) "very low" grade (indicating any estimate of effect is very uncertain). We did not grade the body of evidence for Key Questions 4 and 5 since this is a subset of Key Questions 1 and 2. Also, we did not grade the body of evidence for Key Question 6 since the grading criteria do not apply to our questions about the validity and reliability of educational assessment methods.

Peer Review and Public Commentary

A draft of the completed report was sent to the technical experts and peer reviewers, as well as to the representatives of AHRQ and the Scientific Resource Center. In response to the comments of the technical experts, peer reviewers, and AHRQ, revisions were made to the evidence report, and a summary of the comments and their disposition was submitted to AHRQ.

Chapter 3. Results

Results of Review of Primary Literature

A summary of the search results for the primary literature review is presented in Figure 1. From the search, we retrieved 59,116 unique citations. After reviewing the titles and abstracts, 659 seemed eligible for further review and the full articles were retrieved. A total of 136 primary literature articles are included in this review.

Results of Review of Systematic Reviews

A summary of the search results for the review of systematic reviews is presented in Figure 2. The search yielded 1617 unique citations. After reviewing the titles and abstracts, 43 seemed eligible for review and they were retrieved for further review. A total of nine systematic review articles are included in this review.

Summary of Study Characteristics and Evaluation Methods

Over two-thirds (68 percent) of the studies were randomized controlled trials; the remaining studies were predominantly non-randomized controlled trials (see Appendix F[*], Evidence Table 1). An evaluation was conducted both before and after the intervention in 76 percent of the randomized controlled trials and 88 percent of the non-randomized trials.

Participant questionnaire was the most frequently used evaluation method (59 percent of the studies). Of those that used a participant questionnaire, over two-thirds (69 percent) used a written questionnaire. A few studies administered the questionnaire via computer (5 studies), orally (5), or over the phone (7). About half (47 percent) of the studies used a performance audit to evaluate the CME program. Performance audits were usually conducted through chart review (39 studies) and health plan databases (18). Patient questionnaires were used in 39 studies. Twenty studies included a qualitative evaluation. Seventeen studies evaluated the CME program through observer assessment. Most of these studies used a live standardized patient to assess the observer (11 studies).

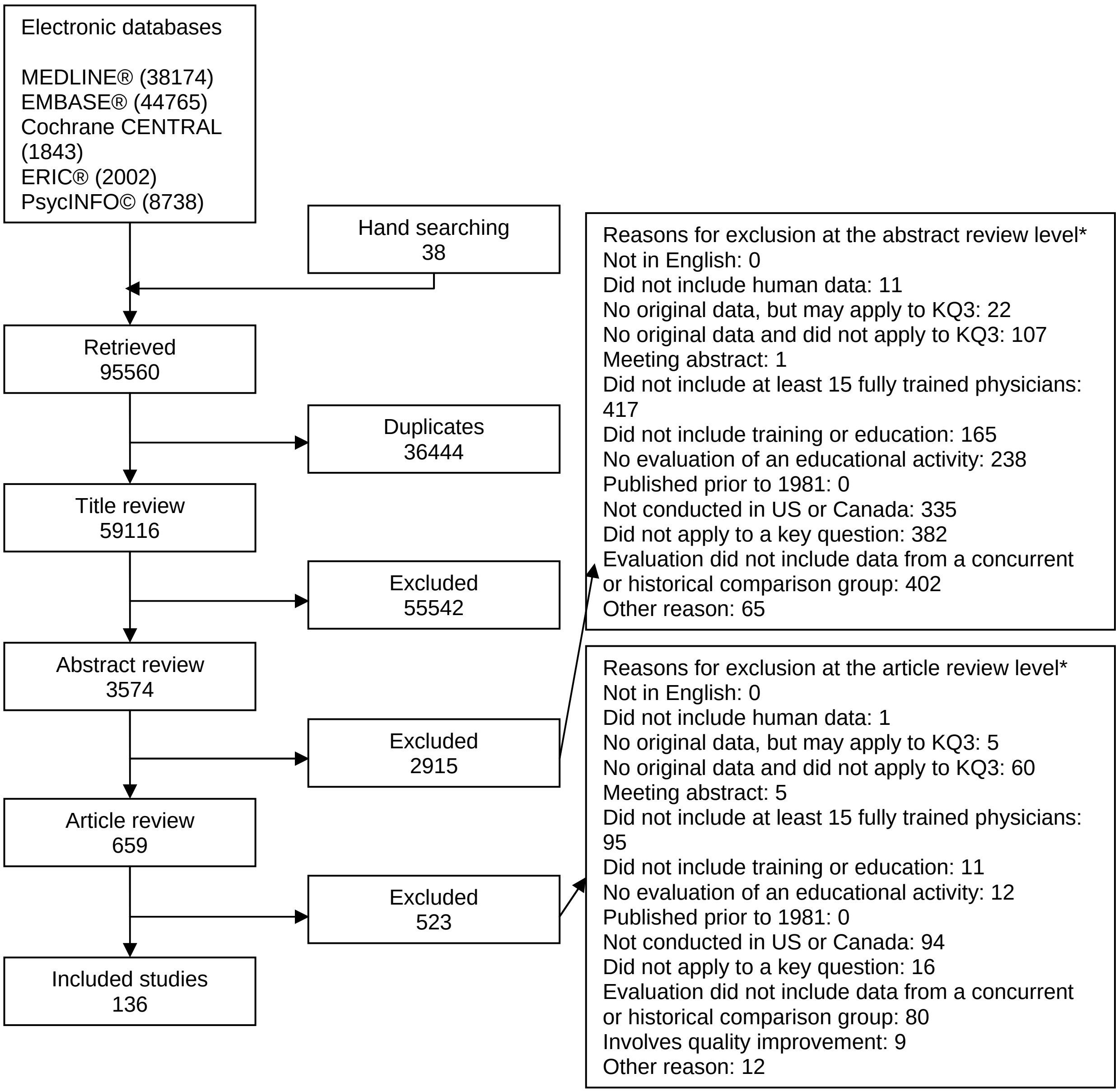
Summary of Study Participants and Study Setting

The CME participants in most of the studies were exclusively fully-trained physicians (see Appendix F, Evidence Table 2). Other CME participants in the other studies most often included nurse practitioners, physician assistants, or nurses. Family medicine (73 studies), internal medicine (58 studies), general medicine (32 studies), pediatrics (21 studies), and primary care (18 studies) were the most common specialties included in the studies. Most study participants worked in private practice (52 studies), for health plans (32 studies), or in hospitals (19 studies). Many of the studies did not report on other characteristics of the study participants. Gender, age

[*] Appendixes cited in this report are provided electronically at http://www.ahrq.gov/clinic/tp/cmetp.htm

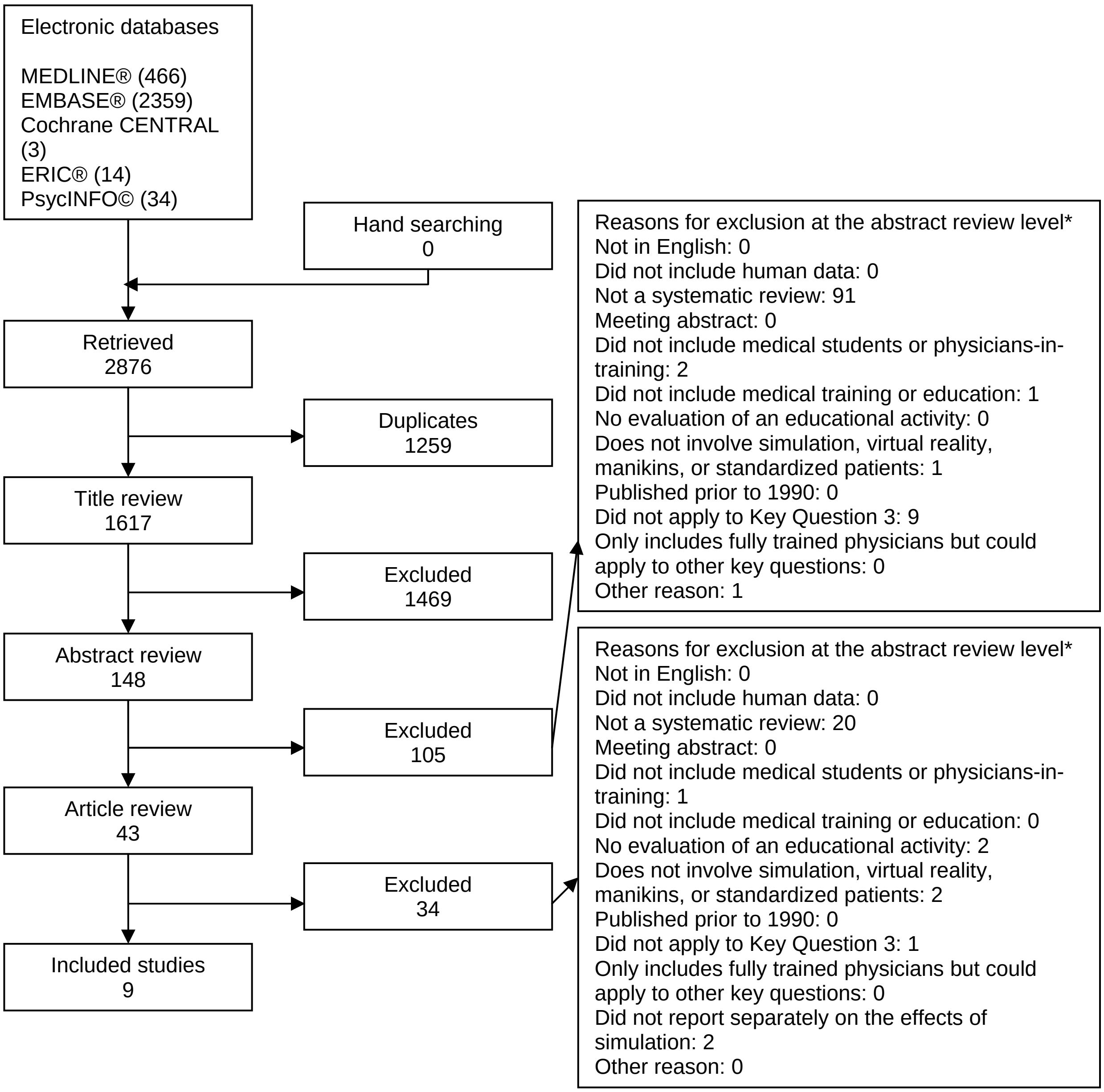
and years of training/experience were reported in 50 percent, 28 percent, and 34 percent of studies.

Figure 1. Summary of literature search and review process for primary literature (number of articles)



* Total may exceed number in corresponding box, as articles could be excluded for more than one reason at this level.
Central = The Cochrane Central Register of Controlled Trials; ERIC = Educational Resource Information Center

Figure 2. Summary of literature search and review process for systematic reviews (number of articles)



* Total may exceed number in corresponding box, as articles could be excluded for more than one reason at this level.
Central = The Cochrane Central Register of Controlled Trials; ERIC = Educational Resource Information Center

One-third of the studies did not report the setting of the CME activity. In 52 studies, the CME activity occurred in the practice setting. The CME activity was not linked to a physical setting in 27 settings. Government agencies sponsored about 40 percent of the studies. Pharmaceutical agencies, professional societies, and insurance/health plan companies sponsored about 10 percent of the studies each. In about two-thirds of the studies, some type of physician, the majority of which were academic, taught the CME activity. The type of educator was not mentioned in about one-quarter of the studies.

Summary of CME Activity Characteristics

Table 4 provides an overview of the characteristics of the CME activities evaluated (for details of the characteristics of CME activities, see Appendix F*, Evidence Table 3). Fifty studies evaluated a single media method. The most common single media method used in the CME activity was live (29 studies). Print media was evaluated in 14 studies and the Internet in 6 studies. Nearly half of the studies used multiple media methods in the CME activities they were evaluating. Eighteen studies compared using a single media method to using multiple media methods. The type of media was not reported in one study.

Table 4. Summary of CME Activity Characteristics

Type of CME activity	Number (%) of studies
Media method	
Single media used in CME activity	50 (37)
Live only media	29 (21)
Print only media	14 (10)
Internet only media	6 (4)
Other type of single media	4 (3)
Multiple media used in CME activity	67 (49)
Single vs. multiple media used in CME activity	18 (13)
Type of media not reported	1 (1)
Educational technique	
Single technique used in CME activity	13 (10)
Multiple techniques used in CME activity	95 (70)
Single vs. multiple techniques used in CME activity	25 (18)
Type of technique not reported	3 (2)
Amount of exposure	
Exposed to CME activity once	44 (32)
Exposed to CME activity multiple times	69 (51)
One vs. multiple exposures to CME activity	12 (9)
Other amount of exposure	7 (5)
Amount of exposure not reported	4 (3)

* Appendixes cited in this report are provided electronically at http://www.ahrq.gov/clinic/tp/cmetp.htm

Most (70 percent) of the studies used multiple educational techniques in the CME activity. Twenty-five studies compared using a single educational technique to using multiple educational techniques. Thirteen studies evaluated a single technique. Six articles evaluated reading only,[13-18] two evaluated only academic detailing,[19 20] and one evaluated each of the following: problem-based learning,[21] conference calls,[22] feedback,[23] lecture,[24] and lecture versus case-based learning.[25]

The participants were exposed to the CME activity only once in about a third of the studies and multiple times in about half. Twelve studies compared participants who were exposed once to a CME activity to participants who were exposed multiple times.

The CME activities were designed for individuals in 90 studies and practice settings/teams in 24 studies. For 17 studies, the CME activities were designed for both individuals and practice settings/teams. The CME activity was reported as being accredited in about a quarter (31 studies) of the studies.

In 41 studies, the CME activity was a part of a quality improvement project. CME activities that were a part of quality improvement projects used multiple media methods significantly more often than CME activities with no quality improvement project (63% versus 43%; $p=0.03$). CME activities with quality improvement projects were also significantly less likely to use single live media (10% versus 26%; $p=0.03$). CME activities with and without quality improvement projects were similar to each other in terms of educational techniques and amount of exposure (data not shown).

Study Quality of Primary Literature

More than two-thirds of the trials were randomized (see Appendix F, Evidence Table 4). Just over half of these trials described their randomization techniques adequately, while five included descriptions of suboptimal randomization schemes. Because participants in a study of an educational intervention cannot be blinded to the intervention, we evaluated the trials for evidence that the outcomes evaluation was blinded. Approximately one-fifth of the trials described a blinded evaluation, with the majority of these including adequate descriptions of the blinding technique. Only one-quarter of the trials described losses to follow-up or reasons for withdrawal. Nearly two-thirds of the trials described power calculations to detect outcomes, but one-quarter of these were not adequately powered.

Based on our quality scoring system described in the Methods chapter, over three-quarters of the trials were rated at two points or less:

- 8 studies achieved a score of 5
- 11 studies achieved a score of 4
- 12 studies achieved a score of 3
- 38 studies achieved a score of 2
- 29 studies achieved a score of 1
- 36 studies achieved a score of 0.

Quality of the Systematic Reviews

All reviews, except one,[26] described search methods in sufficient detail to allow replication of the reviews (see Appendix F, Evidence Table 5). All reviews used one or more electronic databases and hand-searching to identify relevant articles. However, only three reviews[26-28] supplemented their search by soliciting expert opinion to identify relevant articles. Two systematic reviews[29 30] did not report study inclusion (and/or exclusion) criteria and one review[28] did not report inclusion criteria in enough detail to allow replication.

Only two reviews performed quality assessment of the studies included in the review using a validated quality scale.[27 30] In addition, one review[31] provided a descriptive assessment of study quality. Evaluation for publication bias was not reported by any review. All reviews, except one, synthesized evidence qualitatively. One review,[26] that combined individual study results quantitatively to generate a summary effect size, used both fixed-effects and random-effects models.

Four reviews[26 27 30 31] discussed the variation in the results of the original studies in a qualitative manner, one additional study[29] discussed it only partially, and four studies did not discuss the variations in the results of the original studies. Qualitative evaluation of heterogeneity, either by subgroup analyses or meta-regression, was not performed by any of the reviews included in our study.

Reporting of Adult Learning Principles

Only 13 percent of trials were rated as “good” in enabling learners to be active contributors to their learning, while about half of trials were rated as fair (see Appendix F, Evidence Table 6). More than three-quarters of the trials were rated as “good” in relating to learners’ current work or life experiences. Only 12 percent of the trials were rated as “good” in tailoring their curricula to learners’ current or past experiences, and almost half were rated as “poor.” Only 6 percent of the trials were rated as “good” in allowing learners to identify their own learning goals and direct their education, and over 80 percent were rated as “poor.” About 10 percent of trials were rated as “good” in allowing learners to practice what they learned in simulated activities, providing support to self-directed learners, and receiving feedback from teachers or peers during active learning. Two-thirds were rated as “poor” in these areas. Less than 10 percent of trials were rated as “good” in allowing learners to reflect on their learning, while three-quarters of trials were rated as “poor.” Only four trials were rated as “good” in allowing learners to observe the faculty role-model behaviors, while nearly 90 percent of trials were rated as “poor.”

A notable example of a trial that received high ratings for all adult learning principles was Gerrity et al.[32]

Key Question 1: Is there evidence that particular methods of delivering CME are more effective in: a) imparting knowledge to physicians, b) changing physician attitudes, c) acquiring skills, d) changing physician practice behavior, or e) changing clinical practice outcomes?

Key Question 2: Do changes in knowledge, attitudes, skills, practice behavior, or clinical practice outcomes produced by CME persist over time (greater than or equal to 30 days)?

Knowledge Outcomes

Short-term and long-term effects of CME on knowledge (See Appendix F, Evidence Table 7). A total of 39 studies addressed 41 knowledge objectives.[17 19 25 32-67] Eleven studies that addressed 12 objectives had a comparison group, but no control group and thus could not be utilized to determine whether or not the intervention was effective at knowledge transfer.[17 25 58-61 63-67] This left 28 studies addressing 29 objectives. These studies were classified by the outcome of the objective into those in which the objective was met, objective not met, or those with mixed results. In addition, the 28 studies were classified into three groups by the duration of knowledge acquisition/retention into those studies in which the duration was not clearly reported, studies that addressed short-term knowledge changes and long-term knowledge changes.

A total of 22 studies addressing 23 objectives demonstrated improvements in knowledge.[19 33-53] This represents 79% of the 28 studies with an adequate control group. Of these, 6 studies[33-38] addressing 6 objectives did not clearly report the duration of evaluation, 1 study[39] addressing 1 objective demonstrated short-term improvement in knowledge, and 15 studies addressing 16 objectives demonstrated long-term improvements in knowledge. The studies were too heterogeneous too identify any global similarities, but any specific information related to the type of media, educational technique or exposure volume will be addressed in those subsequent sections.

Four studies addressing four objectives failed to show improvements in knowledge.[32 54-56] No study demonstrated a regression in knowledge. Of these four studies, one study[32] did not clearly report on the duration of evaluation while the three remaining studies evaluated long-term knowledge changes. No study was identified that evaluated short-term knowledge and failed to show a change in knowledge. Of the three studies that considered long-term outcomes, the study by Elliott et al demonstrated trends toward improved knowledge but these slight improvements lacked statistical significance.[55] In the remaining two studies, one failed to show improvements in knowledge regarding bioterrorist attacks through the voluntary participation in a web-based educational program and the other failed to show an improvement in knowledge regarding blood pressure control after a mailed CME program.

Two studies addressing two objectives demonstrated mixed results.[57 62] One study did not clearly report on the duration of evaluation and one reported on long-term effects. The study that did not clearly report duration evaluated the impact of an educational intervention aimed at medical care evaluation committees and demonstrated a statistical improvement in only one of the three committees.[57] The study by Chodosh et al considered an evaluation nine months after the intervention. In this study, more intervention group physicians answered knowledge-related questions on capacity determination for patients with possible dementia, but found no differences between intervention group and control group on questions regarding dementia evaluation, patient safety, or depression treatment.

In summary, 78% of the studies with an adequate control group demonstrated that CME activities were effective at improving knowledge with the majority (68%) of these studies demonstrating long-term improvements in knowledge.

Short-term and long-term effects of CME media methods on knowledge. Studies were classified by objectives met and evaluation duration as described above and by media utilized for the educational intervention. The media classifications included multi-media, single media and single versus multi-media.

As stated in the above section, 22 studies addressing 23 objectives demonstrated improvements in knowledge. Seven studies addressing eight objectives evaluated a single media intervention.[39 40 43 45 48 50 53 56] Three of the studies utilized the internet and the remaining four utilized live media. The three studies that utilized the internet demonstrated improved short-term knowledge in one study[39] and long-term knowledge in two studies.[43 50] All four of the studies that utilized live media demonstrated long-term improvements in knowledge. Twelve studies addressing 12 objectives utilized multimedia interventions to demonstrate knowledge benefits.[19 33-37 41 42 46 49 51 52] Five studies did not clearly report on the duration and seven studies demonstrated long-term improvements in knowledge. Three studies compared a single media-based intervention to a multimedia intervention.[38 44 47] All three studies included at least one concurrent control group that only utilized print material and in all three cases multi-media outperformed the print-based single media intervention group.

The four studies that did not demonstrate improvements in knowledge utilized single media (print) in one study[56] that evaluated long-term knowledge, multimedia (live, audio and print) in one study[32] in which evaluation duration was not clearly defined, multimedia (live and print) in one study[55] that considered long-term knowledge changes, and one study[54] that compared single to multi-media for long-term benefits. In this study the comparison was between a live intervention and a live internet with non-real time reading material.

Of the two studies that demonstrated mixed results, one study[57] utilized a single media intervention (live) and the other study[62] utilized multimedia intervention (live internet with not real time print).

When grouped solely by media classification, 9 studies addressing 10 objectives used a single media with 7 demonstrating benefits, 15 studies addressing 15 objectives considered multi-media interventions with 12 demonstrating benefits, and 4 studies addressing 4 objectives compared single to multi-media with 3 of these studies demonstrating that multi-media interventions had greater benefit.

Given the heterogeneity of the studies the only recognized trends were that multimedia seems better than a single media intervention and that print interventions are either not beneficial or very weak in their ability to lead to improved knowledge.

Short-term and long-term effects of CME educational techniques on knowledge. Studies were classified by objectives met and evaluation duration as described above and by technique utilized for the educational intervention. The technique classifications included multiple techniques, single technique and single versus multiple techniques. Two of the studies that have not been previously included because of a lack of a control group can be utilized in this section because the concurrent comparison group did indeed utilize a different technique permitting some head to head comparisons.[25 66] This means that for this section there are 30 studies addressing 31 objectives.

Only one study that met its objectives utilized a single technique, academic detailing, and this study demonstrated improvements in long-term knowledge.[19] Eighteen studies addressing 18 objectives utilized multiple techniques to improve knowledge.[33-37 39 41-46 48-53] Five studies[33-37] that demonstrated improved knowledge did not clearly report the duration, 1 study[39] demonstrated short-term knowledge improvement and 12 studies demonstrated long-term knowledge improvements. The majority of the studies that demonstrated improvement but did not clearly report the duration included case-based learning as a technique in combination with techniques ranging from discussion groups to independent reading. Of the 12 studies that demonstrated long-term improvements in knowledge the majority integrated multiple techniques and most commonly combined case-based learning with discussion groups with independent reading, several utilized standard lectures with readings, and some technique combinations ranged from lecture with a standardized patient to lecture with team-based training. Three studies addressing four objectives compared a single technique versus multiple techniques demonstrated improvements in knowledge.[38 40 47] One study did not clearly report duration and two studies addressing three objectives demonstrated long-term knowledge improvements. The study that did not clearly report duration demonstrated a greater benefit to the combination of case-based learning with readings when compared to readings alone.[38] One study that addressed two objectives compared problem-based learning to the combination of lecture and discussion groups and demonstrated that that problem-based learning group was more effective regarding knowledge of diagnosis and management of headache. The other study compared discussion groups with readings to readings alone and the combination was more effective at increasing knowledge regarding compliance adherence.

Four studies of four objectives did not demonstrate improved knowledge.[32 54-56] One study that utilized multiple techniques that included lecture, discussion groups, role playing and feedback failed to demonstrate improved knowledge and did not clearly report the duration.[32] Two studies failed to demonstrate improvements in knowledge despite utilizing multiple techniques.[55 56] One combined lecture with case-based learning with discussion groups and readings and failed to show improvements in pain knowledge, while the other combined readings with chart cue materials and failed to show improvements in knowledge of hypertension. One study compared a single technique, lecture to a combination of techniques that included lecture with case-based learning and readings and failed to show an improvement in knowledge of bioterrorism.

The two studies that were added to this section deserve a greater explanation. Greenberg et al compared lecture to case-based learning and the case-based learners demonstrated improvements in post-test questions regarding common pediatric problems as compared to 29% improvement in the lecture group.[25] Unfortunately, these improvements seen in the case-based group were not significant at six and nine months after the intervention. Heale et al compared three groups, one receiving lectures, one case-based learning with discussion groups, and the final group received problem-based learning.[66] This study also failed to demonstrate benefits of any technique either in short or long-term knowledge. Thus these two studies, when added to the four above studies that did not demonstrate improvements means a total of six studies did not show improved knowledge.

One of the two studies that demonstrated mixed results did not clearly report duration while the other considered long-term knowledge improvements.[57 62] The study[57] that did not report duration compared a combination of case-based learning with discussion groups to control while the other compared lecture with discussion group to control.

When grouped solely by technique classification then two studies addressing two objectives utilized a single technique with one study showing improvements through the use of academic detailing and one showing no knowledge improvement through the use of readings alone. Twenty-three studies addressing 23 objectives utilized multiple techniques with 18 demonstrating benefits, 3 no benefits, and 2 mixed results. Five studies addressing six objectives compared single versus multiple techniques. Two studies addressing two objectives demonstrated benefits of multiple techniques as compared to single, one study addressing two objectives demonstrated benefits to single technique(problem-based learning) compared to multiple and two studies addressing two objectives did not demonstrate any benefit of single as compared to multiple techniques.

The outcomes from this section are also heterogeneous but it does appear that multiple techniques that most commonly include case-based learning seem to be more likely to be associated with improvements in knowledge.

Short-term and long-term effects of the amount of exposure on knowledge. Studies were classified by objectives met and evaluation duration as described above and by exposure volume for the educational intervention. The exposure volume classifications included multiple exposures, single exposure and single versus multiple exposures. The two studies added in the previous section do not apply to this section given the lack of control groups. In addition, one additional study[38] did not adequately describe the exposure and thus is excluded from analysis in this section leaving 27 studies addressing 28 objectives.

There were 21 studies addressing 22 objectives which demonstrated an improvement in knowledge.[19 33-37 39-53] Five studies addressing five objectives evaluated a single exposure volume with one study[36] not clearly reporting the duration and four studies[44 45 48 53] demonstrating long-term improvements. Three of these considered knowledge at 6 months after intervention and one at 24 months after intervention. Twelve studies addressing 12 objectives utilized multiple exposure volumes. Three studies did not clearly report duration,[33 35 37] one study demonstrated short-term knowledge gains,[39] and the final eight studies all demonstrated long-term knowledge gains.[19 41 43 46 49-52] The shortest time interval to evaluation in these long-term beneficial studies was 3 months and the longest was 15 months. Four studies addressing five objectives compared a single exposure to multiple exposures and demonstrated knowledge gains. One study that did not clearly report duration demonstrated that multiple exposures were better than a single exposure at improving knowledge of office-based dermatologic procedures.[34] The other three studies addressing four objectives all demonstrated that multiple exposures were better than a single exposure at improving knowledge.[40 42 47]

Four studies addressing four objectives did not demonstrate knowledge improvements. No study was identified that evaluated a single exposure only. Three studies evaluated multiple exposures with one[32] not clearly reporting the duration and the other two[55 56] failing to demonstrate long-term knowledge improvements. One study that compared single versus multiple exposures did not show any difference from baseline knowledge at one and six months after intervention in either group.[54]

No studies were identified that utilized a single exposure only or compared a single versus multiple that demonstrated mixed results. Two studies demonstrated mixed results and both utilized multiple exposures.[57 62] One study[57] did not clearly report on duration and the other study demonstrated mixed results at the nine month evaluation.

When grouped solely by exposure volume then all five studies that evaluated a single exposure demonstrated improved knowledge. Twelve of the 17 studies that utilized multiple exposures demonstrated knowledge improvements with an additional 2 demonstrating mixed results. The majority (67%) of these were able to demonstrate long-term knowledge benefits. Of the five studies that compared a single exposure to multiple exposures, four (80%) demonstrated a greater benefit to multiple exposures as compared to a single exposure.

In summary, despite the heterogeneity of these studies it appears that despite the fact that all five studies that utilized a single exposure demonstrated benefit the head-to-head comparison studies imply that when possible multiple exposures produces better knowledge gains.

Summary of the effects of CME on knowledge. The heterogeneity of the studies precludes firm conclusions, but the trends demonstrated that CME is effective at producing both short-term and long-term knowledge gains and that when possible, multimedia, multiple techniques, and multiple exposures should be used.

Quality of the evidence for the short-term and long-term effects of CME on knowledge (see Appendix F[*], Evidence Table 8). Taking into consideration the quantity and quality, and consistency of evidence on the effectiveness of CME on knowledge, we graded the strength of evidence as very low.

Attitude Outcomes

Short-term and long-term effects of CME on physician attitudes (See Appendix F, Evidence Table 9). A total of 35 studies addressed 45 attitude objectives.[13 34-37 39 40 42 47 50 52 53 55 58 59 62-64 66 68-83] Eight studies that addressed 11 objectives had a comparison group, but no control group and thus could not be utilized to determine whether or not the intervention was effective at attitudinal change.[58 59 63 64 66 79 80 83] One additional study that addressed two objectives could not be utilized as results were not reported by groups and thus its results were unclear and it was also not included.[82] This left 26 studies addressing 32 objectives. These studies were classified by the outcome of the objective into those in which the objective was met, objective not met, or those with mixed results. In addition, the 26 studies were classified into three groups by the duration of attitudinal change into those studies in which the duration was not clearly reported, studies that addressed short-term attitudinal changes and long-term attitudinal changes.

A total of 22 studies addressing 26 objectives demonstrated improvements in attitude.[13 34-36 39 40 42 47 50 52 53 68-78] This represents 71% of the 31 studies with an adequate control group. Of these, six studies addressing seven objectives did not clearly report the duration of evaluation,[13 34-36 68 69] one study addressing two objectives demonstrated short-term improvement in attitudes,[39] and 15 studies addressing 17 objectives demonstrated long-term improvements in

[*] Appendixes cited in this report are provided electronically at http://www.ahrq.gov/clinic/tp/cmetp.htm

attitude.[40 42 47 50 52 53 70-78] The studies were too heterogeneous too identify any global similarities, but any specific information related to the type of media, educational technique or exposure volume will be addressed in those subsequent sections.

Four studies addressing four objectives failed to show improvements in attitude.[37 52 55 62] No study demonstrated a regression in attitude. Of these four studies, one study[37] did not clearly report on the duration of evaluation while the three remaining studies evaluated long-term attitudinal changes. No study was identified that evaluated short-term attitudes and failed to show a change in attitudes. Of the three studies that considered long-term outcomes, the study by Elliott et al demonstrated trends toward improved attitudes but these slight improvements lacked statistical significance.[55] In the remaining two studies, one failed to show improvements in attitudes regarding providers' perceptions of quality of care nine months after intervention.[62] The other failed to show an improvement in attitude regarding efficacy of cholesterol lowering practices.[52]

Two studies addressing two objectives demonstrated mixed results.[62 81] Both studies reported on long-term effects. The study by Chodosh et al considered an evaluation nine months after the intervention. In this study, more intervention group physicians endorsed the statement, "Older patients with dementia are difficult to manage in primary care," but no other differences in attitudes regarding dementia were identified.[62] The study by Norris et al utilized an evaluation six months after intervention and noted that intervention group providers had significant improvements in three of ten tested attitudes, including they felt by self report that they were more likely to counsel patients regarding physical activity than control providers.[81]

In summary, 85 percent of the studies with an adequate control group demonstrated that CME activities were effective at improving attitudes with the majority (68%) of these studies demonstrating long-term improvements in attitudes.

Short-term and long-term effects of CME media methods on physician attitudes. Studies were classified by objectives met and evaluation duration as described above and by media utilized for the educational intervention. The media classifications included multi-media, single media and single versus multi-media.

As stated in the above section, 22 studies addressing 26 objectives demonstrated improvements in attitudes. Seven studies addressing eight objectives evaluated a single media intervention.[13 39 40 50 53 71 72] Two of the studies[39 50] utilized the internet, one[13] utilized a computer-based program and the remaining four utilized print media.[40 53 71 72] The two studies addressing three objectives that utilized the internet demonstrated improved short-term attitudes in one study and long-term attitudes in the other. All four of the studies that utilized print media demonstrated long-term improvements in attitudes. The one study that utilized computer-based education for its intervention did not clearly report the duration. Twelve studies addressing 15 objectives utilized multi-media interventions to demonstrate attitudinal benefits.[34-36 42 52 68 69 73 75-78] Five studies addressing six objectives did not clearly report on the duration and seven studies addressing nine objectives demonstrated long-term improvements in attitudes. Three studies compared a single media-based intervention to a multi-media intervention.[47 70 74] All three studies included at least one concurrent control group that only utilized print material and in all three cases multi-media outperformed the print-based single media intervention group. All three studies showed long-term improvements in attitudes.

The four studies that did not demonstrate improvements in attitude all utilized multimedia.[37 52 55 62] One study combined live with print and did not clearly report on duration.[37] The other 3 studies considered long-term attitudinal changes at 9 months in one study and 15 months in the other 2 studies. The study that considered outcomes at nine months utilized a combination of live internet with print material while the other two studies combined live with print in one and live with video and print in the other.

Both of the two studies that demonstrated mixed results utilized multimedia approaches.[62 79] One study utilized live internet with print material and the other study utilized live in conjunction with print and a followup phone call.

When grouped solely by media classification, then 7 studies addressing 8 objectives utilized a single media with all 7 demonstrating attitudinal benefits, 18 studies addressing 26 objectives considered multimedia interventions with 12 demonstrating benefits, and 3 studies addressing 3 objectives compared single to multi-media with all 3 of these studies demonstrating that multimedia interventions had greater benefit.

Given the heterogeneity of the studies the only recognized trends were that multimedia appears better than a single media intervention and that print interventions are either not beneficial or very weak in their ability to lead to improve attitudes.

Short-term and long-term effects of CME educational techniques on physician attitudes. Studies were classified by objectives met and evaluation duration as described above and by technique utilized for the educational intervention. The technique classifications included multiple techniques, single technique and single versus multiple techniques. One study that had not been previously included because of a lack of a control group can be utilized in this section because the concurrent comparison group did indeed utilize a different technique permitting some head to head comparisons.[66] This means that for this section there are 23 studies addressing 27 objectives.

Only one study that met its objectives utilized a single technique, reading, and this study did not clearly report duration.[13] Seventeen studies addressing 21 objectives utilized multiple techniques to improve attitudes. Five studies[34-36 68 69] addressing 6 objectives that demonstrated improved attitudes did not clearly report the duration, 1 study[39] addressing 2 objectives demonstrated short-term attitudinal improvement and 11 studies[42 50 52 53 71-73 75-78] addressing 13 objectives demonstrated long-term attitudinal improvements.

The majority of the studies that demonstrated improvement but did not clearly report the duration included case-based learning as a technique in combination with techniques ranging from discussion groups to independent reading. Of the 11 studies that demonstrated long-term improvements in attitude the majority integrated multiple techniques and most commonly combined case-based learning with discussion groups with independent reading, several utilized standard lectures with readings, and some technique combinations ranged from lecture with a standardized patient to lecture with team-based training. Four studies addressing four objectives compared a single technique versus multiple techniques demonstrated improvements in attitudes.[40 47 70 74] All four studies demonstrated long-term knowledge improvements. Three of these four studies utilized readings as the sole technique and one utilized a discussion group. All four studies demonstrated that multiple techniques were better than single techniques.

Four studies of four objectives did not demonstrate improved attitudes.[37 52 55 62] One study that utilized multiple techniques that included live and print failed to demonstrate improved attitudes and did not clearly report the duration.[37] Two studies failed to demonstrate improvements in attitudes despite utilizing multiple techniques.[52 62] One combined lecture with discussion group and failed to show improvements in provider perceptions about quality of care for patients with dementia, while the other combined case-based learning with discussion with readings, with standardized patients and failed to show improvements in attitudes regarding cholesterol lowering practices. Only one study compared a single technique versus multiple and failed to show an improvement in provider attitudes regarding pain.[55]

The one study that was added to this section deserves a greater explanation. Heale et al[66] compared three groups, one receiving lectures, one case-based learning with discussion groups, and the final group received problem-based learning. This study demonstrated improvements in attitudes that were greatest in the problem-based learning participants.

Both studies that demonstrated mixed results assessed long-term attitudinal change[62 81] and both utilized multiple techniques. These included lecture with a point-of-care opinion leader in one study and lecture with discussion groups in the other.

When grouped solely by technique classification then one study addressing one objective utilized a single technique and it demonstrated attitudinal improvement. Twenty-two studies addressing 26 objectives utilized multiple techniques with 17 demonstrating benefits, 3 no benefits, and 2 mixed results. Five studies addressing five objectives compared single versus multiple techniques. Four studies demonstrated greater attitudinal change with the utilization of multiple techniques as compared to a single technique and one study showed no improvement.

The outcomes from this section are also heterogeneous but it does appear that multiple techniques that most commonly include case-based learning seem to be more likely to be associated with improvements in attitudes.

Short-term and long-term effects of the amount of exposure on physician attitudes. Studies were classified by objectives met and evaluation duration as described above and by exposure volume for the educational intervention. The exposure volume classifications included multiple exposures, single exposure and single versus multiple exposures. The one study added in the previous section does not apply to this section given the lack of control group. In addition, one additional study[58] did not adequately describe the exposure and thus is excluded from analysis in this section leaving 24 studies addressing 25 objectives.

There were 22 studies addressing 25 objectives which demonstrated an improvement in attitude.[13 34-36 39 40 42 47 50 52 53 68-78] Seven studies addressing eight objectives evaluated a single exposure volume with two studies[36 68] not clearly reporting the duration and five studies[53 70 71 74 77] addressing six objectives demonstrating long-term improvements. Eleven studies addressing 12 objectives utilized multiple exposure volumes. Three studies[13 35 69] did not clearly report duration, one study[39] demonstrated short-term knowledge gains, and the final seven studies[50 52 72 73 75 76 78] addressing eight objectives all demonstrated long-term knowledge gains. Four studies addressing five objectives compared a single exposure to multiple exposures and demonstrated attitudinal improvements.[34 40 42 47] One study[34] addressing two objectives did not clearly report duration, while the remaining three studies all demonstrated long-term improvements in attitudes.

Four studies addressing four objectives did not demonstrate attitude improvements. No study was identified that evaluated a single exposure only or that performed a comparison between single and multiple exposures. Three studies evaluated multiple exposures with one[37] not clearly reporting the duration and the other two[55 62] failing to demonstrate long-term knowledge improvements.

No studies were identified that utilized a single exposure only or compared a single versus multiple that demonstrated mixed results. Two studies demonstrated mixed results and both utilized multiple exposures.[62 81] Both studies assessed long-term attitudes.

When grouped solely by exposure volume then all seven studies that evaluated a single exposure demonstrated improved attitudes. Eleven of the 17 studies that utilized multiple exposures demonstrated attitudinal improvements with an additional two demonstrating mixed results. The majority (64%) of these were able to demonstrate long-term attitudinal benefits. Of the four studies that compared a single exposure to multiple exposures all demonstrated a greater benefit to multiple exposures as compared to a single exposure.

In summary, despite the heterogeneity of these studies it appears that there is a trend toward multiple exposures being of greater benefit for attitudinal change then a single exposure, although it must be pointed out that all seven studies that evaluated a single exposure indeed demonstrated improvements in attitudes.

Summary of the effects of CME on physician attitudes. The heterogeneity of the studies precludes firm conclusions, but the trends demonstrated that CME is effective at producing both short-term and long-term attitudinal gains and that when possible, use of multimedia, multiple techniques, and multiple exposures should produce better attitudinal outcomes.

Quality of the evidence for the short-term and long-term effects of CME attitudes (see Appendix F, Evidence Table 8). Taking into consideration the quantity and quality, and consistency of evidence on the effectiveness of CME on attitudes, we graded the strength of evidence as very low.

Skills Outcomes

Short-term effects of CME on skills (See Appendix F, Evidence Table 10). Skill-related outcomes were categorized as either cognitive or psychomotor. The skills reported were varied including cognitive skills such as diagnostic accuracy for psychiatric conditions,[36] or communication skills with patients.[84] Psychomotor skills included examples such as performing a physical exam,[60] or doing a joint injection.[80] A total of 15 studies reported skill outcomes, with a total of 18 skill outcomes.[13 32 33 36 40 49 60 77 80 84-89] Twelve of the 15 studies that reported skill outcomes were cognitive skills,[13 32 33 36 40 49 77 84-88] with the remaining three being psychomotor skills.[60 72 80]

Of those 15 studies, 10 had skill outcomes that met the objectives of the study.[32 33 36 40 49 72 84-87] One study had three skill outcomes that all met the objectives,[84] and another study had two reported skill outcomes that met the objectives.[33] The remaining studies each had one skill outcome. Two studies had skill outcomes that did not achieve the study objectives,[13 77] and one study had mixed results that did not clearly meet the study objectives.[88] Two studies compared different methods and techniques of CME without a separate control group that did not receive CME;[60 80] therefore, the overall effectiveness of CME cannot be discerned from these studies. Given that 10 out of 13 studies that included control groups and reported on skills (13 out of 16 outcomes) met the objectives and given the varied nature of the studies, the literature does indicate that CME is effective in this area, particularly at developing cognitive skills. Little can be said about the effectiveness of CME for psychomotor skills given the paucity of data in this area.

Long-term effects of CME on skills (See Appendix F, Evidence Table 10). Seven of the 15 studies reporting skill outcomes had an evaluation beyond 30 days after the CME activity.[40 49 72 77 84 86 90] Six of the studies addressing long-term skill outcomes addressed cognitive skills,[40 49 77 84 86 90] while one addressed psychomotor skills.[72] Of those seven studies, six met the objectives regarding long-term skill outcomes,[40 49 72 84 86 90] while one did not meet its objectives.[77] The one study that did not meet its objectives regarding long-term skill outcomes addressed cognitive skills.[77] Overall, the data supports the positive effect of CME on long-term skill outcomes.

Short-term effects of CME media methods on skills. The media methods of CME that were included in the studies that met the study objectives regarding skills included seven that used live media,[32 33 36 40 49 72 84] four that included print materials,[32 33 49 85] two that included video methods,[32 36] two that included audio methods,[32 49] two that used the Internet (not real time),[86 87] and one that used computers (off-line).[33] However, in several cases the same media methods were used in all experimental arms and therefore no conclusions can be drawn from the study outcomes applying to specific CME methods. This situation applied to live methods in one study,[40] audio methods in one study,[49] and print materials in two studies.[49 85] In addition, one study was not clear about which groups received particular methods including live, print, and computer (off-line) media.[33] The studies that did not clearly meet skills objectives included live,[77 88] video,[77 88] and computer (off-line) methods.[13] Two studies directly compared different methods of CME but did not include a control group without CME.[60 80] One of these studies showed no difference between print, computer (off-line), and live methods.[80] However, another study showed that live methods were superior to video and print combined.[60] Given this result and the dominance of live methods among the studies that met their skills objectives, the data suggests that live methods have the greatest impact on the effectiveness of CME regarding skills outcomes. Given the paucity of data and the varied results, little can be said about the relative effectiveness of other CME media methods on affecting skills.

Long-term effects of CME media methods on skills. The six studies that addressed long-term skill outcomes beyond 30 days and met their skills objectives used a variety of media methods including four using live methods,[40 49 72 91] two using print materials,[49 85] one using audio methods,[49] and one using the Internet (not real time).[86] However, the one study that used audio methods had audio in all experimental arms,[49] the two that used print media did so in all groups,[49 85] and one of the four that used live methods did so in all groups.[40] Therefore, the experimental effect on long-term outcomes in studies that met their skills objectives was seen only for three studies using live media,[49 72 84] and one study that used the Internet (not real time).[86] The one study that did not meet its objectives regarding long-term skill outcomes used live and video as the methods.[77] The studies that directly compared different methods of CME did not address long-term skill outcomes.[60 80] Based on the limited data, it is difficult to draw conclusions on particular media methods of CME that have a greater or lesser impact on long-term skill outcomes.

Short-term effects of CME educational techniques on skills. Varied educational techniques were used in the studies that met their objectives regarding short-term skill outcomes. These included lectures in six studies,[32 36 40 49 72 84] discussion groups in five studies,[32 49 72 84 85] readings in five studies,[32 33 49 85 86] case-based learning in four studies,[36 49 86 87] feedback in three studies,[32 49 86] role play in three studies,[32 72 84] and clinical experiences in two studies.[32 72] Listserv,[85] programmed learning,[86] problem-based learning,[40] audio-taped encounters,[72] and standardized patients,[84] were seen in one study each in the studies that met their skills objectives. Of note, readings were used as a technique in both experimental and control groups in one study.[85] In the studies where the skills objectives were not clearly met by the outcomes, the following techniques were used: demonstration and lecture in two studies,[77 88] and readings,[13] discussion groups,[88] feedback,[88] programmed learning,[88] and role play[88] in one study each. Two studies that did not include a control group compared the techniques of readings versus readings with demonstration versus mentor/preceptor with simulation.[80] No difference was seen with these different techniques. In another study without a control group, the techniques of demonstration and simulation were compared with demonstration and simulation plus feedback.[60] The group that included feedback was significantly better when skills acquisition was assessed. Finally, two of the studies that met their objectives regarding skills and included control groups did a comparison of individual techniques of delivering CME. One study compared problem-based learning with lecture, and problem-based learning was significantly better.[40] Another study compared discussion groups and readings to discussion groups and readings with feedback.[85] In this study, feedback had no additional effect. Given the limited number of studies, the wide variety of techniques described, and the conflicting results, it is difficult to draw conclusions about the educational techniques that have the greatest and least effect on skills.

Long-term effects of CME educational techniques on skills. The educational techniques used in the studies that met the study objectives regarding long-term skill outcomes included discussion groups in four studies,[49 72 84 85] lectures in four studies,[40 49 72 84] readings in three studies,[49 85 86] role play in two studies,[72 84] case-based learning in two studies,[49 86] and feedback in two studies.[49 86] The techniques of clinical experiences,[72] listserv,[85] programmed learning,[86] problem-based learning,[40] audio-taped encounters,[72] and standardized patients,[84] were seen in one study each that met skills retention objectives. The one study that did not meet its objectives regarding long-term skill outcomes used the techniques of demonstration, lecture, and simulation.[77] The two studies that compared different techniques in CME without a control group did not address long-term skill outcomes.[60 80] However, in two studies that did have a control group, one showed that problem based learning is superior to lectures in long-term skill outcomes,[40] but the other showed no advantage of feedback over demonstration and readings alone.[85] Given the limited number of studies and the varied techniques, it is difficult to draw conclusions about the educational techniques that that have a greater or lesser effect on long-term skill outcomes.

Short-term effects of the amount of exposure on skills. The majority of the studies that met their skills objectives had multiple exposures to the CME activity. Seven of these studies used multiple exposures,[32 40 49 72 84-86] while one used a single exposure.[36] It was unclear how many exposures there were in two of the studies whose skills outcomes met the study objectives.[33 87] The studies that did not meet the skills objectives included two that used a single exposure,[77 88] and one that used multiple exposures.[13] These results suggest that multiple exposures to CME for skills objectives is superior to a single exposure.

Long-term effects of the amount of exposure on skills. All six of the studies that addressed long-term skill outcomes and met the study objectives used multiple exposures to CME.[40 49 72 84-86] The one study that did not meet its study objectives regarding long-term skill outcomes used a single exposure.[77] These results support multiple exposures as having a greater impact on long-term skill outcomes.

Quality of the evidence for the short-term and long-term effects of CME on skills (see Appendix F*, Evidence Table 8). Taking into consideration the quantity and quality, and consistency of evidence on the effectiveness of CME on skills, we graded the strength of evidence as low.

Practice Behavior Outcomes

Short-term and long-term effects of CME on practice behavior (See Appendix F, Evidence Table 11). A total of 105 studies evaluated the short- and long-term impact of CME activity on 135 practice behavior objectives. Of the 105 studies, 61 studies met 70 practice behavior objectives. Ten of these, reporting on 11 objectives, met objectives but did not report evaluation duration, leaving us unable to determine whether the effect of CME was short-term or long-term.[15 32 35 36 68 69 79 87 92 93] Four of these studies reported improvement with regard to medication prescribing, and three reported improvement with regard to screening test referrals. One study with evaluation duration of 30 days or less met objectives in three out of six smoking cessation and documentation behaviors.[94]

Fifty studies with evaluation duration greater than 30 days met 58 objectives, suggesting long-term retention of CME effectiveness.[19 44-49 52 53 62 70 72 75-78 81 82 82 95-125] Among these, evaluation duration ranged from 6 months or less after the educational intervention (17 studies) to 1 year or greater (30 studies).

A wide mix of objectives was studied. For example, 12 objectives were related to medication prescribing, eight were related to screening standards, 14 were related to physician counseling behaviors (mostly smoking cessation, but also dietary counseling, sexual practices counseling, etc.), 11 were related to guideline adherence, and the remainder were related to physician behaviors pertaining to other topics.

Twenty nine total studies, reporting on 38 objectives, did not meet objectives. Of these, twenty four studies reporting on 33 objectives were evaluated at greater than 30 days.[14 16 43 56 70 73 74 96 99 101 119 122 126-137] Two studies with evaluation duration of 30 days or less did not meet objectives.[18 138] Three studies did not report evaluation duration and did not meet objectives.[13 57 139]

Nine studies, evaluating 9 objectives, showed mixed results in terms of their objectives being met.[20 42 71 73 88 137 140-142] One study was unclear as to whether it met objectives.[101] Fourteen studies, evaluating 17 objectives lacked a control group and therefore did not allow us to assess effectiveness.[23-25 59 64-67 83 143-147]

Overall, CME interventions were effective in the short- and long-term achievement of practice behavior objectives.

Short-term and long-term effects of CME media methods on practice behavior. The different types of media evaluated included single-media live presentations (20 studies), single-

* Appendixes cited in this report are provided electronically at http://www.ahrq.gov/clinic/tp/cmetp.htm

media print materials (9 studies), internet (1 study), other single media (2 studies), multimedia (57 studies), and also single versus multimedia comparisons (15 studies).

Of 20 studies using single live media, 10 studies met 11 objectives, three studies did not meet objectives, three studies showed mixed results and four studies did not have a control group. Of these 20 studies, nine studies with evaluation duration of greater than 30 days met 10 objectives,[45 48 53 72 82 102 107 121 125] suggesting that the use of single live media had a favorable long-term effect on practice behavior objectives. One study had an evaluation duration of 30 days or less and met objectives using single live media.[94] Three studies using single live media reported evaluation duration greater than 30 days but showed mixed results.[20 71 140] Four studies lacked a control group, and no meaningful conclusions could be drawn with regard to the comparative effectiveness of single live media.[24 25 64 66] Three studies did not meet practice behavior objectives using single live media. Of these, one did not report evaluation duration,[57] one reported evaluation duration of 30 days or less,[138] and one reported evaluation duration greater than 30 days.[133]

Out of nine studies with ten objectives that examined the impact of single print media, only one met objectives,[15] but it did not report evaluation duration. One study did not meet objectives using single print media and did not report evaluation duration.[139] One study with evaluation duration of 30 days or less did not meet objectives using single print media.[18] Four studies (five objectives) with evaluation duration greater than 30 days did not meet objectives using single print media.[14 56 130 134] Two studies using single print media reported evaluation duration greater than 30 days, but lacked a control group and no meaningful conclusions could be drawn with regard to the comparative effectiveness of single print media.[23 143] The evidence suggests that single print media is not effective in the short- or long-term achievement of practice behavior objectives.

The only study using single internet media reported an evaluation duration greater than 30 days and it was unclear whether it met objectives.[43] One study did not meet objectives using other single media and did not report evaluation duration.[13] One study using other single media did not report evaluation duration and lacked a control group.[147] One study with evaluation duration greater than 30 days did not report the media used and lacked a control group.[145]

Out of 57 studies (78 total objectives) using multimedia, 40 studies met 47 objectives, 14 studies did not meet 19 objectives, 4 studies showed mixed results, and 4 studies lacked a control group. Of the 40 studies which met objectives, 31 studies with 37 objectives were evaluated at greater than 30 days suggesting that multimedia-based CME has a favorable long-term effect on practice behaviors.[19 46 49 52 62 75-78 81 95 98 99 101 103 104 106 108-110 112 113 116-120 122-124 148] Nine studies met 10 objectives using multimedia but did not report evaluation duration.[32 35 36 68 69 79 87 92 93] One study using multimedia did not report evaluation duration; it also lacked a control group.[146] Four studies using multimedia reported an evaluation duration greater than 30 days, and showed mixed results.[42 73 88 142] Three studies (six objectives) with evaluation duration greater than 30 days lacked a control group and precluded meaningful conclusions.[65 83 144] Fourteen studies with 19 objectives with evaluation duration greater than 30 days did not meet objectives using multimedia.[16 73 99 101 119 122 126-129 131 132 135 136] The evidence suggests that multimedia may have a positive short- and long-term effect on practice behavior objectives.

Out of 15 studies comparing single media and multimedia, 10 studies met 11 objectives and all were evaluated at an interval of greater than 30 days after the educational intervention,[44 47 70 96 97 100 105 111 114 115] suggesting that both single media and multimedia have a positive short and long-term effect on practice behavior objectives, and that multimedia have an advantageous effect. One study comparing single media and multimedia did not report evaluation duration and lacked a control group.[59] Two studies comparing single media and multimedia reported evaluation duration greater than 30 days and showed mixed results.[137 141] One study reported evaluation duration greater than 30 days, but lacked a control group.[67] Four studies with evaluation duration greater than 30 days did not meet seven objectives.[70 74 96 137]

One study did not report the type of media used, reported evaluation duration greater than 30 days, lacked a control group, and was inconclusive about meeting objectives.[145]

The evidence suggests that both single media and multimedia may have positive short- and long-term effects on practice behavior, with use of multimedia being advantageous.

Short-term and long-term effects of CME educational techniques on practice behavior. A total of 11 studies reporting on 12 objectives evaluated the impact of a single technique on practice behavior objectives. One study met objectives using a single technique but did not report evaluation duration.[15] One study with evaluation duration of 30 days or less met objectives using a single technique.[94] One study with evaluation duration greater than 30 days met objectives using a single technique.[19] One study did not report evaluation duration and did not meet objectives using a single technique.[13] One study with evaluation duration of 30 days or less did not meet objectives using a single technique.[18] Two studies with evaluation duration of greater than 30 days did not meet objectives using a single technique.[14 16] One study was judged inconclusive because of mixed results.[20] Three studies using a single technique reported evaluation duration of greater than 30 days, but lacked a control group.[23-25] Two of these three studies did not reach statistical significance. This suggests that a using a single technique may not have a short- or long-term positive effect on practice behavior objectives.

A total of 76 studies with 98 objectives evaluated the short- and long-term impact of multiple techniques on practice behavior objectives. Eight studies met 11 objectives using multiple techniques but did not report evaluation duration[32 35 36 68 69 79 92 93] and thus did not allow us to distinguish between short- and long-term effects of CME. Thirty-nine studies with evaluation duration greater than 30 days met 45 objectives using multiple techniques.[44-46 48 49 52 53 62 72 76-78 81 82 82 95 98 99 101-113 116-120 122-124]

Two studies did not report evaluation duration and did not meet objectives using multiple techniques.[57 139] One study with evaluation duration of 30 days or less did not meet objectives using multiple techniques.[138] Sixteen studies with evaluation duration of greater than 30 days reporting on 22 objectives did not meet objectives using multiple techniques.[43 56 73 101 119 122 126-129 131-136]

One study using multiple techniques did not report evaluation duration and lacked a control group.[146] One study using multiple techniques did not report evaluation duration and showed mixed results.[149] Seven studies reporting on 10 objectives using multiple techniques reported an evaluation duration of greater than 30 days but lacked a control group.[64 65 67 83 143-145] Six studies showed mixed results.[42 71 73 88 140 142] One of the six showed a positive effect which was lost 6 months after the intervention.[73]

The evidence suggests that the use of multiple techniques in CME may have an overall positive short- and/or long-term effect on practice behavior objectives.

A total of 18 studies reporting on 24 objectives compared the use of single and multiple educational techniques in CME.[47 59 66 70 74 87 96 97 100 114 115 121 125 130 137 141 147 148] Ten studies with evaluation duration greater than 30 days met 12 objectives comparing single and multiple techniques,[47 70 96 97 100 114 115 121 125 148] and indicated that multiple techniques may have an advantageous short- and long-term effect on practice behavior objectives. Two studies using single versus multiple techniques did not report evaluation duration and neither had a control group, precluding further meaningful conclusions.[59 147] Two studies using single versus multiple techniques reported an evaluation duration of greater than 30 days and showed mixed results,[137 141] One study with evaluation duration greater than 30 days lacked a control group. Five studies with evaluation duration of greater than 30 days reporting on eight objectives did not meet objectives and thus were unable to identify a difference when using single versus multiple techniques.[70 74 96 130 137]

Short-term and long-term effects of the amount of exposure on practice behavior. A total of 37 studies reporting on 41 objectives evaluated the impact of single exposure to the CME activity. Two studies met objectives using single exposure, but did not report evaluation duration.[36 68] One study with evaluation duration of 30 days or less met objectives using a single exposure to the CME activity.[94] Sixteen studies with evaluation duration greater than 30 days met 18 objectives using single exposure to the CME activity.[44 45 48 53 70 77 82 98 100 102-104 106 107 111 114] This suggests that single CME exposure may have a positive short- and long-term effect on practice behavior objectives. Two studies with evaluation duration of 30 days or less did not meet objectives using single exposure to the CME activity.[18 138] Only six studies with evaluation duration greater than 30 days did not meet objectives using single exposure to the CME activity.[14 16 70 74 128 129] Five studies with evaluation duration greater than 30 days lacked a control group,[24 25 64-66] although one of the five did not meet objectives for either intervention group.[24] Six studies with evaluation duration greater than 30 days showed mixed results.[20 71 88 140-142]

A total of 55 studies (72 objectives) evaluated the impact of multiple exposures to the CME activity. Five studies met objectives using multiple exposures to the CME activity, but did not report evaluation duration.[15 32 35 69 93] Thirty studies with evaluation duration greater than 30 days met 36 objectives using multiple exposures to the CME activity.[19 46 49 52 62 72 75 76 78 81 95 97 99 101 105 108-110 112 113 115-121 123 125 148] One study using multiple exposures to the CME activity did not report evaluation duration and lacked a control group.[147] Five studies of evaluation duration greater than 30 days lacked a control group[24 25 64-66] whereas two studies showed mixed results.[73 137] No meaningful conclusions could be drawn from these studies. Two studies did not meet objectives using multiple exposures to the CME activity, and did not report evaluation duration.[13 57] Sixteen studies with evaluation duration greater than 30 days did not meet 21 objectives using multiple exposures to the CME activity.[43 56 73 99 101 119 126 127 130 132-137 150] Overall, we conclude that multiple exposure volume to the CME activity may have positive short- and long-term effects on practice behaviors.

A total of eight studies reporting on 17 objectives did a head-to-head comparison between single and multiple exposures.[42 47 59 79 83 96 122 144] Whereas four of these studies indicated that multiple exposures may be better than single exposure, six showed mixed or negative results, thus not allowing us to draw any strong conclusions. One study met objectives using single versus multiple exposures to the CME activity, but did not report evaluation duration.[79] Three studies with evaluation duration greater than 30 days met objectives using single versus multiple exposures to the CME activity.[47 96 122]

One study using single versus multiple exposures to CME activity did not report evaluation duration and had no control group.[59] Two studies using single versus multiple exposures to CME activity reported evaluation duration greater than 30 days but did not have a control group.[83 144] No meaningful conclusions could be drawn from these studies. One study using single versus multiple exposures to CME activity reported evaluation duration greater than 30 days and showed mixed results.[42]

Two studies with evaluation duration greater than 30 days did not meet objectives using single versus multiple exposures to the CME activity.[96 122]

One study did not meet objectives and did not report exposure to CME activity or evaluation duration.[139]

Two studies met objectives using other exposures to the CME activity, but did not report evaluation duration.[87 92] One study with evaluation duration greater than 30 days met objectives using other exposures to the CME activity.[124] One study using other exposure to CME activity did not report evaluation duration and lacked a control group.[146]

Quality of the evidence for the short-term and long-term effects of CME on practice behavior (see Appendix F, Evidence Table 8). Taking into consideration the quantity and quality, and consistency of evidence on the effectiveness of CME on practice behaviors, we graded the strength of evidence as very low.

Clinical Outcomes

Short-term effects of CME on clinical outcomes (See Appendix F, Evidence Table 12). Only one study measured the short-term effects of CME on clinical outcomes, i.e., less than 30 days after the educational intervention.[18] This study reported on the effect of printed CME on adherence to beta-blocker use, and was successful in achieving the stated objective of the intervention. However, the effects of CME were evaluated in non-equivalent patient groups, rendering the results of the study inconclusive. Three additional studies did not clearly report the time at which clinical outcomes were measured.[32 33 151] Of these, two reported that the desired objective of the intervention was met,[33 151] and a third showed mixed results.[32] The first of these studies reported on a direct measure of health status: depression. In that study, depression was improved to a greater degree among patients of physicians who had received a quality improvement intervention that included CME in the form of academic detailing, discussion groups, printed materials, and feedback, than among a control group.[151] However, the effect of CME was difficult to separate from the effect of the quality improvement component. The second study addressed antimicrobial drug use with a complex statewide intervention that targeted education directly at patients as well as their physicians; this made the actual effect of the CME component difficult to estimate.[33] The third study evaluated a multi-modality depression education program and found significantly improved patient satisfaction among women, but not among men.[32]

Long-term effects of CME on clinical outcomes. Thirty-three studies, reporting on 42 clinical outcomes, measured the long-term effect of CME, i.e., more than 30 days following the educational intervention.[22 43 47 55 56 65 72-75 77 78 81 84 95 99 109 111-115 117 120 131 132 135 137 152-156] Fourteen of these studies were successful in achieving the desired effect of the CME intervention on clinical outcomes.[22 43 47 74 78 84 95 109 111 115 152-155] One study showed mixed results, impacting frequency of office visits but not emergency room visits or hospitalizations.[120] In the remaining 23 studies, either no effect of CME was observed, or the effect was uncertain due to ambiguous results or problems in study design. Of the 14 studies that did show a long-term effect, six reported on direct measures of health status of the target patient population. These outcomes were arthritis pain and disability,[95] depression,[22 152] general health and function,[109] emotional distress,[84] and lost work due to back pain.[153] Eight studies reported on health-related behaviors or attitudes. These outcomes were: percent of patients taking medication,[152] patient adherence with antibiotics,[47] patient satisfaction with care,[74] frequency of physician visits,[111] hospitalizations,[78] hospital length of stay,[155] and smoking cessation rates.[115 154] One study reported a mixed outcome, "quality of practice," which combined direct measures of patient health status, such as whether the blood pressure was below 130/80 mm Hg, with behavioral or physician-related outcomes, such as whether the physician had recorded a family history of diabetes.[43]

Short-term effects of CME media methods on clinical outcomes. Only one study was available to assess the relative effectiveness of different types of media (live, print, internet, or multiple) on short-term clinical outcomes (less than 30 days). In this study, a print intervention improved adherence with beta-blocker use.[18] Five studies did not report on duration of clinical outcome.[32 33 146 151 157] Thus, no conclusions could be drawn about the differential effectiveness of CME media in the short term.

Long-term effects of CME media methods on clinical outcomes. Of the studies that had information about the effectiveness of different single media forms of CME on long-term clinical outcomes, five used a live CME intervention;[72 84 152 154 155] four of these five achieved the stated goal of the study. Two studies used print media and neither achieved its objective.[56 157] Another used Internet-based CME and did achieve its objective.[43] Most of the studies, however, used multiple CME media. Twenty-two studies used multiple media CME in comparison to a control.[55 65 73 73 75 75 77 78 81 95 99 109 112 113 117 120 120 131 131 132 135 156] In four of these, the study achieved its stated aim. Seven studies compared multiple media CME to single media CME.[47 74 111 114 115 137 153] Six of these achieved the stated aim; each found multiple media CME to be more effective than single media in improving clinical outcomes.

Short-term effects of CME educational techniques on clinical outcomes. A total of 15 different educational techniques were identified in the studies that reported clinical outcomes: readings, conference calls, academic detailing, discussion groups, lectures, point of care CME, feedback, physician visits, case-based learning, role-play, standardized patients, demonstrations, clinical experiences, simulation, and problem-based learning. Only one CME technique was evaluated singly in comparison to control for short-term clinical outcomes: provision of educational readings was associated with increased use of beta-blockers.[18]

Long-term effects of CME educational techniques on clinical outcomes. Only one study evaluated the effect of a single CME technique in comparison to control for long-term clinical outcomes. In this study, the use of conference calls was associated with improvements in depression.[22] With only one such study, no conclusions could be drawn regarding the comparative effectiveness of single CME techniques on long-term clinical outcomes. Most of the studies evaluated used multiple CME techniques. Thirty-eight studies reported on the use of multiple simultaneous CME techniques in comparison to control. Twelve of these reported that the desired clinical outcome of the CME intervention was achieved.[43 47 74 78 84 95 109 111 115 152 153 155] Two studies yielded mixed results, i.e., some of the outcomes showed improvement while others did not.[120 151] No individual CME techniques were common to the studies that did or did not achieve their stated objective; thus, one cannot draw any conclusions regarding the differential effectiveness of specific educational techniques. Five studies compared single to multiple CME interventions.[47 74 115 137 152] In three of the five studies, the use of multiple simultaneous CME techniques was superior to the use of a single CME technique (readings).

Short-term effects of the amount of exposure on clinical outcomes. Only one study assessed the short-term effect of CME on clinical outcomes (less than 30 days). In this study, a one-time print intervention improved adherence with beta-blocker use.[18] Five studies did not report on duration of clinical outcome,[32 33 146 151 157] and all other studies reported long-term outcomes. Thus, no conclusions could be drawn about the differential effectiveness of amount of CME exposure (one-time vs. multiple exposures) on short term outcomes.

Long-term effects of the amount of exposure on clinical outcomes. Seven studies evaluated the long-term effect of a single CME exposure on clinical outcomes.[65 74 77 111 114 152 154] Four of these studies reported that the CME objective had been met.[74 111 152 154] In one study, the objective was not met.[114] Of the remaining two studies, one lacked a well-defined control group[65] and one yielded unclear results.[77] Most studies employed multiple CME exposures. In 24 studies, the multiple CME exposures were compared to a control with no CME.[22 43 55 56 72 73 75 75 78 81 84 95 99 109 112 113 115 117 120 131 132 135 137 156] In seven of the studies, the objectives were met.[22 43 78 84 95 109 115] In 16 studies, the objectives were not met or it was unclear if they were met.[55 56 72 73 75 75 81 99 112 113 117 131 132 135 137 156] One study produced mixed results, as described above.[120] In one study, a single printed CME intervention and a combination of printed material plus tutorial were compared with control.[47] While the CME intervention was deemed successful in changing clinical outcomes, the use of multiple CME exposures (tutorial plus reading) outperformed a single CME exposure (reading alone) in only 2 of 5 outcomes studied. In summary, both one-time and multiple exposure CME interventions have produced changes in clinical outcomes in about half of the studies, but it is unclear whether multiple exposure CME produces better results than one-time CME.

Quality of the evidence for the short-term and long-term effects of CME on clinical outcomes (see Appendix F, Evidence Table 8). Taking into consideration the quantity and quality, and consistency of evidence on the effectiveness of CME on skills, we graded the strength of evidence as low.

Key Question 3: What is the evidence from systematic reviews about the effectiveness of simulation methods in medical education outside of CME?

Characteristics of the Systematic Reviews

The nine systematic reviews that met the inclusion criteria were a heterogeneous group (see Appendix F[*], Evidence Table 13). All included systematic reviews were published between 1990 and 2006. Eight of the reviews evaluated the role of simulation in skill acquisition, while two reviews[28 158] evaluated the role of simulators in knowledge acquisition. Out of the eight reviews

[*] Appendixes cited in this report are provided electronically at http://www.ahrq.gov/clinic/tp/cmetp.htm

that evaluated the role of simulation in skill acquisition, five reviews[26 29-31 159] addressed the effectiveness of simulation in training procedural or surgical skills, two reviews[158 160] addressed the effectiveness of simulation in training on communication skills, and two reviews[158 159] examined the effectiveness of simulation in training on physical examination skills. One study[27] addressed the general features and uses of high-fidelity simulation in effective learning. Five reviews[26 27 31 159 160] clearly stated the study question to allow replication of the results, while four other reviews[28-30 159] only partially stated the study question.

Types of simulation studied. A wide variety of simulation-based methods were identified in these reviews. Two reviews[26 30] included studies that had evaluated virtual reality, two reviews[31 159] included studies with full simulation, three reviews[28 158 160] included studies with standardized patients or role play, five reviews[29-31 158 159] included studies with partial task simulation, and six reviews[28-31 158 159] included studies with computer simulation. All reviews had studies that compared simulation-based training with another type of simulation-based training, other educational intervention, standard training, no education, or no training.

Study populations and study designs. Three reviews[26 158 160] restricted inclusion criteria to studies that had enrolled only medical students or physicians-in-training. Other reviews also included studies that enrolled, in addition to medical students and physicians-in-training, fully-trained physicians, nurses, allied health professionals, and non-medical personnel. One review[31] included only randomized controlled trials, while other reviews included non-randomized controlled trials and prospective trials in addition to randomized controlled trials.

Effectiveness of Simulation in Teaching Procedural Skills

Since the reviews often included a variety of studies, depending on the focus of the review, each systematic review was further broken down by the number of studies which addressed the effectiveness of simulation as an educational method (see Table 5 and Appendix F, Evidence Table 14).

Table 5. Quantity and direction of evidence for effectiveness of simulation

Learning objectives	Number of reviews which addressed learning objective	Number of studies which addressed effectiveness of simulation as an educational method	Direction of evidence
Psychomotor Skills	6[26 29-31 158 159]	63	Favors simulation
Communication Skills	2[158 160]	14	Favors simulation
Cognitive Skills	2[28 159]	37	Mixed results

Three reviews evaluated the effectiveness of virtual reality in teaching surgical skills. In virtual reality, the surgical field is represented in three dimensions which may help in learning more accurate surgical planning and procedures. One meta-analysis[26] found that training in a virtual reality environment significantly decreases the total amount of time required for task completion. There was also a trend toward a decreased error rate which did not reach a statistically significant level. Another systematic review[29] found four studies that evaluated the role of virtual reality in training surgical techniques. Two studies in this review found improvement in surgical skills after training with a virtual reality simulator while two other studies found no significant improvement after training with virtual reality simulators. A third systematic review[31] found that trainees trained on computer simulation perform better than those who received no training, however, studies found an inconsistent benefit of computer simulation if simulation-trained students were compared with those who received standard training. This systematic review found only one study in which computer simulation was found to be superior to a physical training model. On the other hand, this review found that physical or model simulation may be superior to no training and standard training as instructions from mentors or manuals.

Video simulation was studied in one review.[31] Video simulation was not superior to standard training or no training, and there was insufficient evidence to support the superiority of computer simulation to video simulation.

One review[30] evaluated the effectiveness of simulators for training in gastrointestinal endoscopy and concluded that flexible sigmoidoscopy can be applied for clinical training of residents and fellows for better patient comfort only. However, this review did not find enough evidence to support the use of simulators for clinical training in gastrointestinal endoscopy to improve clinical outcomes.

Another review[159] found one study with a cross-over design that reported a better post-test score (on a 22-object written test) of the anesthesia residents who were trained on a simulator as compared to those who were not trained.

Effectiveness of Simulation in Teaching Physical Examination

Two systematic reviews evaluated the effectiveness of simulation in teaching physical examination. One review[158] found that use of standardized patients to teach breast examination to medical students was associated with better performance in a clinical skills examination. This review further found that use of standardized patients or breast examination models was associated with improved ability of the students to detect breast lumps. The second review[159] found that use of a patient simulator was associated with improved practical skills as measured on a post-test examination.

Effectiveness of Simulation in Teaching Communication Skills

Two reviews evaluated the effectiveness of simulation in teaching communication skills. One review[158] found that when students were taught communication skills by patients with cancer, including training for giving bad news, students were more likely to respond empathetically to patients and better able to communicate bad news than students who were not taught communication skills by patients with cancer. This review further found that role-playing may be important in teaching oncology-specific communication skills as well as in communicating bad news. The second review[160] found that use of standardized patients and role-play was effective in teaching medical students smoking cessation counseling skills. This review further found that the use of standardized patients in teaching tobacco cessation skills to medical students was associated with increased confidence of students in their smoking cessation counseling skills.

Effectiveness of Simulation in Knowledge Acquisition

We found two reviews[28 159] that addressed the effectiveness of simulation in knowledge acquisition. Hmelo[28] found that computer assisted models are effective in teaching pathophysiologic principles to medical students. The pooled effect size, which measures the combined magnitude of the effect of intervention across 33 studies, was 0.63 for use of computer assisted learning (in favor of simulation). One study included in Ravert[159] looked at computer-based trauma simulation to teach trauma management; individual-study effect sizes ranged from -0.04 to 0.35 (did not favor simulation or were neutral). This review[159] did not report on the pooled effect size.

Features of High-Fidelity Simulators for Effective Learning

One review[27] systematically evaluated the features of high-fidelity simulators essential for effective learning. This review found that the following features of a high-fidelity simulator were important for effective learning: should provide feedback during learning experience, allow repetitive practice, can integrate in overall curriculum, has increasing levels of difficulty, is adaptable to multiple learning strategies, can allow clinical variation in a simulated environment, provides controlled environment to make and detect mistakes without consequences, provides individualized and standardized learning, defines outcomes clearly, and must have face validity-realism of simulator.

Summary

Overall the direction of evidence points to the effectiveness of simulation training, especially in psychomotor skills (e.g., procedures or physical examination techniques) and communication skills, but the strength of the evidence was considered low, due to the small number of appropriate studies, the scarcity of quantitative data, and other limitations. Several factors may be responsible for the inadequate quality of evidence in support of this method. In our view the most important factor is the lack of widely-accepted and standardized methods to quantify the competency in procedural or communication skills. In addition, the high cost of simulation methods and difficulty in introducing clinical realism in a simulated environment are other factors that may be responsible for inadequate quality of evidence in this field.

Key Question 4: Which characteristics of the audience by themselves or in combination with other characteristics influence the effectiveness of certain educational techniques?

Key Question 5: Which external factors by themselves or in combination with other factors reinforce the effects of CME in changing behavior?

We sought to evaluate the impact of both internal audience characteristics and external factors on the effectiveness of CME. Certain audiences may respond differently to an educational intervention, and it would be important to determine the most effective means to educate these subgroups. Specifically, we were interested in whether certain audience characteristics, such as gender and years in practice, might influence the effectiveness of certain educational techniques. Likewise, we wished to determine whether the presence of specific external factors or incentives might affect the short-term and long-term outcomes of CME activities. Both types of factors could impact future CME course design. Table 6 contains a list of the relevant internal and external factors that we considered.

Table 6. Internal audience characteristics and external factors examined in the review

Internal Audience Characteristics	External Factors
▪ Age	▪ Regulation
▪ Gender	▪ State licensing board
▪ Practice setting	▪ Professional boards
▪ Years in practice	▪ Hospital credentialing
▪ Specialty	▪ External audits
▪ Foreign vs. U.S. medical graduate	▪ Monetary/financial rewards
▪ Country of practice	▪ Academic advancement
▪ Personal motivation	▪ Provision of tools
▪ Non-monetary rewards/motivations	▪ Public demand/expectations
▪ Learning satisfaction	▪ CME credit
▪ Knowledge enhancement	

Audience Characteristics

Thirteen studies examined the influence of audience characteristics on the educational intervention that was evaluated.[33 39 53 61 69 70 79 80 92 101 105 140 161] In only one of these studies was evaluation of these characteristics considered the primary goal of the paper.[105] Evidence Table 15 contains a description of the studies reviewed, grouped by the audience characteristic examined. We excluded characteristics that were unique to individual outcome measures (e.g., Medicaid practice size, nursing home practice size) and instead focused on features of the audience that were evaluated more frequently (see Table 6). We also specifically searched for articles that described personal motivation factors (e.g., knowledge enhancement and non-monetary rewards) in their analysis but could not find any.

Six studies examined the effect of years in practice on the educational intervention.[33 53 79 80 92 140] Beaulieu, et al. suggested that physicians with less than 11 years of experience ordered fewer unnecessary screening tests than those with more experience, however, these results were not stratified by the educational technique actually employed by individual physicians.[140] Two other studies suggested that physicians with greater experience who underwent educational interventions had improvements in attitudes[33] and self-reported practice behavior.[53] However, none of the studies examined revealed a relationship between years in practice and acquiring knowledge, acquiring skills, or changing practice outcomes. Similarly, age had no influence on the outcomes of educational interventions in the 6 studies that reported on the effects of age.[39 79 80 101 105 161]

Of the five studies[39 53 79 80 161] that analyzed the effect of gender, only one showed a significant association. Leopold, et al. showed that women improved more than men in confidence with an objective performance of knee joint injections after an educational intervention consisting of printed material, hands-on instruction, or video instruction.[80] Only one paper described the influence of race on the effectiveness of the educational intervention.[79] Grady, et al. suggested that non-whites who underwent a presentation on mammography screening followed by cue enhancement (i.e., chart stickers and clinic posters) improved their screening rates more than whites.[79] This study also suggested that the intervention had a greater effect on solo practitioners compared to those in other practice settings. Three studies that examined the influence of board certification on educational outcomes primarily focused on internists and family practitioners and failed to show an association between certification and the desired outcome.[53 79 105]

Conclusions and Limitations. We cannot reach definitive conclusions regarding the influence of audience characteristics on the effectiveness of specific educational techniques due to the heterogeneity of the educational interventions and characteristics examined. Furthermore, there are very limited data regarding any specific characteristic and the overall quality of the existing data on these questions are suboptimal.

External Factors

The literature is limited about the role of external factors, by themselves or in combination with other factors, in reinforcing the effects of CME on changing behavior. Very few studies explicitly stated that such factors were examined independently or collected data regarding these factors. Only one study rigorously examined external factors as a primary outcome.[79] Grady et al. studied whether token monetary rewards in addition to an educational intervention and chart cues increased the rate of mammography referral. While chart cues were effective in increasing mammogram referral and completion rates, the addition of a token monetary incentive provided no added benefit.

The offering of CME credit would not intuitively appear to be an external motivating factor for behavior change. Yet, two studies specifically examined the role of offering CME credit for this purpose, so it was included in our analysis. Both of these studies looked at results in association with earning CME credit for the educational activity.[106 156] Chassin and colleagues examined in a subgroup analysis the effect of offering CME credit for attendance at educational programs designed to decrease inappropriate x-ray pelvimetry rates in 64 study hospitals.[162] They found no significant difference among intervention participants with respect to the offering of CME credit; both groups had a comparable decrease in pelvimetry use. Messina et al. found a potential association of offering CME credit for a physician educational program with an increase in the use of screening mammography in women who had never undergone mammography, but it did not reach statistical significance. The trend did not hold true for previous mammogram users.[156] These findings may be because CME credit may be an inducement to attend a CME activity but may not be sufficient to engage the participant in active learning.

Some CME courses utilize the signature of a “commitment-to-change” statement as an external motivating factor to improve clinical outcomes. Two studies examined the effectiveness of such a practice.[161 163] Mazmanian and colleagues randomized 110 physicians to signature versus non-signature groups. While they found that those expressing an intent to change were more likely to change practice behavior (as documented by self-report on a follow-up survey), the act of signing such a commitment-to-change statement had no effect.[161] In a much smaller study of 16 physicians attending a geriatrics course, Pereles et al. found that the physicians who were asked to make written commitments for practice changes (n=7) made more changes than controls at both one and three months followup. The results are of unclear statistical significance given the small study numbers.[163]

Conclusions and Limitations. There are several barriers to collecting data on external factors. First, it is methodologically difficult to offer incentives (such as CME credit or financial reward) in a controlled fashion. Second, most evaluation of external factors is based on self-report. Finally, small study sizes often preclude a valid analysis of external factors in subgroup analyses due to lack of adequate power. Consequently, it is difficult to draw conclusions regarding the effectiveness of external factors in enhancing CME effects on behavior.

Key Question 6: What is the reported validity and reliability of the methods that have been used for measuring the effects of CME in terms of a) imparting knowledge, b) changing attitudes, c) acquiring skills, d) changing practice behavior, or e) changing clinical practice outcomes?

Background

Valid and reliable evaluation tools are necessary to demonstrate the effectiveness of CME interventions. The validity of the evaluation method is "the degree to which the method truly measures what it is intended to measure."[11] A valid evaluation method accurately measures achievement of the stated objective of the educational intervention, whether it involves knowledge, attitudes, skills, practice behaviors, or clinical outcomes. The reliability of the evaluation method is "the consistency or reproducibility of measurements."[11] A reliable evaluation method allows educators to have confidence in their assessments of learning across multiple measurements. As one measurement expert emphasizes, "small amounts of unreliability may cause misclassification errors and large score differences on retesting."[164]

An evaluation method may be statistically reliable without being valid for the objective intended by the investigators. However, a method cannot be valid without being reasonably reliable. Thus, Downing argues that "reliability is a necessary but not sufficient condition for validity, and reliability is a major source of validity for all assessments."[164]

An educational study may employ a newly created evaluation method or one that previously has been shown to be valid and/or reliable in another study population. The creation of a new evaluation method consumes time and resources for pilot testing, cognitive testing, and psychometric analyses to determine the validity and reliable of the new method. However, a previously used method may not be a valid measure for a new educational intervention if it does not map appropriately to the stated objective. Also, the reliability of a method changes as it is applied in different populations and ideally should be re-measured each time.

Results

We found reports of the validity and/or reliability of at least one evaluation method in 46 out of 136 total articles (33.8 percent). Among these 46 articles, 11 reported on the validity and/or reliability of more than one method: eight studies described two methods;[42 43 48 52 60 72 137 144] two studies described three methods;[55 84] and one study described four methods.[32] Thus, 61 evaluation methods were accompanied by validity or reliability data. For the results below, percentages are based on the total number of methods – rather than articles – since some articles reported on multiple methods.

Among these 61 evaluation methods, 30 (49.2 percent) were drawn from previous studies and 28 (45.9 percent) were created for the current studies. For 3 methods (4.9 percent), it was not clearly reported whether the method was newly created or previously used. For 22 of the 30 previously used methods, the authors reported that reliability had been assessed: 13 within the current study population, 8 within previous study populations, and 1 within current and previous study populations. However, only 14 methods were presented with specific statistical data to support this reliability. For 12 of the 30 newly created methods, the authors reported that pilot and/or cognitive testing was performed.

Appendix F[*], Evidence Table 16 presents the 61 evaluation methods, organized by type of outcome.

Knowledge or cognitive skills were evaluated by 15 methods (24.5 percent).

Attitudes were evaluated by seven methods (11.5 percent). Two methods focused exclusively on attitudes, while five methods evaluated a combination of attitudes and knowledge / cognitive skills.

Skills (communication, psychomotor, or procedural) were evaluated by 11 methods (18.0 percent). One method evaluated physical exam skills in an educational setting. A combination of skills (communication, psychomotor, or procedural) and practice behaviors were measured by 10 methods, using standardized patients to visit physicians at their practice setting or analyzing interactions with real patients.

Practice behaviors (without clinical outcomes) were evaluated by 20 methods (32.8 percent). Seven methods used self-report by physicians of their practice behaviors. Three methods used patients' report of their physicians' behaviors in their medical care. Ten used chart review of medical records and/or claims data.

Clinical outcomes (with or without practice behaviors) were evaluated by 8 methods (13.1 percent). Two studies used chart review. One used reports by patients or families of their attitudes. One study used patient satisfaction. Two studied patient reports of their own behavior – including medication adherence and participation in preventive screening – as the outcome. One study used patients' reports of preventative services provided by their physicians. Three used measures of the patient's health.

The following articles provide notable examples for reporting of the validity or reliability of educational outcome measures:

- <u>Knowledge or cognitive skills:</u> Fordis et al[42] describes the development of a knowledge test for cholesterol management, including: content validation by experts; description of the test and response options; piloting and item number reduction; and high internal consistency reliability (Cronbach alpha = 0.79).
- <u>Attitudes:</u> Mann et al[52] describes the development of a knowledge and attitudes test about cholesterol management, including: content validation by experts; need for >90 percent agreement on question inclusion and consistency; description of the test and response

[*] Appendixes cited in this report are provided electronically at http://www.ahrq.gov/clinic/tp/cmetp.htm

options; pilot testing with internal consistency testing in the pilot population (KR20 = 0.60); and test-retest reliability analysis using control group test scores.

- Skills (communication, psychomotor, or procedural): Roter et al[84] describes a coding system to rate physicians' proficiency in managing standardized patients' emotional distress, including: blinding of coders; dichotomous coding system; and internal consistency reliability (Cronbach alpha = 0.20-0.62 for shorter scales, 0.76-0.81 for longer scales, and 0.62 for overall score).
- Practice behaviors: Sibley et al[136] describes chart abstraction for quality of care, including: content validity of pre-determined criteria by experienced clinicians; rating system; training of blinded nurse-abstractors; and high interrater and intrarater reliability (kappa >0.8).
- Clinical outcomes: Roter et al[84] describes use of the General Health Questionnaire-28 to detect emotional distress in patients, including: citation of original source for this previously validated questionnaire; repeated reliability testing with the study population, yielding high internal consistency (Cronbach alpha = 0.90-0.92).

Table 7 presents the number of evaluation methods for each type of validity or reliability, as well as tallies for each type of outcome within each validity or reliability. Of note, methods may capture more than one type of outcome and may be repeated in more than one column for each row. Of 61 evaluation methods with validity or reliability reported, 16 (26 percent) included descriptions of validity alone, 29 (48 percent) included descriptions of reliability alone, and ten (16 percent) had descriptions of both validity and reliability. For six methods (10 percent), the methods were described as valid and/or reliable, but the specific type of validity or reliability was not reported.

Validity was reported for 31 of 61 evaluation methods (50.8 percent). Content validity was reported for 16 methods. The specific "experts" who reviewed the assessment were reported for 11 of these 15 methods. Concurrent criterion validity was reported for 8 methods. Predictive criterion validity was reported for only 1 method, which involved a comparison between physicians' reports of asthma management behaviors and patients' reports of physician behaviors. Construct validity was reported for 5 methods, usually through "known-group validity" (establishing construct validity by demonstrating better scores among those with higher levels of training or clinical experience). High statistical validity was only demonstrated for two methods.[72 137] Five methods were described as valid without specific details. Thus, the vast majority of CME studies offered no or limited psychometric data for the validity of their evaluation methods.

Reliability was reported for 43 of 61 evaluation methods (70.5 percent). Internal consistency reliability was reported for 19 methods, including 13 learner instruments, 1 observer instrument for audio-taped interactions, 1 standardized patient instrument, and 3 clinical patient instruments. Inter-rater reliability was reported for 16 methods, including 9 medical data abstractions and 6 skills assessments. Intra-rater reliability was assessed for 2 medical data abstraction studies. Equivalence reliability was reported for 4 methods, and test-retest reliability for 5 methods. Four methods were described as reliable without specific details. When reported, statistical tests yielded primarily modest evidence of reliability based on Cronbach-alpha, Kappa, or correlation statistics.

Conclusions

- Forty-six of 136 articles (34 percent) reported the validity and/or reliability of at least one evaluation method for assessing the effectiveness of CME.
- Thirty methods were drawn from previous studies, and 28 were created for the current studies. For 3 methods, the source was unclear. Authors did not commonly report reliability testing within the new study population for methods found to be reliable in other populations.
- The most common type of outcome evaluated by valid and/or reliable evaluation methods involved practice behaviors, for 20 out of 61 methods (34 percent).
- Of 61 evaluation methods with validity or reliability reported, 16 (26 percent) included descriptions of validity alone, 29 (48 percent) included descriptions of reliability alone, and ten (16 percent) had descriptions of both validity and reliability. For six methods (10 percent), the methods were described as valid and/or reliable, but the specific type of validity or reliability was not reported.
- Among these 61 methods, content validity was the most commonly reported type of validity (26 percent).
- Among these 61 methods, internal consistency (31 percent) and inter-rater (28 percent) were the most common types of reliability reported.

Although many studies of the effectiveness of CME have considered the validity or reliability of their evaluation methods, relatively few studies have used methods that have strong evidence of both construct and criterion validity. In addition, relatively few studies have used evaluation methods that have strong evidence of each of the specific types of reliability (internal consistency, inter-rater, intra-rater, equivalence, and test-retest). We therefore conclude that the overall strength of evidence on the effectiveness of CME is limited by weaknesses in the evaluation methods that have been used. To strengthen the evidence base on the effectiveness of CME, it will be necessary to commit additional resources to the development of valid and reliable evaluation methods. This may be quite challenging because of the limited resources that generally are available to clinician-educators. Where appropriate, educators may save time and resources by using previously validated and reliable methods, but they must demonstrate the validity of these methods for their specific educational outcomes and the reliability of these methods for their particular study populations.

Table 7. Number of methods evaluated for each type of validity or reliability, organized by outcome type

Type of Validity	Definition*	# of Methods	Knowledge or cognitive skills†	Attitudes†	Skills (communication or psychomotor)†	Practice Behaviors†	Clinical Outcomes†
Content	Degree to which an instrument accurately represents the skill or characteristic it is designed to measure, based on people's experience and available knowledge	16	15[21 32 36 38 40 42 46 48 51-54 57 85 142]	3[51-53]	0	2[53 136]	0
Concurrent criterion	Degree to which an instrument produces the same results as another accepted or proven instrument that measures the same variable	8	1[142]	1[82]	1[25]	6[16 25 72 82 137 144]	2[47 137]
Predictive criterion	Degree to which a measure accurately predicts expected outcomes	1	0	0	0	1[78]	0
Construct	Degree to which an instrument measures the theoretical construct it intends to measure	5	3[36 43 85]	0	0	2[53 104]	0
Type of Reliability	**Definition**	**# of Methods**	**Knowledge or cognitive skills†**	**Attitudes†**	**Skills (communication or psychomotor)†**	**Practice Behaviors†**	**Clinical Outcomes†**
Internal consistency	How well items reflecting the same construct yield similar results	19	12[36 40 42 45 48 49 52 53 55 63 64 85]	8[45 49 52 53 55 62-64]	2[32 84]	6[32 45 49 53 72 84]	3[55‡84]
Inter-rater	Degree to which measurements are the same when obtained by different persons	16	1[85]	0	6[32 60 84 88 138 140]	13[32 42 76 84 88 108 118 132 134 136 138 140 144]	2[132 137]
Intra-rater	Degree to which measurements are the same when repeated by the same person	2	0	0	0	2[48 136]	0
Equivalence	Degree to which alternate forms of the same measurement instrument produce the same results	4	3[17 36 54]	0	0	1[53]	0
Test-retest	Degree to which the same test produces the same results when repeated under the same conditions	5	3[52‡53]	2[52 53]	0	3[22 53 134]	0
Validity: not specifically reported		4	0	1[72]	3[32 43 72]	3[32 72 121]	1[81]
Reliability: not specifically reported		5	1[60]	0	1[32]	2[32 121]	1[81]

*Definitions were obtained from Reed, et al.[11]
† Methods referenced may target more than one type of outcome and are listed under each applicable column.
‡ Two assessment methods within the same article.

Chapter 4. Discussion

Conclusions

We conducted a systematic review of the medical literature to evaluate the effectiveness of CME in improving knowledge, attitudes, skills, physician behavior and clinical outcomes. Overall, despite the generally low quality of the evidence, most of the studies reviewed suggest that CME is effective, at least to some degree, in not only achieving, but also in maintaining the objectives studied. Despite the wide variety of CME techniques, media, exposures used, and despite the heterogeneity of the studies reviewed, we found common themes among studies which applied across objectives. For example, when assessing the effectiveness of CME across domains, print media seem to be less effective than live media, and multimedia generally seem to be more effective than single media. In addition, interactive techniques seem to be more effective than non-interactive ones, and multiple exposures to the CME activity seem to be more effective than single exposure. Thus, the evidence supports consideration of these attributes of effective educational interventions when designing a CME course.

To ascertain whether broader lessons could be drawn from the non-CME medical education realm, we evaluated the effect of simulation methods in medical education by conducting a review of systematic reviews. Although we found that simulation training generally was effective, especially in the dissemination of psychomotor skills (e.g., procedures or physical examination techniques), studies which examined simulation did not review outcomes along the entire continuum of domains (i.e., knowledge through clinical outcomes), and were heterogeneous enough that few other conclusions could be drawn.

We also studied whether certain internal (audience) and external characteristics or factors, special to the environment, the participants or the course, may affect the effectiveness of CME. We found that the small and heterogeneous studies available did not allow us to reach definitive conclusions regarding the influence of audience characteristics or external factors on the effectiveness of CME. This is an area where further study might yield useful results in asking whether it might be important to marry the CME activity offered with those particular characteristics which might enhance its effectiveness and value.

Limitations

This evidence report has a number of limitations. First, the heterogeneous nature of the studies inhibits a quantitative summary of the effectiveness of CME. There is a lack of standardization of the definition of CME or associated performance improvement. The educational interventions studied targeted different types of audiences, using multiple types of objectives, across diverse content areas. Thus, comparing the effectiveness of educational methods and techniques across studies is challenging. Even if multiple studies shared comparable objectives, we found that authors did not use standardized reporting of results – such as effect sizes – prohibiting a quantitative meta-analysis of the results. Given these limitations, we had to pursue a qualitative synthesis of the available data.

Second, the generally low quality of study designs limits our ability to draw firm conclusions about the effectiveness of CME. Although we limited the review to studies with comparison groups, including a large number of randomized control trials, many studies lacked adequate descriptions of randomization methods or techniques for adjusting for baseline group differences. Moreover, too many of the articles we studied were published with comparison groups but did not have a control group, which did not allow us to evaluate effectiveness. In addition, only one-fifth of the studies described blinding of those evaluating the outcomes, leaving open the potential for biased assessment.

Third, the quality of reporting was variable. Authors rarely described the study design and the interventions in enough detail to allow reproducibility. In particular, studies rarely described specific learning objectives, prohibiting assessment of whether objectives matched appropriately to the evaluation methods/outcomes.

Fourth, the lack of valid and reliable CME evaluation tools leaves open the possibility of overestimation or underestimation of the effectiveness of CME. Most studies lacked psychometric data regarding their evaluation methods. Thus, the evaluation methods may not have truly assessed the outcomes targeted by the educational interventions. In addition, evaluation methods with poor reliability may fail to detect actual improvements in outcomes.

Fifth, our search strategy may be subject to some publication bias. Our search was limited to published English-language articles about educational studies within the United States and Canada. Our review does not include studies from other countries where high quality CME studies have been conducted. As indicated in the Methods chapter, this methodological choice was made because the medical education systems in other countries are very different from the system in the United States, thereby limiting the applicability of such studies to CME in the United States. Also, educational studies with negative findings are less likely to be published, potentially leading to overestimation of the effectiveness of CME.

Sixth, there is a lack of standardization of approaches to CME research in general, i.e., no Phase 1, Phase 2, Phase 3-like process that crafts an organized approach to how aims are set up and how comparative groups are organized. This includes the lack of standardization for definitions of controls.

Seventh, there is general lack of standardization of terminology related to media, techniques, exposure volume, etc, which makes studying the impact of different methods, techniques, exposures etc. on the effectiveness of CME difficult.

Finally, several limitations were specific to particular key questions:

For Key Questions 1 and 2, this report does not systematically review the effectiveness of quality improvement interventions. Although we included quality improvement studies if they included a physician education component, our search strategy did not systematically target all quality improvement studies. Thus, we cannot draw definitive conclusions comparing the effectiveness of physician education in quality improvement interventions versus quality improvement interventions more generally.

Moreover, our conclusions are limited secondary to the heterogeneity of studies included along multiple domains. In addition, many of the studies lacked a clear control group, which did not allow effectiveness of CME to be determined, but only different effectiveness across different interventions.

For Key Question 3, conclusions are limited due to the weaknesses of the systematic reviews available, the poor quality of many of the included studies, the heterogeneity of included studies, and the rapidly evolving nature of computerized simulation.

For Key Questions 4 and 5, there was lack of standard definitions of internal and/or external factors that might impact CME. In addition, conclusions are limited due to small sample sizes prohibiting analysis based on within-group characteristics and infrequent collection of data on external and internal motivating factors. In addition, lack of standardization of tools to assess the efficacy of CME inhibited our ability to draw firm conclusions.

For Key Question 6, conclusions are limited due to inconsistent reporting of validity and reliability for evaluation methods drawn from previous studies; we may have missed some valid or reliable evaluation methods that were not described as "valid" or "reliable" and for which psychometric data was not reported.

Additional limitations for Key Question 3 include:

a) With the exception of Hmelo,[28] these reviews were quite recent (2002-2006), and point to evolving educational methods. Virtual reality in 2001 may be difficult to compare to virtual reality in 2006. The computer assisted instruction described in the review by Hmelo[28] is already dated.
b) No review included tests for publication bias, which would be highly anticipated with any new technology.
c) Simulation can include a variety of tasks and procedures, with varying lengths and complexities. Some studies included partial task simulators with complex surgical and endoscopic procedures; pooling such disparate skills may be inappropriate.
d) One of the major advantages of simulation over standard medical education training for procedures should be the opportunity to practice and receive feedback in a shorter period of time. No study explored this important contributor to effectiveness, i.e., the frequency and intensity of the simulation method and whether there is a "dose-response" effect with the use of simulation and the outcome of clinical skills competence. This aspect was assessed by a systematic review published after our literature search which found an association between hours of practice on high-fidelity simulators and standardized learning outcomes.[165]
e) There is no consensus on the appropriate outcome measures for effectiveness of simulation. Haque,[26] Sutherland,[31] Gerson,[30] Aucar,[29] and Issenberg[27] all included validity studies within their reviews, but heterogeneity of tasks and simulators again makes it difficult to pool results.
f) Although nearly every review included a careful description of search methodology, most fell short in nearly every quality measure of a systematic review. The exception, Issenberg[27] is an example of a high quality systematic review of an educational topic; the authors unfortunately did not address the outcome of interest to Key Question 3.
g) For Key Question 3, systematic reviews that addressed the use of simulation in CME educational activities were excluded as this aspect was covered by our other Key Questions. It is possible that systematic reviews of the efficacy of simulation in CME activities may reach a different conclusion.

Future Research Implications

We believe that assessing those factors that make CME more or less effective will be important for the planning of effective CME activities in the future. Although the overall quality of the studies was low, there were a few important trends. CME appears to be generally effective not only in the acquisition or achievement of knowledge, attitudes, skills, behaviors, and clinical practice outcomes, but also in their retention, and there are certain techniques, methods or exposures which seemed to be better than others. Unfortunately, most studies did not describe multiple evaluation points after the intervention, which did not allow us to determine at what point the CME effect, when persistent, became extinguishable and might have needed reinforcement. To enable future systematic reviews of CME, study researchers should refer to an excellent review by Reed et al, which summarizes guidelines for standardization in the conduct and reporting of educational interventions.[11]

Simulation, as a teaching tool, has the potential to affect patient safety and clinical outcomes, but no study included in this review used a patient-based clinical outcome as a measure of effectiveness. Future research should seek to determine the impact of simulation in improving clinical outcomes.

We believe that educators should develop strategies for identifying and prioritizing the gaps in our knowledge about CME that should be the focus of additional research. Future research should include high quality randomized controlled studies of CME with clear intervention and control groups and measurement of effectiveness at multiple points post-intervention. Such studies should focus on high priority areas given the resource constraints that educators typically face in conducting research on CME. Educators will need to use a variety of study designs, including qualitative research methods, because it will not be feasible to perform randomized controlled trials on many of the issues. Indeed, it will be difficult to rely too heavily on randomized controlled trials given the difficulty of creating and maintaining effective control groups.

To advance research on CME, leaders in medical education could develop a national agenda on what is needed to improve the effectiveness of CME. Such an agenda should include a clear definition of what constitutes CME. For example, whether quality improvement or practice improvement alone should have been included in our evaluation presented a dilemma. We decided that there needed to be a well-defined educational intervention for us to include quality improvement or practice improvement studies in our review of the effectiveness of CME. The agenda for future research should include development of more standardized approaches to the description of CME interventions, media, techniques, and exposure volumes. Ideally, the agenda would be based on a sound conceptual model of what influences the effectiveness of CME, including participating physician perspectives. Given the large amount of time, effort and money invested in CME, it seems reasonable to invest in a national consensus conference that could help to lay the foundation for a comprehensive research agenda for CME. In addition, greater resources should be devoted to funding educational researchers to design higher quality CME studies as well as the tools to evaluate CME outcomes.

References

1. American Academy of Family Practice. CME Requirements for Members. Accessed 22 November 2006 at http://www.aafp.org/online/en/home/cme/cmea/cmerequirements.html.

2. American Medical Association. House of Delegates Policy #300.988. Restoring Integrity to Continuing Medical Education. Accessed 12 September 2006 at http://www.ama-assn.org/apps/pf_new/pf_online?f_n=resultLink&doc=policyfiles/HnE/H-300.988.HTM&s_t=300.988&catg=AMA/HnE&catg=AMA/BnGnC&catg=AMA/DIR&&nth=1&&st_p=0&nth=1&.

3. Chassin MR, Galvin RW. The urgent need to improve health care quality. Institute of Medicine National Roundtable on Health Care Quality. JAMA 1998;280(11):1000-5.

4. Steinbrook R. Renewing board certification. N Engl J Med 2005;353(19):1994-7.

5. U.S. Department of Health and Human Services. Moving Medical Innovations Forward - New Initiatives from HHS, U.S. Department of Health and Human Services. January 2005 Accessed November 2006 at http://www.hhs.gov/reference/medicalinnovations.shtml#_Toc93371787.

6. Cabana MD, Rand CS, Powe NR, et al. Why don't physicians follow clinical practice guidelines? A framework for improvement. JAMA 1999;282(15):1458-65.

7. Berlin JA. Does blinding of readers affect the results of meta-analyses? University of Pennsylvania Meta-analysis Blinding Study Group. Lancet 1997;350(9072):185-6.

8. Jadad AR, Moore RA, Carroll D, et al. Assessing the quality of reports of randomized clinical trials: is blinding necessary? Control Clin Trials 1996;17(1):1-12.

9. Kaufman DM. Applying educational theory in practice. Br Med J 2003;326(7382):213-6.

10. Moher D, Cook DJ, Eastwood S, Olkin I, Rennie D, Stroup DF. Improving the quality of reports of meta-analyses of randomised controlled trials: the QUOROM statement. Quality of Reporting of Meta-analyses. Lancet 1999;354(9193):1896-900.

11. Reed D, Price EG, Windish DM, et al. Challenges in systematic reviews of educational intervention studies. Ann Intern Med 2005;142(12 Pt 2):1080-9.

12. Atkins D, Best D, Briss PA, et al. Grading quality of evidence and strength of recommendations. Br Med J 2004;328(7454):1490.

13. Mukohara K, Schwartz MD. Electronic delivery of research summaries for academic generalist doctors: a randomised trial of an educational intervention. Med Educ 2005;39(4):402-9.

14. Bjornson DC, Rector TS, Daniels CE, Wertheimer AI, Snowdon DA, Litman TJ. Impact of a drug-use review program intervention on prescribing after publication of a randomized clinical trial. Am J Hosp Pharm 1990;47(7):1541-6.

15. Dormuth CR, Maclure M, Bassett K, Jauca C, Whiteside C, Wright JM. Effect of periodic letters on evidence-based drug therapy on prescribing behaviour: a randomized trial. CMAJ 2004;171(9):1057-61.

16. Schectman JM, Schroth WS, Elinsky EG, Ott JE. The effect of education and drug samples on antihistamine prescribing costs in an HMO. HMO Pract 1996;10(3):119-22.

17. Slotnick HB. Educating physicians through advertising: using the brief summary to teach about pharmaceutical use. J Contin Educ Health Prof 1993;13(4):299-314.

18. Zuckerman IH, Weiss SR, McNally D, Layne B, Mullins CD, Wang J. Impact of an educational intervention for secondary prevention of myocardial infarction on Medicaid drug use and cost. Am J Manag Care 2004;10(7 Pt 2):493-500.

19. Cohn BA, Wingard DL, Patterson RC, McPhee SJ, Gerbert B. The National DES Education Program: effectiveness of the California Health Provider Intervention. J Cancer Educ 2002;17(1):40-5.

20. Ray WA, Schaffner W, Federspiel CF. Persistence of improvement in antibiotic prescribing in office practice. JAMA 1985;253(12):1774-6.

21. Chan DH, Leclair K, Kaczorowski J. Problem-based small-group learning via the Internet among community family physicians: a randomized controlled trial. MD Comput 1999;16(3):54-8.

22. Rost K, Nutting P, Smith J, Werner J, Duan N. Improving depression outcomes in community primary care practice: a randomized trial of the quEST intervention. Quality Enhancement by Strategic Teaming. J Gen Intern Med 2001;16(3):143-9.

23. Winickoff RN, Coltin KL, Morgan MM, Buxbaum RC, Barnett GO. Improving physician performance through peer comparison feedback. Med Care 1984;22(6):527-34.

24. Mazmanian PE, Daffron SR, Johnson RE, Davis DA, Kantrowitz MP. Information about barriers to planned change: a randomized controlled trial involving continuing medical education lectures and commitment to change. Acad Med 1998;73(8):882-6.

25. Greenberg LW, Jewett LS. The impact of two teaching techniques on physicians' knowledge and performance. J Med Educ 1985;60(5):390-6.

26. Haque S, Srinivasan S. A meta-analysis of the training effectiveness of virtual reality surgical simulators. IEEE Trans Inf Technol Biomed 2006;10(1):51-8.

27. Issenberg SB, McGaghie WC, Petrusa ER, Lee Gordon D, Scalese RJ. Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systematic review. Med Teach 2005;27(1):10-28.

28. Hmelo CE. Computer-assisted instruction in health professions education: a review of the published literature. J Educ Technol. 1990;18(2):83-101.

29. Aucar JA, Groch NR, Troxel SA, Eubanks SW. A review of surgical simulation with attention to validation methodology. Surg Laparosc Endosc Percutan Tech 2005;15(2):82-9.

30. Gerson LB, Van Dam J. Technology review: the use of simulators for training in GI endoscopy. Gastrointest Endosc 2004;60(6):992-1001.

31. Sutherland LM, Middleton PF, Anthony A, et al. Surgical simulation: a systematic review. Ann. Surg. 2006;243(3):291-300.

32. Gerrity MS, Cole SA, Dietrich AJ, Barrett JE. Improving the recognition and management of depression: is there a role for physician education? J Fam Pract 1999;48(12):949-57.

33. Kiang KM, Kieke BA, Como-Sabetti K, Lynfield R, Besser RE, Belongia EA. Clinician knowledge and beliefs after statewide program to promote appropriate antimicrobial drug use. Emerg Infect Dis 2005;11(6):904-11.

34. Curran VR, Hoekman T, Gulliver W, Landells I, Hatcher L. Web-based continuing medical education. (II): Evaluation study of computer-mediated continuing medical education. J Contin Educ Health Prof 2000;20(2):106-19.

35. Costanza ME, Zapka JG, Harris DR, et al. Impact of a physician intervention program to increase breast cancer screening. Cancer Epidemiol Biomarkers Prev 1992;1(7):581-9.

36. Andersen SM, Harthorn BH. Changing the psychiatric knowledge of primary care physicians. The effects of a brief intervention on clinical diagnosis and treatment. Gen Hosp Psychiatry 1990;12(3):177-90.

37. Block L, Banspach SW, Gans K, et al. Impact of public education and continuing medical education on physician attitudes and behavior concerning cholesterol. Am J Prev Med 1988;4(5):255-60.

38. Premi J SS. Randomized controlled trial of a combined video-workbook educational program for CME. Acad Med. 1993;68(10 Suppl):S13-5.

39. Harris JM Jr, Kutob RM, Surprenant ZJ, Maiuro RD, Delate TA. Can Internet-based education improve physician confidence in dealing with domestic violence? Fam Med 2002;34(4):287-92.

40. Doucet MD, Purdy RA, Kaufman DM, Langille DB. Comparison of problem-based learning and lecture format in continuing medical education on headache diagnosis and management. Med Educ 1998;32(6):590-6.

41. Premi J, Shannon S, Hartwick K, Lamb S, Wakefield J, Williams J. Practice-based small-group CME. Acad Med 1994;69(10):800-2.

42. Fordis M, King JE, Ballantyne CM, et al. Comparison of the instructional efficacy of Internet-based CME with live interactive CME workshops: a randomized controlled trial. JAMA 2005;294(9):1043-51.

43. Stewart M, Marshall JN, Ostbye T, et al. Effectiveness of case-based on-line learning of evidence-based practice guidelines. Fam Med 2005;37(2):131-8.

44. Beaulieu M, Choquette D, Rahme E, Bessette L, Carrier R. CURATA: A patient health management program for the treatment of osteoarthritis in Quebec: an integrated approach to improving the appropriate utilization of anti-inflammatory/analgesic medications. Am J Manag Care 2004;10(8):569-75.

45. Lane DS, Messina CR, Grimson R. An educational approach to improving physician breast cancer screening practices and counseling skills. Patient Educ Couns 2001;43(3):287-99.

46. Gifford DR, Mittman BS, Fink A, Lanto AB, Lee ML, Vickrey BG. Can a specialty society educate its members to think differently about clinical decisions? Results of a randomized trial. J Gen Intern Med 1996;11(11):664-72.

47. Maiman LA, Becker MH, Liptak GS, Nazarian LF, Rounds KA. Improving pediatricians' compliance-enhancing practices. A randomized trial. Am J Dis Child 1988;142(7):773-9.

48. White CW, Albanese MA, Brown DD, Caplan RM. The effectiveness of continuing medical education in changing the behavior of physicians caring for patients with acute myocardial infarction. A controlled randomized trial. Ann Intern Med 1985;102(5):686-92.

49. Terry PB, Wang VL, Flynn BS, et al. A continuing medical education program in chronic obstructive pulmonary diseases: design and outcome. Am Rev Respir Dis 1981;123(1):42-6.

50. Short LM, Surprenant ZJ, Harris JM Jr. A community-based trial of an online intimate partner violence CME program. Am J Prev Med 2006;30(2):181-5.

51. Meredith LS, Jackson-Triche M, Duan N, Rubenstein LV, Camp P, Wells KB. Quality improvement for depression enhances long-term treatment knowledge for primary care clinicians. J Gen Intern Med 2000;15(12):868-77.

52. Mann KV, Lindsay EA, Putnam RW, Davis DA. Increasing physician involvement in cholesterol-lowering practices: The role of knowledge, attitudes and perceptions. Adv Health Sci Educ Theory Pract 1997;2(3):237-53.

53. Gerstein HC, Reddy SS, Dawson KG, Yale JF, Shannon S, Norman G. A controlled evaluation of a national continuing medical education programme designed to improve family physicians' implementation of diabetes-specific clinical practice guidelines. Diabet Med 1999;16(11):964-9.

54. Chung S, Mandl KD, Shannon M, Fleisher GR. Efficacy of an educational Web site for educating physicians about bioterrorism. Acad Emerg Med 2004;11(2):143-8.

55. Elliott TE, Murray DM, Oken MM, et al. Improving cancer pain management in communities: main results from a randomized controlled trial. J Pain Symptom Manage 1997;13(4):191-203.

56. Evans CE, Haynes RB, Birkett NJ, et al. Does a mailed continuing education program improve physician performance? Results of a randomized trial in antihypertensive care. JAMA. 1986;255(4):501-4.

57. Maxwell JA, Sandlow LJ, Bashook PG. Effect of a medical care evaluation program on physician knowledge and performance. J Med Educ 1984;59(1):33-8.

58. Kemper KJ, Gardiner P, Gobble J, Mitra A, Woods C. Randomized controlled trial comparing four strategies for delivering e-curriculum to health care professionals. BMC Med Educ 2006;6(1):2.

59. Rosenthal MS, Lannon CM, Stuart JM, Brown L, Miller WC, Margolis PA. A randomized trial of practice-based education to improve delivery systems for anticipatory guidance. Arch Pediatr Adolesc Med 2005;159(5):456-63.

60. Hergenroeder AC, Chorley JN, Laufman L, Fetterhoff A. Two educational interventions to improve pediatricians' knowledge and skills in performing ankle and knee physical examinations. Arch Pediatr Adolesc Med 2002;156(3):225-9.

61. Des Marchais JE, Jean P, Castonguay LG. Training psychiatrists and family doctors in evaluating interpersonal skills. Med Educ 1990;24(4):376-81.

62. Chodosh J, Berry E, Lee M, et al. Effect of a dementia care management intervention on primary care provider knowledge, attitudes, and perceptions of quality of care. J Am Geriatr Soc 2006;54(2):311-7.

63. White M, Michaud G, Pachev G, Lirenman D, Kolenc A, FitzGerald JM. Randomized trial of problem-based versus didactic seminars for disseminating evidence-based guidelines on asthma management to primary care physicians. J Contin Educ Health Prof 2004;24(4):237-43.

64. Lockyer JM, Fidler H, Hogan DB, Pereles L, Lebeuf C, Wright B. Dual-track CME: accuracy and outcome. Acad Med 2002;77(10 Suppl):S61-3.

65. Kutcher SP, Lauria-Horner BA, MacLaren CM, Bujas-Bobanovic M. Evaluating the impact of an educational program on practice patterns of canadian family physicians interested in depression treatment. Prim Care Companion J Clin Psychiatry 2002;4(6):224-31.

66. Heale J, Davis D, Norman G, Woodward C, Neufeld V, Dodd P. A randomized controlled trial assessing the impact of problem-based versus didactic teaching methods in CME. Res Med Educ 1988;27:72-7.

67. Labelle M, Beaulieu M, Renzi P, Rahme E, Thivierge RL. Integrating clinical practice guidelines into daily practice: impact of an interactive workshop on drafting of a written action plan for asthma patients. J Contin Educ Health Prof 2004;24(1):39-49.

68. Bloomfield HE, Nelson DB, van Ryn M, et al. A trial of education, prompts, and opinion leaders to improve prescription of lipid modifying therapy by primary care physicians for patients with ischemic heart disease. Qual Saf Health Care 2005;14(4):258-63.

69. Lane DS, Polednak AP, Burg MA. Effect of continuing medical education and cost reduction on physician compliance with mammography screening guidelines. J Fam Pract 1991;33(4):359-68.

70. Lewis CE, Bursch B, Klau M, Konitsney D, Conrow S. Continuing medical education for AIDS: an organizational response. AIDS Educ Prev 1993;5(3):263-71.

71. Kronick J, Blake C, Munoz E, Heilbrunn L, Dunikowski L, Milne WK. Improving on-line skills and knowledge. A randomized trial of teaching rural physicians to use on-line medical information. Can Fam Physician 2003;49:312-7.

72. Brown JB, Boles M, Mullooly JP, Levinson W. Effect of clinician communication skills training on patient satisfaction. A randomized, controlled trial. Ann Intern Med 1999;131(11):822-9.

73. Lin EH, Katon WJ, Simon GE, et al. Achieving guidelines for the treatment of depression in primary care: is physician education enough? Med Care 1997;35(8):831-42.

74. Pinto BM, Goldstein MG, DePue JD, Milan FB. Acceptability and feasibility of physician-based activity counseling. The PAL project. Am J Prev Med 1998;15(2):95-102.

75. Harris SB, Leiter LA, Webster-Bogaert S, Van DM, O'Neill C. Teleconferenced educational detailing: diabetes education for primary care physicians. J Contin Educ Health Prof 2005;25(2):87-97.

76. Jennett PA, Laxdal OE, Hayton RC, et al. The effects of continuing medical education on family doctor performance in office practice: a randomized control study. Med Educ 1988;22(2):139-45.

77. Rodney WM, Albers G. Flexible sigmoidoscopy: primary care outcomes after two types of continuing medical education. Am J Gastroenterol 1986;81(2):133-7.

78. Clark NM, Gong M, Schork MA, et al. Long-term effects of asthma education for physicians on patient satisfaction and use of health services. Eur Respir J 2000;16(1):15-21.

79. Grady KE, Lemkau JP, Lee NR, Caddell C. Enhancing mammography referral in primary care. Prev Med 1997;26(6):791-800.

80. Leopold SS, Morgan HD, Kadel NJ, Gardner GC, Schaad DC, Wolf FM. Impact of educational intervention on confidence and competence in the performance of a simple surgical task. J Bone Joint Surg Am 2005;87(5):1031-7.

81. Norris SL, Grothaus LC, Buchner DM, Pratt M. Effectiveness of physician-based assessment and counseling for exercise in a staff model HMO. Prev Med 2000;30(6):513-23.

82. Schroy PC, Heeren T, Bliss CM, Pincus J, Wilson S, Prout M. Implementation of on-site screening sigmoidoscopy positively influences utilization by primary care providers. Gastroenterology 1999;117(2):304-11.

83. Cherkin D, Deyo RA, Berg AO, Bergman JJ, Lishner DM. Evaluation of a physician education intervention to improve primary care for low-back pain. I. Impact on physicians. Spine 1991;16(10):1168-72.

84. Roter DL, Hall JA, Kern DE, Barker LR, Cole KA, Roca RP. Improving physicians' interviewing skills and reducing patients' emotional distress. A randomized clinical trial. Arch Intern Med 1995;155(17):1877-84.

85. Macrae HM, Regehr G, McKenzie M, et al. Teaching practicing surgeons critical appraisal skills with an Internet-based journal club: a randomized, controlled trial. Surgery 2004;136(3):641-6.

86. Gerbert B, Bronstone A, Maurer T, Berger T, McPhee SJ, Caspers N. The effectiveness of an Internet-based tutorial in improving primary care physicians' skin cancer triage skills. J Cancer Educ 2002;17(1):7-11.

87. Frush K, Hohenhaus S, Luo X, Gerardi M, Wiebe RA. Evaluation of a Web-based education program on reducing medication dosing error: a multicenter, randomized controlled trial. Pediatr Emerg Care 2006;22(1):62-70.

88. Carney PA, Dietrich AJ, Freeman DH Jr, Mott LA. A standardized-patient assessment of a continuing medical education program to improve physicians' cancer-control clinical skills. Acad Med 1995;70(1):52-8.

89. Farrin A, Russell I, Torgerson D, Underwood M. Differential recruitment in a cluster randomized trial in primary care: the experience of the UK back pain, exercise, active management and manipulation (UK BEAM) feasibility study. Clin Trials 2005;2(2):119-24.

90. Frumovitz M, Ramirez PT, Greer M, et al. Laparoscopic training and practice in gynecologic oncology among Society of Gynecologic Oncologists members and fellows-in-training. Gynecol Oncol 2004;94(3):746-53.

91. Olson AL, Dietrich AJ, Prazar G, et al. Two approaches to maternal depression screening during well child visits. J Dev Behav Pediatr 2005;26(3):169-76.

92. Juzych NS, Banerjee M, Essenmacher L, Lerner SA. Improvements in antimicrobial prescribing for treatment of upper respiratory tract infections through provider education. J Gen Intern Med 2005;20(10):901-5.

93. Goldberg HI, Deyo RA, Taylor VM, et al. Can evidence change the rate of back surgery? A randomized trial of community-based education. Eff Clin Pract 2001;4(3):95-104.

94. Sharif I, Oruwariye T, Cohen R, Ozuah PO. Effectiveness of clinician training in smoking cessation counseling. Arch Pediatr Adolesc Med. 2002;156(9):944-5.

95. Stein CM, Griffin MR, Taylor JA, Pichert JW, Brandt KD, Ray WA. Educational program for nursing home physicians and staff to reduce use of non-steroidal anti-inflammatory drugs among nursing home residents: a randomized controlled trial. Med Care 2001;39(5):436-45.

96. Maclure M, Dormuth C, Naumann T, et al. Influences of educational interventions and adverse news about calcium-channel blockers on first-line prescribing of antihypertensive drugs to elderly people in British Columbia. Lancet 1998;352(9132):943-8.

97. Rabin DL. Adapting an effective primary care provider STD/HIV prevention training programme. AIDS Care 1998;10 Suppl 1:S75-82.

98. Schwartzberg JG, Guttman R. Effect of training on physician attitudes and practices in home and community care of the elderly. Arch Fam Med 1997;6(5):439-44.

99. Mehler PS, Krantz MJ, Lundgren RA, et al. Bridging the quality gap in diabetic hyperlipidemia: a practice-based intervention. Am J Med 2005;118(12):1414.

100. Rahme E, Choquette D, Beaulieu M, et al. Impact of a general practitioner educational intervention on osteoarthritis treatment in an elderly population. Am J Med 2005;118(11):1262-70.

101. Davis RS, Bukstein DA, Luskin AT, Kailin JA, Goodenow G. Changing physician prescribing patterns through problem-based learning: an interactive, teleconference case-based education program and review of problem-based learning. Ann Allergy Asthma Immunol 2004;93(3):237-42.

102. Herbert CP, Wright JM, Maclure M, et al. Better Prescribing Project: a randomized controlled trial of the impact of case-based educational modules and personal prescribing feedback on prescribing for hypertension in primary care. Fam Pract 2004;21(5):575-81.

103. Anderson JF, McEwan KL, Hrudey WP. Effectiveness of notification and group education in modifying prescribing of regulated analgesics. Can Med Assoc J. 1996;154(1):31-9.

104. Ozer EM, Adams SH, Lustig JL , et al. Increasing the screening and counseling of adolescents for risky health behaviors: a primary care intervention. Pediatrics 2005;115(4):960-8.

105. Soumerai SB, Avorn J. Predictors of physician prescribing change in an educational experiment to improve medication use. Med Care 1987;25(3):210-21.

106. Chassin MR, McCue SM. A randomized trial of medical quality assurance. Improving physicians' use of pelvimetry. JAMA 1986;256(8):1012-6.

107. Perera DR, LoGerfo JP, Shulenberger E, Ylvisaker JT, Kirz HL. Teaching sigmoidoscopy to primary care physicians: a controlled study of continuing medical education. J Fam Pract 1983;16(4):785-8.

108. Schectman JM, Schroth WS, Verme D, Voss JD. Randomized controlled trial of education and feedback for implementation of guidelines for acute low back pain. J Gen Intern Med 2003;18(10):773-80.

109. Ray WA, Stein CM, Byrd V, et al. Educational program for physicians to reduce use of non-steroidal anti-inflammatory drugs among community-dwelling elderly persons: a randomized controlled trial. Med Care 2001;39(5):425-35.

110. Dietrich AJ, Olson AL, Sox CH, Winchell CW, Grant-Petersson J, Collison DW. Sun protection counseling for children: primary care practice patterns and effect of an intervention on clinicians. Arch Fam Med 2000;9(2):155-9.

111. Gonzales R, Steiner JF, Lum A, Barrett PH Jr. Decreasing antibiotic use in ambulatory practice: impact of a multidimensional intervention on the treatment of uncomplicated acute bronchitis in adults. JAMA 1999;281(16):1512-9.

112. Cummings SR, Richard RJ, Duncan CL, et al. Training physicians about smoking cessation: a controlled trial in private practice. J Gen Intern Med 1989;4(6):482-9.

113. Cummings SR, Coates TJ, Richard RJ, et al. Training physicians in counseling about smoking cessation. A randomized trial of the "Quit for Life" program. Ann Intern Med 1989;110(8):640-7.

114. Kottke TE, Brekke ML, Solberg LI, Hughes JR. A randomized trial to increase smoking intervention by physicians. Doctors Helping Smokers, Round I. JAMA 1989;261(14):2101-6.

115. Lindsay-McIntyre E, Wilson D, Best JA, et al. The impact of a continuing education package for smoking cessation on physicians' clinical behavior and patient smoking. Res Med Educ 1987;26:14-9.

116. Stross JK, Bole GG. Evaluation of an educational program for primary care practitioners, on the management of osteoarthritis. Arthritis Rheum 1985;28(1):108-11.

117. Cummings SR, Richard RJ, Duncan CL, et al. Training physicians about smoking cessation: A controlled trial in private practices. J Gen Intern Med. 1989;4(6):482-9.

118. Margolis PA, Lannon CM, Stuart JM, Fried BJ, Keyes-Elstein L, Moore DE Jr. Practice based education to improve delivery systems for prevention in primary care: randomised trial. Br Med J 2004;328(7436):388.

119. McClellan WM, Millman L, Presley R, Couzins J, Flanders WD. Improved diabetes care by primary care physicians: results of a group-randomized evaluation of the Medicare Health Care Quality Improvement Program (HCQIP). J Clin Epidemiol 2003;56(12):1210-7.

120. Clark NM, Gong M, Schork MA, et al. Impact of education for physicians on patient outcomes. Pediatrics 1998;101(5):831-6.

121. Moran JA, Kirk P, Kopelow M. Measuring the effectiveness of a pilot continuing medical education program. Can Fam Physician 1996;42:272-6.

122. Browner WS, Baron RB, Solkowitz S, Adler LJ, Gullion DS. Physician management of hypercholesterolemia. A randomized trial of continuing medical education. West J Med 1994;161(6):572-8.

123. Bunting PS, Van Walraven C. Effect of a controlled feedback intervention on laboratory test ordering by community physicians. Clin Chem 2004;50(2):321-6.

124. Ockene IS, Hebert JR, Ockene JK, Merriam PA, Hurley TG, Saperia GM. Effect of training and a structured office practice on physician-delivered nutrition counseling: the Worcester-Area Trial for Counseling in Hyperlipidemia (WATCH). Am J Prev Med 1996;12(4):252-8.

125. Adams A, Ockene JK, Wheller EV, Hurley TG. Alcohol counseling: physicians will do it. J Gen Intern Med 1998;13(10):692-8.

126. Hagen BF, Armstrong-Esther C, Quail P, et al. Neuroleptic and benzodiazepine use in long-term care in urban and rural Alberta: characteristics and results of an education intervention to ensure appropriate use. Int Psychogeriatr 2005;17(4):631-52.

127. Solomon DH, Katz JN, La Tourette AM, Coblyn JS. Multifaceted intervention to improve rheumatologists' management of glucocorticoid-induced osteoporosis: a randomized controlled trial. Arthritis Rheum 2004;51(3):383-7.

128. Pazirandeh M. Does patient partnership in continuing medical education (CME) improve the outcome in osteoporosis management? J Contin Educ Health Prof 2002;22(3):142-51.

129. Thom DH. Training physicians to increase patient trust. J Eval Clin Pract 2000;6(3):245-53.

130. Schectman JM, Kanwal NK, Schroth WS, Elinsky EG. The effect of an education and feedback intervention on group-model and network-model health maintenance organization physician prescribing behavior. Med Care 1995;33(2):139-44.

131. Casebeer LL, Klapow JC, Centor RM, et al. An intervention to increase physicians' use of adherence-enhancing strategies in managing hypercholesterolemic patients. Acad Med 1999;74(12):1334-9.

132. Gullion DS, And Others. Management of hypertension in private practice: a randomized controlled trial in continuing medical education. J Contin Educ Health Prof 1988;8(4):239-55.

133. Lin EH, Simon GE, Katzelnick DJ, Pearson SD. Does physician education on depression management improve treatment in primary care? J Gen Intern Med 2001;16(9):614-9.

134. Socolar RR, Raines B, Chen-Mok M, Runyan DK, Green C, Paterno S. Intervention to improve physician documentation and knowledge of child sexual abuse: a randomized, controlled trial. Pediatrics 1998;101(5):817-24.

135. Brown R, Bratton SL, Cabana MD, Kaciroti N, Clark NM. Physician asthma education program improves outcomes for children of low-income families. Chest 2004;126(2):369-74.

136. Sibley JC, Sackett DL, Neufeld V, Gerrard B, Rudnick KV, Fraser W. A randomized trial of continuing medical education. N Engl J Med 1982;306(9):511-5.

137. Kim CS, Kristopaitis RJ, Stone E, Pelter M, Sandhu M, Weingarten SR. Physician education and report cards: do they make the grade? Results from a randomized controlled trial. Am J Med 1999;107(6):556-60.

138. Levinson W, Roter D. The effects of two continuing medical education programs on communication skills of practicing primary care physicians. J Gen Intern Med 1993;8(6):318-24.

139. Schectman JM, Elinsky EG, Pawlson LG. Effect of education and feedback on thyroid function testing strategies of primary care clinicians. Arch Intern Med 1991;151(11):2163-6.

140. Beaulieu MD, Rivard M, Hudon E, Beaudoin C, Saucier D, Remondin M. Comparative trial of a short workshop designed to enhance appropriate use of screening tests by family physicians. Can Med Assoc J. 2002;167(11):1241-6.

141. Tziraki C, Graubard BI, Manley M, Kosary C, Moler JE, Edwards BK. Effect of training on adoption of cancer prevention nutrition-related activities by primary care practices: results of a randomized, controlled study. J Gen Intern Med 2000;15(3):155-62.

142. Gifford DR, Holloway RG, Frankel MR, et al. Improving adherence to dementia guidelines through education and opinion leaders. A randomized, controlled trial. Ann Intern Med 1999;131(4):237-46.

143. Pimlott NJ, Hux JE, Wilson LM, Kahan M, Li C, Rosser WW. Educating physicians to reduce benzodiazepine use by elderly patients: a randomized controlled trial. Can Med Assoc J. 2003;168(7):835-9.

144. McBride P, Underbakke G, Plane MB, et al. Improving prevention systems in primary care practices: the Health Education and Research Trial (HEART). J Fam Pract 2000;49(2):115-25.

145. Howe HL, Lehnherr M, Katterhagen JG. Effects of physician outreach programs on rural-urban differences in breast cancer management. J Rural Health 1997;13(2):109-17.

146. Goldstein MK, Lavori P, Coleman R, Advani A, Hoffman BB. Improving adherence to guidelines for hypertension drug prescribing: cluster-randomized controlled trial of general versus patient-specific recommendations. Am J Manag Care 2005;11(11):677-85.

147. Allison JJ, Kiefe CI, Wall T , et al. Multicomponent Internet continuing medical education to promote chlamydia screening. Am J Prev Med 2005;28(3):285-90.

148. Myers RE, Turner B, Weinberg D, et al. Impact of a physician-oriented intervention on follow-up in colorectal cancer screening. Prev Med 2004;38(4):375-81.

149. Fick DM, Maclean JR, Rodriguez NA, et al. A randomized study to decrease the use of potentially inappropriate medications among community-dwelling older adults in a southeastern managed care organization. Am J Manag Care 2004;10(11 Pt 1):761-8.

150. Peterson L, Tremblay G, Ewigman B, Popkey C. The parental daily diary. A sensitive measure of the process of change in a child maltreatment prevention program. Behav Modif 2002;26(5):627-47.

151. Wells KB, Sherbourne C, Schoenbaum M, et al. Impact of disseminating quality improvement programs for depression in managed primary care: a randomized controlled trial. JAMA 2000;283(2):212-20.

152. Worrall G, Angel J, Chaulk P, Clarke C, Robbins M. Effectiveness of an educational strategy to improve family physicians' detection and management of depression: a randomized controlled trial. Can Med Assoc J. 1999;161(1):37-40.

153. Derebery VJ, Giang GM, Saracino G, Fogarty WT. Evaluation of the impact of a low back pain educational intervention on physicians' practice patterns and patients' outcomes. J Occup Environ Med 2002;44(10):977-84.

154. Wilson DM, Taylor DW, Gilbert JR, et al. A randomized trial of a family physician intervention for smoking cessation. JAMA 1988;260(11):1570-4.

155. McMahon SM, McKenna P, Hodgins JL. An application of continuing medical education to decrease excessive lengths of stay. J Med Educ 1988;63(5):364-71.

156. Messina CR, Lane DS, Grimson R. Effectiveness of women's telephone counseling and physician education to improve mammography screening among women who underuse mammography. Ann Behav Med 2002;24(4):279-89.

157. Goldwater SH, Milkovich G, Morrison AJ Jr, Lindgren B. Comparison of therapeutic interchange with standard educational tools for influencing fluoroquinolone prescribing. Am J Health Syst Pharm 2001;58(18):1740-5.

158. Gaffan J, Dacre J, Jones A. Educating undergraduate medical students about oncology: a literature review. J Clin Oncol 2006;24(12):1932-9.

159. Ravert P. An integrative review of computer-based simulation in the education process (Structured abstract). Comput Inform Nurs. 2002;20(5):203-8.

160. Spangler JG, George G, Foley KL, Crandall SJ. Tobacco intervention training: current efforts and gaps in US medical schools. JAMA 2002;288(9):1102-9.

161. Mazmanian PE, Johnson RE, Zhang A, Boothby J, Yeatts EJ. Effects of a signature on rates of change: a randomized controlled trial involving continuing education and the commitment-to-change model. Acad Med 2001;76(6):642-6.

162. Schaafsma F, Hulshof C, van Dijk F, Verbeek J. Information demands of occupational health physicians and their attitude towards evidence-based medicine. Scand J Work Environ Health 2004;30(4):327-30.

163. Pereles L, Lockyer J, Hogan D, Gondocz T, Parboosingh J. Effectiveness of commitment contracts in continuing medical education. Acad Med 1996;71(4):394.

164. Downing SM. Reliability: on the reproducibility of assessment data. Med Educ 2004;38(9):1006-12.

165. McGaghie WC, Issenberg SB, Petrusa ER, Scalese RJ. Effect of practice on standardised learning outcomes in simulation-based medical education. Med Educ 2006;40(8):792-7.

List of Acronyms/Abbreviations

ABMS	American Board of Medical Specialties
ACCP	American College of Chest Physicians
AHRQ	Agency for Healthcare Research and Quality
AMA	American Medical Association
CI	Confidence interval
CME	Continuing medical education
EPC	Evidence-based Practice Center
KQ	Key questions
KR20	Kuder-Richardson 20
MOC	Maintenance of Certification
NIH	National Institutes of Health
SD	Standard deviation
US	United States

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MEDLINE Strategy

Terms	Returns
(((("Education, Continuing"[MeSH] OR "Education, Medical"[MeSH]) NOT ("Education, Dental, Continuing"[MeSH] OR "Education, Nursing, Continuing"[MeSH] OR "Education, Pharmacy, Continuing"[MeSH] OR "Education, Medical, Undergraduate"[MeSH] OR "Internship and Residency"[MeSH]) OR ("continuing medical education"[tiab] OR CME[tiab]) OR ((educat*[tiab] OR train*[tiab] OR curriculum[tiab]) AND (physician* OR Family practi*[tiab] OR Family medicine[tiab] OR General practi*[tiab] OR internist*[tiab] OR Surgeon*[tiab] OR Primary care[tiab] OR Allergist*[tiab] OR Immunologist*[tiab] OR Anesthesiology*[tiab] OR Dematolog*[tiab] OR Emergency medicine[tiab] OR Forensic medicine[tiab] OR Hospitalist*[tiab] OR Internal medicine[tiab] OR Cardiolog*[tiab] OR Endocrinolog*[tiab] OR Gastroenterolog*[tiab] OR Hematolog*[tiab] OR Oncolog*[tiab] OR Nephrolog*[tiab] OR Pulmonolog*[tiab] OR Rhematolog*[tiab] OR Neurolog*[tiab] OR Patholog*[tiab] OR Pediatric*[tiab] OR Psychiatr*[tiab] OR Radiolog*[tiab] OR Obstetrician*[tiab] OR Gynecolog*[tiab]))) AND (behav*[tiab] OR practice*[tiab] OR evaluat*[tiab] OR assess*[tiab] OR learn*[tiab] OR skill*[tiab] OR outcome*[tiab] OR effective*[tiab] OR analy*[tiab] OR intervention*[tiab] OR examin*[tiab])) NOT (dental*[tiab] OR dentist*[tiab] OR student*[tiab] OR undergraduate*[tiab] OR athlet*[tiab])) AND English[lang] NOT (animal[mh] NOT human [mh]) AND (1981:2006[dp]) NOT (review[pt] OR meta-analysis[pt] OR editorial[pt] OR comment[pt] OR letter[pt])	38174

EMBASE Strategy

(((('**medical education**':de) NOT ('**clinical supervision**':de OR '**dental education**':de OR '**medical school**':de OR '**physician assistant education**':de OR '**residency education**':de)) OR ('**continuing medical education**':ti,ab) OR **cme**:ti,ab OR ((**educat***:ti,ab OR **train***:ti,ab OR **curriculum**:ti,ab) AND (**physician***:ti,ab OR (**family**:ti,ab AND **practi***:ti,ab) OR (**family**:ti,ab AND **medicine**:ti,ab) OR (**general**:ti,ab AND **practi***:ti,ab) OR **internist***:ti,ab OR **surgeon***:ti,ab OR (**primary**:ti,ab AND **care**:ti,ab) OR **allergist***:ti,ab OR **immunologist***:ti,ab OR **anesthesiolog***:ti,ab OR **dermatolog***:ti,ab OR (**emergency**:ti,ab AND **medicine**:ti,ab) OR (**forensic**:ti,ab AND **medicine**:ti,ab) OR **hospitalist***:ti,ab OR (**internal**:ti,ab AND **medicine**:ti,ab) OR **cardiolog***:ti,ab OR **endocrinolog***:ti,ab OR **gastroenterolog***:ti,ab OR **hematolog***:ti,ab OR **oncolog***:ti,ab OR **nephrolog***:ti,ab OR **pulmonolog***:ti,ab OR **rhemaolog***:ti,ab OR **neurolog***:ti,ab OR **patholog***:ti,ab OR **pediatric***:ti,ab OR **psychiatr***:ti,ab OR **radiolog***:ti,ab OR **obstetric***:ti,ab OR **gynecolog***:ti,ab))) AND (**behav***:ti,ab OR **practice***:ti,ab OR **evaluat***:ti,ab OR **assess***:ti,ab OR **learn***:ti,ab OR **skill***:ti,ab OR **outcome***:ti,ab OR **effective***:ti,ab OR **analy***:ti,ab OR **intervention***:ti,ab OR **examin***:ti,ab)) NOT (dental*:ti,ab OR dentist*:ti,ab OR student*:ti,ab OR undergraduate*:ti,ab OR athlet*:ti,ab) AND [English]/lim NOT ([animals]/lim NOT [humans]/lim) AND [1981-2006]/py NOT ([conference paper]/lim OR [editorial]/lim OR [erratum]/lim OR [letter]/lim OR [note]/lim OR [review]/lim)	44765

The Cochrane Central Register of Controlled Trials (CENTRAL)

(((((Continuing medical education):ti,ab,kw OR (CME):ti,ab,kw) OR ((educat* OR train* OR curriculum):ti,ab,kw NEAR (physician* OR Family practi* OR Family medicine OR General practice OR internist* OR Surgeon* OR Primary care OR Allergist OR Immunologist OR Anesthesiolog* OR Dematolog* OR Emergency medicine OR Forensic medicine OR Hospitalist* OR Internal medicine OR Cardiolog* OR Endocrinolog* OR Gastroenterolog* OR Hematolog* OR Oncolog* OR Nephrolog* OR Pulmon* OR Rhematolog* OR Neurolog* OR Patholog* OR Pediatric* OR Psychiatr* OR Radiolog* OR Obstetrician* OR Gynecolog*):ti,ab,kw)) AND (behav* OR evaluat* OR assess* OR learn* OR skill* OR outcome* OR effective* OR analy* OR examin* OR intervention*):ti,ab,kw) NOT (dental* OR dentist* OR student* OR undergraduate* OR athlet*):ti,ab,kw), LIMIT DATE RANGE from 1981 to 2006	1843

PsycINFO

(((((MM "Continuing Education" OR MM "Inservice Training" OR MM "Medical Education") NOT (MM "Medical Internship" OR MM "Medical Residency")) OR (TI “continuing medical education” OR TI "CME" OR AB “continuing medical education” OR AB "CME") OR ((AB educat* OR AB train* OR AB curriculum) AND (AB physician* OR AB Family practi* OR AB Family medicine OR AB General practi* OR AB internist* OR AB Surgeon* OR AB Primary care OR AB Allergist OR AB Immunologist OR AB Anesthesiology* OR AB Dematolog* OR AB Emergency medicine OR AB Forensic medicine OR AB Hospitalist* OR AB Internal medicine OR AB Cardiolog* OR AB Endocrinolog* OR AB Gastroenterolog* OR AB Hematolog* OR AB Oncolog* OR AB Nephrolog* OR AB Pulmonolog* OR AB Rhematolog* OR AB Neurology* OR AB Patholog* OR AB Pediatric* OR AB Psychiatr* OR AB Radiolog* OR AB Obstetrician* OR AB Gynecolog*))) AND (AB behav* OR AB evaluat* OR AB assess* OR AB learn* OR AB skill* OR AB outcome* OR AB effective* OR AB analy* OR AB examin*)) NOT (AB dental* OR AB dentist* OR AB student* OR AB undergraduate* OR AB athlet*)) AND (LA English NOT (PO animal NOT PO human) AND DT 198101-200602 NOT (PZ abstract collection OR PZ bibliography OR PZ column/opinion OR PZ comment/reply OR PZ editorial OR PZ erratum/correction OR PZ letter OR PZ obituary OR PZ all chapters OR PZ original chapter OR PZ reprinted chapter OR PZ reprinted journal article OR PZ publication information OR PZ review)) [FURTHER LIMITED TO ALL JOURNALS]	8738

ERIC

(((((MM "Continuing Education" OR MM "Inservice Training" OR MM "Medical Education") NOT (MM "Medical Internship" OR MM "Medical Residency")) OR (TI "continuing medical education" OR TI "CME" OR AB "continuing medical education" OR AB "CME") OR ((AB educat* OR AB train* OR AB curriculum) AND (AB physician* OR AB Family practi* OR AB Family medicine OR AB General practi* OR AB internist* OR AB Surgeon* OR AB Primary care OR AB Allergist OR AB Immunologist OR AB Anesthesiology* OR AB Dematolog* OR AB Emergency medicine OR AB Forensic medicine OR AB Hospitalist* OR AB Internal medicine OR AB Cardiolog* OR AB Endocrinolog* OR AB Gastroenterolog* OR AB Hematolog* OR AB Oncolog* OR AB Nephrolog* OR AB Pulmonolog* OR AB Rhematolog* OR AB Neurology* OR AB Patholog* OR AB Pediatric* OR AB Psychiatr* OR AB Radiolog* OR AB Obstetrician* OR AB Gynecolog*))) AND (AB behav* OR AB evaluat* OR AB assess* OR AB learn* OR AB skill* OR AB outcome* OR AB effective* OR AB analy* OR AB examin*)) NOT (EL "Early Childhood Education" OR EL "Preschool Education" OR EL "Elementary Secondary Education" OR EL "Elementary Education" OR EL "Primary Education" OR EL "Adult Basic Education" OR EL "Intermediate Grades" OR EL "Secondary Education" OR EL "Middle Schools" OR EL "Junior High Schools" OR EL "High Schools" OR EL "High School Equivalency Programs" OR EL "Postsecondary Education" OR EL "Two Year Colleges")) AND (LA English AND DT 198101-200602 AND PT Journal Article NOT (PO animal NOT PO human))	2002

Detailed Electronic Database Search Strategies for Systematic Reviews on Effectiveness of Simulation Techniques in Medical Education

MEDLINE Strategy

Terms	Returns
(((“Education, Medical”[MeSH] OR ((educat*[tiab] OR train*[tiab] OR curriculum[tiab]) AND (medical*[tiab] OR resident*[tiab] OR residenc*[tiab] OR physician*[tiab] OR surgery[tiab] OR surgeon*[tiab] OR surgical*[tiab])))) AND (“Patient Simulation”[MeSH] OR Computer Simulation[MeSH] OR Manikins[MeSH] OR simulation*[tiab] OR simulat*[tiab] OR mannikin[tiab] OR manikin[tiab] OR mannequin*[tiab] OR virtual[tiab] OR computer-based[tiab] OR “standardized patient”[tiab] OR “standardized patients”[tiab])) AND ((review[tiab] or review[pt] or meta-analys*[tiab] or meta-analysis[pt]) AND English[lang] NOT (letter[pt] or comment[pt] or editorial[pt])) NOT (animal[mh] NOT human [mh]) AND ("1990/01/01"[pdat] : "2006/02/28"[pdat])	466

EMBASE Strategy

(((('medical education'/exp) NOT (**'clinical supervision'**/exp OR **'dental education'**/exp OR **'physician assistant education'**/exp)) OR ((**educat***:ti,ab OR **train***:ti,ab OR **curriculum**:ti,ab) AND (medical*:ti,ab OR resident*:ti,ab OR residenc*:ti,ab OR surgery:ti,ab OR surgical*:ti,ab OR **physician***:ti,ab OR (**family**:ti,ab AND **practi***:ti,ab) OR (**family**:ti,ab AND **medicine**:ti,ab) OR (**general**:ti,ab AND **practi***:ti,ab) OR **internist***:ti,ab OR **surgeon***:ti,ab OR (**primary**:ti,ab AND **care**:ti,ab) OR **allergist***:ti,ab OR **immunologist***:ti,ab OR **anesthe***:ti,ab OR **anaesthe***:ti,ab OR **dermatolog***:ti,ab OR (**emergency**:ti,ab AND **medicine**:ti,ab) OR (**forensic**:ti,ab AND **medicine**:ti,ab) OR **hospitalist***:ti,ab OR (**internal**:ti,ab AND **medicine**:ti,ab) OR **cardiolog***:ti,ab OR **endocrinolog***:ti,ab OR **gastroenterolog***:ti,ab OR **hematolog***:ti,ab OR **oncolog***:ti,ab OR **nephrolog***:ti,ab OR **pulmonolog***:ti,ab OR **rhemaolog***:ti,ab OR **neurolog***:ti,ab OR **patholog***:ti,ab OR **pediatric***:ti,ab OR **psychiatr***:ti,ab OR **radiolog***:ti,ab OR **obstetric***:ti,ab OR **gynecolog***:ti,ab))) AND ('skill'/exp OR 'simulator'/exp OR 'simulation'/exp OR 'virtual reality'/exp OR simulation*:ti,ab OR simulat*:ti,ab OR mannikin:ti,ab OR manikin:ti,ab OR mannequin*:ti,ab OR virtual:ti,ab OR computer-based:ti,ab OR (standardized:ti,ab AND patient*:ti,ab))) AND (review:ti,ab,it OR 'meta analysis':ti,ab,it OR metaanalysis:ti,ab,it) NOT (letter:it OR comment:it OR editorial:it OR 'conference paper':it OR erratum:it OR note:it) AND [English]/lim NOT ([animals]/lim NOT [humans]/lim) AND [1981-2006]/py	2359

The Cochrane Database of Systematic Reviews and the Cochrane Database of Abstracts of Reviews of Effects (DARE)

(Simulation or simulator or manikin or mannikin or mannequin or virtual or computer-based or "standardized patient" or "standardized patients") AND education in title, abstract or keywords restricted to reviews	3

PsycINFO

((((MM "Medical Education") OR ((AB educat* OR AB train* OR AB curriculum) AND (AB physician* OR AB Family practi* OR AB "Family medicine" OR AB General practi* OR AB internist* OR AB Surgeon* OR AB "Primary care" OR AB Allergist OR AB Immunologist OR AB Anesthesiolog* OR AB Dematolog* OR AB "Emergency medicine" OR AB "Forensic medicine" OR AB Hospitalist* OR AB "Internal medicine" OR AB Cardiolog* OR AB Endocrinolog* OR AB Gastroenterolog* OR AB Hematolog* OR AB Oncolog* OR AB Nephrolog* OR AB Pulmonolog* OR AB Rhematolog* OR AB Neurolog* OR AB Patholog* OR AB Pediatric* OR AB Psychiatr* OR AB Radiolog* OR AB Obstetrician* OR AB Gynecolog* OR AB Medical OR AB resident* OR AB residenc* OR AB surgery OR AB surgical*))) AND (MM "Simulation" or MM "Virtual Reality" or MM "Human Machine Systems" or AB "simulation" or AB simulat* or AB manikin or AB mannikin or AB mannequin or AB virtual or AB "standardized patient" or AB "standardized patients")) AND (LA English NOT (PO animal NOT PO human) AND DT 199001-200602 NOT (PZ abstract collection OR PZ bibliography OR PZ column/opinion OR PZ comment/reply OR PZ editorial OR PZ erratum/correction OR PZ letter OR PZ obituary OR PZ all chapters OR PZ original chapter OR PZ reprinted chapter OR PZ reprinted journal article OR PZ publication information))) AND (PZ review OR AB review OR AB meta-analys*)	34

ERIC

((((DE "Medical Education") OR ((AB educat* OR AB train* OR AB curriculum) AND (AB physician* OR AB "Family practice" OR AB "Family practitioner" OR AB "Family medicine" OR AB "General practice" OR AB "General practitioner" OR AB internist* OR AB Surgeon* OR AB "Primary care" OR AB Allergist OR AB Immunologist OR AB Anesthesiolog* OR AB Dematolog* OR AB "Emergency medicine" OR AB "Forensic medicine" OR AB Hospitalist* OR AB "Internal medicine" OR AB Cardiolog* OR AB Endocrinolog* OR AB Gastroenterolog* OR AB Hematolog* OR AB Oncolog* OR AB Nephrolog* OR AB Pulmonolog* OR AB Rhematolog* OR AB Neurolog* OR AB Patholog* OR AB Pediatric* OR AB Psychiatr* OR AB Radiolog* OR AB Obstetrician* OR AB Gynecolog* OR AB Medical OR AB resident* OR AB residenc* OR AB surgery OR AB surgical*))) AND (DE "Simulation" or DE "Virtual Reality" or AB "simulation" or AB simulat* or AB manikin or AB mannikin or AB mannequin or AB virtual or AB "standardized patient" or AB "standardized patients")) AND (LA English AND DT 198101-200602 AND PT Journal Article NOT (PO animal NOT PO human))) AND (AB review* OR AB meta-analys* OR TI review* OR TI meta-analys*)	14

Abidi F, Lee-Gorman M. Learning from experience: developments in forensic investigation from case histories. Sci Justice 2005;45(1):45-51
Not US or Canada, Does not apply

Adelson R, Hepburn K, Reed R et al. Effective dissemination of the AHCPR guideline: prevention and early management of pressure ulcers. Abstract Book/Association for Health Services Research 97;14167-8
Abstract

Ahluwalia N S, Das A, Verity R. Radical curriculum design: an experiment in learner empowerment. Med Educ 2005;39(5):509-10
Not US or Canada

AIDS education in general practice. N Z Med J 88;101(859):835-6
No evaluation, Does not apply

A-Latif A. Continuing medical education: merits of a surgical journal club. Med Teach 90;12(2):219-21
Not US or Canada

Alexander B, Nasrallah H A, Perry P J. The impact of psychopharmacology education on prescribing practices. HOSP. COMMUNITY PSYCHIATRY 83;34(12):1150-1153
<15 trained physicians, No comparison

Aloisio G, Barone L, Bergamasco M et al. Computer-based simulator for catheter insertion training. Stud Health Technol Inform 2004;984-6
No original data, No training, Not US or Canada

Alroy G, Ber R, Kramer D. An evaluation of the short-term effects of an interpersonal skills course. MED. EDUC. 84;18(2):85-89
Not US or Canada

Amatayakul M. Self-assessment for continuing education. Council on Certification of the American Health Information Management Association. J AHIMA 92;63(2):83-4, 109-11
No original data, No evaluation

Amiel G E, Ungar L, Alperin M et al. Ability of primary care physician's to break bad news: a performance based assessment of an educational intervention. Patient Educ Couns 2006;60(1):10-5
Not US or Canada

Amin Z, Hoon Eng K, Chay Hoon T. A novel approach to faculty development programme evaluation. Med Educ 2004;38(11):1187-8
<15 trained physicians, Not US or Canada

Amos E, White M J. Problem-based learning. Nurse Educ 98;23(2):11-4
<15 trained physicians

Anders K T. Click and learn. Continuing education on the Web. Contemp Longterm Care 2000;23(11):suppl 12-4
No original data, No evaluation

Andrews J O, Tingen M S, Waller J L et al. Provider feedback improves adherence with AHCPR Smoking Cessation Guideline. Prev Med 2001;33(5):415-21
<15 trained physicians

Athanasiadis L, Papaharitou S, Salpiggidis G et al. Educating physicians to treat erectile dysfunction patients: development and evaluation of a course on communication and management strategies. J Sex Med 2006;3(1):47-55
Not US or Canada, No comparison

Avorn J, Soumerai S B, Everitt D E et al. A randomized trial of a program to reduce the use of psychoactive drugs in nursing homes. N Engl J Med 92;327(3):168-73
<15 trained physicians

Awad S S, Fagan S P, Bellows C et al. Bridging the communication gap in the operating room with medical team training. Am J Surg 2005;190(5):770-4
Does not apply, No comparison

Ayoub M M, Clark J A. Reduction of fresh frozen plasma use with a simple education program. Am Surg 89;55(9):563-5
No comparison

Backhaus J, Junghanns K, Mueller-Popkes K et al. Short-term training increases diagnostic and treatment rate for insomnia in general practice. Eur Arch Psychiatry Clin Neurosci 2002;252(3):99-104
Not US or Canada

Baldwin C D, Gephart D, Maulitz R. Collaborative planning of a Web-based learning resource for primary care education. Acad Med 2001;76(5):549-50
<15 trained physicians

Barsuk D, Ziv A, Lin G et al. Using advanced simulation for recognition and correction of gaps in airway and breathing management skills in prehospital trauma care. Anesth Analg 2005;100(3):803-9, table of contents
<15 trained physicians, Not US or Canada

Barta P J, Phillips W D, Davidson R. Physician education on five complications of diabetes mellitus. N J Med 94;91(4):269-70
No comparison

Bashook P, Meyer T C, Richards R K et al. Symposium: Self-directed learning and physicians" practice changes: concepts, research and implications for CME. Proc Annu Conf Res Med Educ 86;25329-38
No original data

Belda T E, Gajic O, Rabatin J T et al. Practice variability in management of acute respiratory distress syndrome: bringing evidence and clinician education to the bedside using a web-based teaching tool. Respir Care 2004;49(9):1015-21
No comparison

Ben-Arye E, Frenkel M, Hermoni D. An approach to teaching primary care physicians how to integrate complementary medicine into their daily practices: a pilot study. J Altern Complement Med 2006;12(1):79-83
<15 trained physicians, Not US or Canada, No comparison

Ben-Arye E, Frenkel M. An approach to teaching physicians about complementary medicine in the treatment of cancer. Integr Cancer Ther 2004;3(3):208-13
Not US or Canada

Benjamin E M, Schneider M S, Hinchey K T. Implementing practice guidelines for diabetes care using problem-based learning. A prospective controlled trial using firm systems. Diabetes Care 99;22(10):1672-8
<15 trained physicians, PI or QI, Other

Bennett P. The process of postgraduate education in general practice. Practitioner 87;231(1436):1298-302
No original data, No evaluation

Beno L, Hinchman J, Kibbe D et al. Design and implementation of training to improve management of pediatric overweight. J Contin Educ Health Prof 2005;25(4):248-58
No comparison

Berkenstadt H, Ziv A, Barsuk D et al. The use of advanced simulation in the training of anesthesiologists to treat chemical warfare casualties. Anesth Analg 2003;96(6):1739-42, table of contents
Not US or Canada

Berkowitz K J, Anderson L A, Panayioto R M et al. Mini-residency on diabetes care for healthcare providers: enhanced knowledge and attitudes with unexpected challenges to assessing behavior change.. Diabetes Educ 98;24(2):143-144, 149
<15 trained physicians, No comparison

Berntson A, Goldner E, Leverette J et al. Psychiatric training in rural and remote areas: increasing skills and building partnerships. Can J Psychiatry 2005;50(9):1-8
No original data, No original data

Birnbaum M L, Robinson N E, Kuska B M et al. Effect of advanced cardiac life-support training in rural, community hospitals. Crit Care Med 94;22(5):741-9
No comparison

Bjornson DC, Rector TS, Daniels CE et al. Impact of a drug-use review program intervention on prescribing after publication of a randomized clinical trial [see comment]. American journal of hospital pharmacy. 90;47(7):1541
Other

Black F. "You show me yours and I'll show you mine". A new CME option--learning from your own consultations. Aust Fam Physician 94;23(9):1788-90
No original data, Not US or Canada

Blackstien-Hirsch P, Anderson G, Cicutto L et al. Implementing continuing education strategies for family physicians to enhance asthma patients' quality of life. J Asthma 2000;37(3):247-57
No comparison

Blum R H, Raemer D B, Carroll J S et al. Crisis resource management training for an anaesthesia faculty: a new approach to continuing education. Med Educ 2004;38(1):45-55
No comparison

Boland M R, Hornblow A R, Gibbs J M et al. The learning process in medical education. NEW ZEALAND MED. J. 85;98(788):861-863
No original data

Booth M B. Teaching and learning in a neonatal intensive care unit. Arch Dis Child 98;78(3):275-7
No original data, Not US or Canada

Bordley W C, Travers D, Scanlon P et al. Office preparedness for pediatric emergencies: a randomized, controlled trial of an office-based training program. Pediatrics 2003;112(2):291-5
PI or QI

Borgiel A E, Williams J I, Davis D A et al. Evaluating the effectiveness of 2 educational interventions in family practice. CMAJ 99;161(8):965-70
PI or QI

Botelho R J, McDaniel S H, Jones J E. Using a family systems approach in a balint-style group: an innovative course for continuing medical education. Fam Med 90;22(4):293-5
<15 trained physicians, No comparison

Boudreau D, Tamblyn R, Dufresne L. Evaluation of consultative skills in respiratory medicine using a structured medical consultation. Am J Respir Crit Care Med 94;150(5 Pt 1):1298-304
<15 trained physicians, Does not apply

Bratton S L, Cabana M D, Brown R W et al. Asthma educational seminar targeting Medicaid providers. Respir Care 2006;51(1):49-55
No comparison

Bravata D M, Huot S J, Abernathy H S et al. The development and implementation of a curriculum to improve clinicians' self-directed learning skills: a pilot project. BMC Med Educ 2003;37
<15 trained physicians

Brezis M, Cohen R. Interactive learning with voting technology. Med Educ 2004;38(5):574-5
No original data, <15 trained physicians

Brown R L. Evaluation of a continuing medical education program for primary care physicians on the management of alcoholism. J Med Educ 88;63(6):482-4
No comparison

Brown R M. What do phonemes have to do with learning medicine?. Acad Med 2005;80(5):455
No original data

Brown R M. What do phonemes have to do with learning medicine?. Acad Med 2005;80(5):455
Does not apply

Browning P, Foss G. Evaluation of rehabilitation continuing education. Annu Rev Rehabil 83;364-92
No original data

Burlingame G M, Earnshaw D, Hoag M et al. A systematic program to enhance clinician group skills in an inpatient psychiatric hospital. Int. J. Group Psychother. 2002;52(4):555-587
No original data, <15 trained physicians

Burr R, Johanson R. Continuing medical education: an opportunity for bringing about change in clinical practice. Br J Obstet Gynaecol 98;105(9):940-5
No original data

Byrne A J, Sellen A J, Jones J G et al. Effect of videotape feedback on anaesthetists' performance while managing simulated anaesthetic crises: a multicentre study. Anaesthesia 2002;57(2):176-9
Not US or Canada

Byrnes J A, Kulick T A, Schwartz D G. Information-seeking behavior changes in community-based teaching practices. J Med Libr Assoc 2004;92(3):334-40
No comparison

Cabana MD, Slish KK, Evans D et al. Randomized control trial of physician education to improve pediatric outcomes for asthma [Abstract]. American Thoracic Society 2005 International Conference; May 20-25; San Diego, California 2005;[D93] [Poster: 626]
Abstract

Cahan J I. Continuing medical education. An effective tool or a faulty fantasy?. Md Med 2001;2(3):14-6
No original data, No evaluation

Cameron C, Naylor C D. No impact from active dissemination of the Ottawa Ankle Rules: further evidence of the need for local implementation of practice guidelines. CMAJ 99;160(8):1165-8
<15 trained physicians, Not US or Canada

Campbell C, Parboosingh J, Gondocz T et al. A study of the factors that influence physicians" commitments to change their practices using learning diaries. Acad Med 99;74(10 Suppl):S34-6
No training, No comparison

Campbell D D. Implementing and evaluating continuing professional education: elements of a strategy. Physiother Can 83;35(5):253-6
No original data

Campbell H S, Fletcher S W, Pilgrim C A et al. Improving physicians' and nurses' clinical breast examination: a randomized controlled trial. Am J Prev Med 91;7(1):1-8
<15 trained physicians

Campbell N R, McAlister F A, Brant R et al. Temporal trends in antihypertensive drug prescriptions in Canada before and after introduction of the Canadian Hypertension Education Program. J Hypertens 2003;21(8):1591-7
No comparison

Carbonell J L, Chez R A, Hassler R S. Florida physician and nurse education and practice related to domestic violence. Womens Health Issues 95;5(4):203-7
No evaluation, No comparison

Cardenas V M, Roces M C, Wattanasri S et al. Improving global public health leadership through training in epidemiology and public health: the experience of TEPHINET. Training Programs in Epidemiology and Public Health Interventions Network. Am J Public Health 2002;92(2):196-7
No original data, Does not apply

Carlson B. A day spent learning how to satisfy patients. Manag Care 97;6(9):57-60
No original data, Does not apply

Carpenter J L, Battles J B, McIntire D et al. Assessing the usefulness of using standardized patients in a clinical medicine course.. Acad Med 92;67(4):286
<15 trained physicians

Casebeer L L, Strasser S M, Spettell C M et al. Designing tailored Web-based instruction to improve practicing physicians' preventive practices. J Med Internet Res 2003;5(3):e20
No original data, Does not apply, Other

Casebeer L, Kristofco R E, Strasser S et al. Standardizing evaluation of on-line continuing medical education: physician knowledge, attitudes, and reflection on practice. J Contin Educ Health Prof 2004;24(2):68-75
No original data, No comparison

Cauffman J G, Rasgon I M, Mayne J C. Relationship between quality of CME instruction and changes in physicians' patient-management plans. J. MED. EDUC. 85;60(6):486-488
No comparison

Centor R, Casebeer L, Klapow J. Using a combined CME course to improve physicians" skills in eliciting patient adherence. Acad Med 98;73(5):609-10
No comparison

Cerne F. Learning to survive. Continuing education is helping health care managers thrive in today"s managed care-driven environment. Hosp Health Netw 95;69(17):47-8, 50
No original data, Does not apply

Chen F M, Burstin H, Huntington J. The importance of clinical outcomes in medical education research. Med Educ 2005;39(4):350-1
No original data

Cherkin D, Deyo R A, Berg A O. Evaluation of a physician education intervention to improve primary care for low-back pain. II. Impact on patients. Spine 91;16(10):1173-8
No comparison

Chopra V, Gesink B J, de Jong J et al. Does training on an anaesthesia simulator lead to improvement in performance?. Br J Anaesth 94;73(3):293-7
Not US or Canada

Clark K M. Notes on continuing education: Self-Directed Learning Network. J Contin Educ Nurs 86;17(3):101-3
No original data, No evaluation

CME evaluation. Semin. Oncol. 2005;32(SUPPL. 2):S23
Does not apply

CME evaluation. Semin. Oncol. 2005;32(SUPPL. 2):S23
No original data

CME examination for volume 41Include entire volume with the exception of the CME articles. J Am Acad Dermatol 2000;42(6):33-6
No original data, No evaluation

CME examination. Am J Obstet Gynecol 98;179(6 Pt 2):114-8
No original data

CME examination. J. Am. Acad. Dermatol. 2005;53(2):210-212
No original data, No evaluation, Does not apply

CME examination: July 2005. Pediatr. Emerg. Care 2005;21(7):457
No original data, No evaluation, Does not apply a

CME quiz & evaluation. Ca Cancer J. Clin. 2005;55(4):260-264
No original data, No evaluation, Does not apply

Cohen S J, Stookey G K, Katz B P et al. Encouraging primary care physicians to help smokers quit. A randomized, controlled trial. Ann Intern Med 89;110(8):648-52
<15 trained physicians

Cole T B, Glass R M. Learning associated with participation in journal-based continuing medical education. J Contin Educ Health Prof 2004;24(4):205-12
No comparison

Coleman E A, Stewart C B, Wilson S et al. An evaluation of standardized patients in improving clinical breast examinations for military women. Cancer Nurs 2004;27(6):474-82
<15 trained physicians, PI or QI

Collins R, Hammond M. Self-directed learning to educate medical educators, Part 2: Why do we use self-directed learning?. Med Teach 87;9(4):425-32
No original data., Not US or Canada

Connolly Nancy K, Williams Mark E. Facilitating Change through CME in Geriatrics.. Journal of Continuing Education in the Health Professions 92;12(4):215-224
No comparison

Continuing education: keeping pace with the changing scene. Council on Practice Continuing Education Committee. J Am Diet Assoc 88;88(10):1224-5
No original data, Does not apply

Continuing Medical Education examination: EBV the prototypical human tumor virus - Just how bad is it?. J. Allergy Clin. Immunol. 2005;116(2):262
No original data, Does not apply

Continuing Medical Education examination: Innate immune responses to infection. J. Allergy Clin. Immunol. 2005;116(2):250
No original data, Does not apply

Cook D A. Internet-based continuing medical education. JAMA 2006;295(7):758; author reply 758-9
No original data

Craig M, Nichols A, Price D. Education for general practitioners proposing to administer anaesthesia in rural general practice. Anaesth Intensive Care 93;21(4):432-41
Not US or Canada

Craychee G A. The psychosocial dimension of professional continuing education: behavioral intentions. Radiol Technol 87;58(6):529-35
<15 trained physicians, Does not apply

Crow W C. Using "pearls" to ensure that learners learn key information. Fam Med 2004;36(9):619-21
No original data, <15 trained physicians, No training, No evaluation

Cunningham A M, Edwards A, Jones K V et al. Evaluation of a service development to increase detection of urinary tract infections in children. J Eval Clin Pract 2005;11(1):73-6
Not US or Canada

Curtis J R, Rubenfeld G D, Hudson L D. Training pulmonary and critical care physicians in outcomes research: should we take the challenge?. Am J Respir Crit Care Med 98;157(4 Pt 1):1012-5
No original data

Curtis J R, Rubenfeld G D, Hudson L D. Training pulmonary and critical care physicians in outcomes research: should we take the challenge?. Am J Respir Crit Care Med 98;157(4 Pt 1):1012-5
Does not apply

Curtis P, Carey T S, Evans P et al. Training primary care physicians to give limited manual therapy for low back pain: patient outcomes. Spine 2000;25(22):2954-60; discussion 2960-1
No comparison

Da Costa M. Practice-based continuing medical education. Educ. Gen. Pract. 99;10(1):70-72
<15 trained physicians, No comparison

D'Alessandro M P, Galvin J R, Erkonen W E et al. The instructional effectiveness of a radiology multimedia textbook (HyperLung) versus a standard lecture. Invest Radiol 93;28(7):643-8
<15 trained physicians

Dankelman J, Wentink M, Grimbergen C A et al. Does virtual reality training make sense in interventional radiology? Training skill-, rule- and knowledge-based behavior. Cardiovasc. Intervent. Radiol. 2004;27(5):417-421
No original data, Not US or Canada

Dark G G. Learning on the Internet. Br J Hosp Med 97;58(11):572-4
No original data

Dauphinee W D. Role of examinations of the Medical Council of Canada in improving medical standards. CAN. MED. ASSOC. J. 81;124(11):1425-1427
No original data

David T J, Dolmans D H, Patel L et al. Problem-based learning as an alternative to lecture-based continuing medical education. J R Soc Med 98;91(12):626-30
No original data, Does not apply

Davis D, O"Brien M A T, Freemantle N et al. Review: Interactive, but not didactic, continuing medical education is effective in changing physician performance. Evid.-Based Med. 2000;5(2):64
No original data

Davis D. Evaluating continuing medical education: common sense and science. CMAJ 86;134(5):485-6
No original data

Davis M H, Karunathilake I. The place of the oral examination in today"s assessment systems. Med Teach 2005;27(4):294-7
No original data

Dayal R, Faries P L, Lin S C et al. Computer simulation as a component of catheter-based training. J Vasc Surg 2004;40(6):1112-7
<15 trained physicians

de Burgh S, Mant A, Mattick R P et al. A controlled trial of educational visiting to improve benzodiazepine prescribing in general practice. Aust J Public Health 95;19(2):142-8
Not US or Canada

De Muylder R, Tonglet R, Nackers F et al. Randomised evaluation of a specific training of general practitioners in cardiovascular prevention. Acta Cardiol 2005;60(2):199-205
Not US or Canada

Deeb L C, Pettijohn F P, Shirah J K et al. Interventions among primary-care practitioners to improve care for preventable complications of diabetes. Diabetes Care 88;11(3):275-80
<15 trained physicians, PI or QI

Delmont G. Using electronic portfolios to document learning. Athl. Ther. Today 2003;8(4):22-23
No evaluation, Does not apply

Delvaux N, Razavi D. Psychological training for health-care professionals in oncology. A way to improve communication skills. Ann N Y Acad Sci 97;809336-49
No original data

Devitt P, Worthley S, Palmer E et al. Evaluation of a computer based package on electrocardiography. Aust N Z J Med 98;28(4):432-5
Not US or Canada

Diarrhoeal Diseases Control Programme. Supervisory skills training course. Wkly Epidemiol Rec 90;65(42):326-7
No original data, <15 trained physicians, No evaluation, Not US or Canada, Does not apply

Dibbern D A, Wold E. Workshop-based learning: a model for teaching ethics. JAMA 95;274(9):770-1
No original data, Does not apply

DiMatteo M R. Evidence-based strategies to foster adherence and improve patient outcomes. JAAPA 2004;17(11):18-21
No original data

Din-Dzietham R, Porterfield D S, Cohen S J et al. Quality care improvement program in a community-based participatory research project: example of Project DIRECT. J Natl Med Assoc 2004;96(10):1310-21
No comparison

DM program cuts back pain costs by educating, supporting primary care physicians. Healthc Demand Dis Manag 99;5(10):149-53
Abstract, No evaluation, PI or QI

Dolan N C, Ng J S, Martin G J et al. Effectiveness of a skin cancer control educational intervention for internal medicine housestaff and attending physicians. J Gen Intern Med 97;12(9):531-6
<15 trained physicians

Dornan T, David T. Adult learning and continuing education. Diabet Med 2000;17(1):78-80
No original data, Does not apply

Dornbusch D, Allegra C, Willey J et al. How Do U.S. Medical Oncologists Learn and Apply New Clinical Trials Information from Press Releases in Nonmedical Media? A Case Study Based on ECOG 4599. Oncologist 2006;11(1):31-8
No training, No comparison

D"Orsi C J, Karellas A, Costanza M E et al. Preliminary report of an intervention to improve mammography skills of radiologists. Prog Clin Biol Res 89;293151-7
No comparison

Dougherty M. Going the distance. Balancing work and education in a distance learning program. J AHIMA 2005;76(6):38-42
No human data, <15 trained physicians, Does not apply

Dowell J, Pagliari C, McAleer S. Development and evaluation of a concordance training course for medical practitioners. Med Teach 2004;26(4):384-6
<15 trained physicians, Not US or Canada, No comparison

Du Pen A R, Du Pen S, Hansberry J et al. An educational implementation of a cancer pain algorithm for ambulatory care. Pain Manag Nurs 2000;1(4):116-28
<15 trained physicians

Duggan C M. Designing effective training. J AHIMA 2005;76(6):28-32; quiz 33-4
Does not apply

Dumay A C, Jense G J. Endoscopic surgery simulation in a virtual environment. Comput Biol Med 95;25(2):139-48
No original data, Not US or Canada

Duncan A K, Multari A, Li J. Curriculum in physician-patient communication skills for new faculty. Acad Med 2002;77(5):462
No original data, Does not apply

Dutta P K. Continuing medical education of general practitioners on MCH care through distance learning. Indian J Public Health 96;40(3):68-70
Not US or Canada

Dykes P C, Acevedo K, Boldrighini J et al. Clinical practice guideline adherence before and after implementation of the HEARTFELT (HEART Failure Effectiveness & Leadership Team) intervention. J Cardiovasc Nurs 2005;20(5):306-14
<15 trained physicians

Eisenberg J. Changing provider behavior: is it possible?. Clin Perform Qual Health Care 96;4(4):204-5
No original data, Does not apply

El Ansari W, Pearson D, Davis T. Satisfaction with interprofessional education? Influences of learners" demographic and academic characteristics. J. Interprof. Care 2002;16(2):174-175
<15 trained physicians, Not US or Canada

Elkin P L, Gorman P N. Continuing medical education and patient safety: an agenda for lifelong learning. J Am Med Inform Assoc 2002;9(6 Suppl):S128-32
No original data, No evaluation

Emlet C A, da Silva P. Medications, behavior and the elderly: a continuing education program for board and care facility operators. Gerontol Geriatr Educ 86;6(4):41-51
<15 trained physicians, No comparison

Evans A W, McKenna C, Oliver M. Self-assessment in medical practice. J. R. Soc. Med. 2002;95(10):511-513
No original data

Evans P R. CME in general practice. Postgrad Med J 96;72 Suppl 1S27-9
No training, Not US or Canada

Ewart C K, Li V C, Coates T J. Increasing physicians' antismoking influence by applying an inexpensive feedback technique. J Med Educ 83;58(6):468-73
<15 trained physicians, No comparison

Fallowfield L, Jenkins V, Farewell V et al. Enduring impact of communication skills training: results of a 12-month follow-up. Br J Cancer 2003;89(8):1445-9
Not US or Canada

Farris K B, Kirking D M, Shimp L A et al. Design and results of a group counter-detailing DUR educational program. Pharm Res 96;13(10):1445-52
<15 trained physicians

Fasel J, Sieber R, Rohr H P. Laservision-disk and computer-assisted medical learning. J Audiov Media Med 86;9(1):15-6
No evaluation, Does not apply

Featherstone H J, LoGerfo J P, Barnes R H. Performance-based continuing medical education. Prophylactic cephalosporin use in hysterectomy patients. QUAL. REV. BULL. 83;9(6):169-174
<15 trained physicians

Feighny K M, Monaco M, Arnold L. Empathy training to improve physician-patient communication skills. Acad Med 95;70(5):435-6
<15 trained physicians

Fiallo V M, O'Connor F X, Reed W P. Preceptored introduction of laparoscopic techniques for cholecystectomy into a large university-affiliated medical center. Surg Endosc 94;8(9):1063-6
<15 trained physicians, No comparisonv

Fincher R M, Abdulla A M, Sridharan M R et al. A prospective educational trial comparing efficacy of computer-assisted learning and weekly seminars in teaching EKG interpretation.. Proc Annu Conf Res Med Educ 86;25(-):3-7
<15 trained physicians

Finestone A J, Lanzilotti S S, Marks A D et al. An assessment of practice-based CME. Pa Med 87;90(6):45-6, 48
No comparison

Fishbein R H. Professionalism and "the master clinician"--an early learning experience. J Eval Clin Pract 2000;6(3):241-3
No original data, Does not apply

Folberg R, Dickinson L K, Christiansen R A et al. Interactive videodisc and compact disc-interactive for ophthalmic basic science and continuing medical education. Ophthalmology 93;100(6):842-50
No original data, No evaluation

Fox R D, Bennett N L. Continuing medical education. Learning and change: Implications for continuing medical education. Br. Med. J. 98;316(7129):466-468
No original data

Fox S, Tsou C V, Klos D S. Increasing mammography screening: An application of general principles of CME methodology. J. PSYCHOSOM. OBSTET. GYNECOL. 85;4(2):95-104
<15 trained physicians

Frenkel M, Ben-Arye E, Hermoni D. An approach to educating family practice residents and family physicians about complementary and alternative medicine. Complement Ther Med 2004;12(2-3):118-25
Not US or Canada, No comparison

Friedenberg R M. Medical education and practice in a new environment. Radiology 97;202(3):33A-36A
No original data, Does not apply

Friedmann P, Selbovitz L G. Continuous quality improvement and physician training. Qual Manag Health Care 92;1(1):13-9
No original data, No evaluation, Does not apply

Friss L, Lass S. An evaluation approach for continuing education programs in the health professions. Mobius 82;2(1):5-13
No original data, No comparison

Fustukian S, Macdonald J. Health action is: continuing education for PHC. HealthAction 94;(8):2
Other

Gainford M C, McCready D, Cohen Z et al. The latest is the greatest? Results of a structured lecture about aromatase inhibitor use for breast cancer. Breast Cancer Res Treat 2005;1-4
No comparison

Gallagher A G, McClure N, McGuigan J et al. Virtual reality training in laparoscopic surgery: a preliminary assessment of minimally invasive surgical trainer virtual reality (MIST VR). Endoscopy 99;31(4):310-3
Not US or Canada

Gallagher R E, Smith D U. Formulation of teaching/learning objectives useful for the development and assessment of lessons, courses, and programs. J Cancer Educ 89;4(4):231-4
No original data, No evaluation

Gask L, Dowrick C, Dixon C et al. A pragmatic cluster randomized controlled trial of an educational intervention for GPs in the assessment and management of depression. Psychol Med 2004;34(1):63-72
Not US or Canada, Not US or Canada

Gautam V, Heyworth J. A method to measure the value of formal training in trauma management: comparison between ATLS and induction courses. Injury 95;26(4):253-5
Not US or Canada

Gemson D H, Ashford A R, Dickey L L et al. Putting prevention into practice. Impact of a multifaceted physician education program on preventive services in the inner city. Arch Intern Med 95;155(20):2210-6
<15 trained physicians

Gilbert J H. Interprofessional education for collaborative, patient-centred practice.. Can J Nurs Leadersh 2005;18(2):32-36, 38
No original data, Does not apply

Giovino G A, Cummings K M, Koenigsberg M R et al. An evaluation of a physician training program on patient smoking cessation. Prog Clin Biol Res 90;33927-48
<15 trained physicians

Girgis A, Sanson-Fisher R W, Howe C et al. A skin cancer training programme: evaluation of a postgraduate training for family doctors. Med Educ 95;29(5):364-71
Not US or Canada

Glassman P A, Luck J, O'Gara E M et al. Using standardized patients to measure quality: evidence from the literature and a prospective study. Jt Comm J Qual Improv 2000;26(11):644-53
No evaluation

Glazier R H, Badley E M, Lineker S C et al. Getting a Grip on Arthritis: an educational intervention for the diagnosis and treatment of arthritis in primary care. J Rheumatol 2005;32(1):137-42
<15 trained physicians

Godfrey J, Dennick R, Welsh C. Training the trainers: do teaching courses develop teaching skills?. Med Educ 2004;38(8):844-7
Not US or Canada

Goettner P. Effective e-learning for healthcare.. Health Manag Technol 2000;21(12):64, 63
No original data

Goldberg H I, Wagner E H, Fihn S D et al. A randomized controlled trial of CQI teams and academic detailing: can they alter compliance with guidelines?. Jt Comm J Qual Improv 98;24(3):130-42
PI or QI

Gomel M K, Wutzke S E, Hardcastle D M et al. Cost-effectiveness of strategies to market and train primary health care physicians in brief intervention techniques for hazardous alcohol use. Soc Sci Med 98;47(2):203-11
Not US or Canada

Gonzalez-Willis A, Rafi I, Boekeloo B et al. Using simulated patients to train physicians in sexual risk assessment and risk reduction. Acad Med 90;65(9 Suppl):S7-8
No comparison

Gopalakrishnan G, Devarajan V. StapSim: a virtual reality-based stapling simulator for laparoscopic hemiorrhaphy. Stud Health Technol Inform 2004;98111-3
No training, Does not apply

Gordon M S, Ewy G A, Felner J M et al. A cardiology patient simulator for continuing education of family physicians. J Fam Pract 81;13(3):353-6
No comparison

Gordon S M, Troncale J. Evaluation of the effectiveness of an addiction treatment training program for physicians. Am Clin Lab 2002;21(5):22-4
<15 trained physicians

Gore M J. Outcomes assessment: Latest way to gauge the value of CLS education. CLIN. LAB. SCI. 91;4(2):70-73
No original data

Gormley G J, Steele W K, Stevenson M et al. A randomised study of two training programmes for general practitioners in the techniques of shoulder injection. Ann Rheum Dis 2003;62(10):1006-9
Not US or Canada

Goulet F, Jacques A, Gagnon R. An innovative approach to remedial continuing medical education, 1992-2002. Acad Med 2005;80(6):533-40
Does not apply, No comparison

Greco M, Buckley J, Francis W. Triads: An effective method for learning the art of listening. EDUC. GEN. PRACT. 97;8(4):329-337
Not US or Canada

Greenberg L W, Jewett L S. The impact of two educational techniques on physician knowledge, performance and patient care. Mobius 84;4(4):51-4
Other

Greene R A, Beckman H, Chamberlain J et al. Increasing adherence to a community-based guideline for acute sinusitis through education, physician profiling, and financial incentives. Am J Manag Care 2004;10(10):670-8
No comparison

Griffin G A, Barry S M. Muscle and joint pain: design and evaluation of courses for general practitioners. J R Coll Gen Pract 81;31(232):661-8
Not US or Canada

Grogan E L, Stiles R A, France D J et al. The impact of aviation-based teamwork training on the attitudes of health-care professionals. J Am Coll Surg 2004;199(6):843-8
No comparison

Groveman H D, Ganiats T G, Klauber M R et al. Computer-assisted assessment of family physicians" knowledge about cancer screening guidelines. West J Med 85;143(4):541-4
No comparison

Groveman H D, Sanowski R A, Klauber M R. Training primary care physicians in flexible sigmoidoscopy--performance evaluation of 17,167 procedures. West J Med 88;148(2):221-4
No comparison

Grunwald T, Clark D, Fisher S S et al. Using cognitive task analysis to facilitate collaboration in development of simulator to accelerate surgical training. Stud Health Technol Inform 2004;98114-20
No training, No evaluation

Guenther S M, Laube D W, Matthes S. Effectiveness of the gynecology teaching associate in teaching pelvic examination skills. J. MED. EDUC. 83;58(1):67-69
<15 trained physicians

Gullion D S, Adamson T E, Watts M S. The effect of an individualized practice-based CME program on physician performance and patient outcomes. West J Med 83;138(4):582-8
No comparison

Gullion D S, Adamson T E. A practice-based CME program in hypertension using a medication and behavioral treatment approach. Proc Annu Conf Res Med Educ 85;24207-12
No comparison

Gurwitz JH, Noonan JP, Soumerai SB. Reducing the use of H2-receptor antagonists in the long-term-care setting [see comment]. Journal of the American Geriatrics Society. 92;40(4):359
No comparison

Hall P, Hupe D, Scott J. Palliative care education for community-based family physicians: the development of a program, the evaluation, and its consequences. J Palliat Care 98;14(3):69-74
No comparison

Halm E A, Horowitz C, Silver A et al. Limited impact of a multicenter intervention to improve the quality and efficiency of pneumonia care. Chest 2004;126(1):100-7
<15 trained physicians, No comparison, PI or QI

Hamstra S J, Dubrowski A. Effective training and assessment of surgical skills, and the correlates of performance. Surg Innov 2005;12(1):71-7
No original data, <15 trained physicians

Handler S. Does continuing medical education affect medical care. A study of improved transfusion practices. Minn Med 83;66(3):167-80
Does not apply, Other

Handmaker N S, Hester R K, Delaney H D. Videotaped training in alcohol counseling for obstetric care practitioners: A randomized controlled trial. Obstet. Gynecol. 99;93(2):213-218
<15 trained physicians

Hardern R D. Teaching and learning evidence based medicine skills in accident and emergency medicine. J. Accid. Emerg. Med. 99;16(2):126-129
No original data

Harewood G C, Yusuf T E, Clain J E et al. Assessment of the impact of an educational course on knowledge of appropriate EUS indications. Gastrointest Endosc 2005;61(4):554-9
No comparison

Harper G, Norris D, Woo B. Physician education in a diverse society: listening to and learning from new voices. Pharos Alpha Omega Alpha Honor Med Soc 95;58(2):39-42
No original data, No training

Harris G D. Professionalism: part II -- teaching and assessing the learner''s professionalism. Fam Med 2004;36(6):390-2
No original data, No training, Does not apply

Harris I B, Wempner J. Continuing medical education reconceived: evaluation of a sabbatical program for physicians. Acad Med 96;71(10 Suppl):S46-8
No comparison

Harrison R V, Gallay L S, McKay N E et al. The association between community physician's attendance at a medical center's CME courses and their patient referrals to the medical center. J Contin Educ Health Prof 90;10(4):315-20
Does not apply

Haynes R B, Johnston M E, McKibbon K A et al. A program to enhance clinical use of MEDLINE. A randomized controlled trial. Online J Curr Clin Trials 93;Doc No 56[4005 words; 39 paragraphs]
<15 trained physicians

Heins H C, Miller J M, Childs D et al. Perinatal educational programs and perinatal outcomes. J S C Med Assoc 84;80(9):431-5
<15 trained physicians

Henderson R W. Learners in your practice.. Can Fam Physician 95;41(-):32-33
No original data

Herdson P B. Pathology, pathologists and problem-based learning.. Pathology 98;30(3):326-327
No original data, Not US or Canada

Hinchman J, Beno L, Dennison D et al. Evaluation of a training to improve management of pediatric overweight. J Contin Educ Health Prof 2005;25(4):259-67
<15 trained physicians

Hirsch I B, Goldberg H I, Ellsworth A et al. A multifaceted intervention in support of diabetes treatment guidelines: a cont trial. Diabetes Res Clin Pract 2002;58(1):27-36
<15 trained physicians

Hochberger J, Euler K, Naegel A et al. The compact Erlangen Active Simulator for Interventional Endoscopy: a prospective comparison in structured team-training courses on "endoscopic hemostasis" for doctors and nurses to the "Endo-Trainer" model. Scand J Gastroenterol 2004;39(9):895-902
Not US or Canada

Holloway R G, Gifford D R, Frankel M R et al. A randomized trial to implement practice recommendations: design and methods of the Dementia Care Study. Control Clin Trials 99;20(4):369-85
No training, Other

Holmes D R, Fox R D, Tommaso C et al. Renal and iliac artery stenting by interventional cardiologists and vascular surgeons: the Foundation to Advance Medical Education (FAME) initiative. Am Heart J 2005;149(5):883-7
No comparison

Holmes G R, Smith M E, Donald A G. Behavioral science in medical education: a 1985 updated bibliography. Psychol Rep 85;57(3 Pt 1):895-9
No original data

Holsgrove G. Getting the most out of distance learning. Practitioner 91;235(1500):196-200
No evaluation, Does not apply

Holsgrove G. Techniques for distance learning. Practitioner 91;235(1501):296-300
No evaluation, Does not apply

Hood A F. CME examination. J. Am. Acad. Dermatol. 2005;53(3):389-392
No original data, Does not apply

Horowitz C R, Goldberg H I, Martin D P et al. Conducting a randomized controlled trial of CQI and academic detailing to implement clinical guidelines. Jt Comm J Qual Improv 96;22(11):734-50
PI or QI

Houge D R. Participant/observer evaluation in continuing medical education. J Med Educ 81;56(6):527
Does not apply, No comparison

HSJ awards 2005. Skills development. Winner: new standards for doctors" training that take in general management skills. Health Serv J 2005;115(5982):suppl 51-2
No original data, Does not apply

Huas D, Wallace P. Is participation in research as an investigator an effective form of continuing medical education?. Br J Gen Pract 2000;50(461):982-3
Not US or Canada

Hull A L, Wasman J, Goodnough L T. Effects of a CME program on physicians' transfusion practices. Acad Med 89;64(11):681-5
<15 trained physicians, PI or QI

Hull S A. Rheumatology education for general practice. Ann Rheum Dis 91;50 Suppl 3449-52
No original data

Hummel L J. An investigation of physician self-directed learning activities. Proc Annu Conf Res Med Educ 85;24213-8
No evaluation, Does not apply

Hunt D M. Appraisal and assessment. Ann R Coll Surg Engl 98;80(6 Suppl):281-3
No original data, No training

Hunter T B. Electronic aids to education and practice in radiology: the personal computer in the radiologist"s office. J Digit Imaging 89;2(2):71-4
No original data

Hutchinson L. Evaluating and researching the effectiveness of educational interventions. BMJ 99;318(7193):1267-9
No original data

Hux J E, Melady M P, DeBoer D. Confidential prescriber feedback and education to improve antibiotic use in primary care: a controlled trial. CMAJ 99;161(4):388-92
PI or QI

Hyler S E. APA Online CME Practice Guideline for the Treatment of Patients with Major Depressive Disorder. J Psychiatr Pract 2002;8(5):315-9
No original data, <15 trained physicians, No evaluation, Does not apply

Illes J, Glover G H, Wexler L et al. A model for faculty mentoring in academic radiology. Acad. Radiol. 2000;7(9):717-724
No comparison

Inui T S, Yourtee E L, Williamson J W. Improved outcomes in hypertension after physician tutorials. A controlled trial. Ann Intern Med 76;84(6): 646-51
Pre 1981

Irvine Doran D M, Baker G R, Murray M et al. Achieving clinical improvement: an interdisciplinary intervention. Health Care Manage Rev 2002;27(4):42-56
<15 trained physicians, Other

Jacobs B. Hardly child''s play: implementing a pediatric-specific, integrated CPOE system. Midwest pediatric hospital tackles all the hurdles--needs assessment, clinician buy-in, training and measuring results--as it strengthens its patient safety efforts with wireless CPOE. Health Manag Technol 2004;25(8):30-2
Does not apply, Other

Jacobs K, Aja D, Hermenau D. Adult learning through case simulation. Am J Occup Ther 94;48(11):1089-92
No original data

Jansen J J, Scherpbier A J, Metz J C et al. Performance-based assessment in continuing medical education for general practitioners: construct validity. Med Educ 96;30(5):339-44
Not US or Canada, No comparison

Jennett P A, Laxdal O E, Hayton R C et al. Designing education interventions to improve physician performance in office practice. Mobius 84;4(4):55-61
No evaluation

Johannes B, Salnitski V P, Goeters K M et al. Learning with simulation only--artificial skills. J Gravit Physiol 2004;11(2):P27-8
No original data, <15 trained physicians

Johnston M. Supporting learners. Nurs Times 91;87(12):47-8
No evaluation, Does not apply

Jones D L. Viability of the commitment-for-change evaluation strategy in continuing medical education. Acad Med 90;65(9 Suppl):S37-8
No comparison

Jones J M, James J, Rodin G et al. The evaluation of a two-day interdisciplinary continuing education event in psychosocial oncology. J Cancer Educ 2004;19(3):161-4
<15 trained physicians

Jones R, Spencer J. Conference report: teaching old docs new tricks: research dissemination and professional behavioural change. Fam Pract 93;10(2):229-30
No original data, No training

Joos S K, Hickam D H, Gordon G H et al. Effects of a physician communication intervention on patient care outcomes. J Gen Intern Med 96;11(3):147-55
<15 trained physicians

Jordan J A, Gallagher A G, McGuigan J et al. Virtual reality training leads to faster adaptation to the novel psychomotor restrictions encountered by laparoscopic surgeons. Surg Endosc 2001;15(10):1080-4
Not US or Canada

Kaegi L. Using guidelines to change clinical behavior: dissemination through Area Health Education Centers and Geriatric Education Centers. QRB Qual Rev Bull 93;19(5):165-9
No original data, Does not apply

Kanter M H, van Maanen D, Anders K H et al. A study of an educational intervention to decrease inappropriate preoperative autologous blood donation: its effectiveness and the effect on subsequent transfusion rates in elective hysterectomy. Transfusion 99;39(8):801-7
<15 trained physicians

Karlsten R, Strom K, Gunningberg L. Improving assessment of postoperative pain in surgical wards by education and training. Qual Saf Health Care 2005;14(5):332-5
<15 trained physicians, Not US or Canada

Karp J G, Hyler I, Wald M et al. The use of an audiotaped analysis in a continuous case seminar. Psychoanal Q 93;62(2):263-9
<15 trained physicians

Katz H P, Goldfinger S E, Fletcher S W. Academia-industry collaboration in continuing medical education: description of two approaches. J Contin Educ Health Prof 2002;22(1):43-54
No evaluation, Does not apply

Katz S, Feigenbaum A, Pasternak S et al. An interactive course to enhance self-efficacy of family practitioners to treat obesity. BMC Med Educ 2005;5(1):4
Not US or Canada, No comparison

Kaufman J, Forman W B. Hospice and palliative care: an educational intervention for healthcare professionals in a rural community. Am J Hosp Palliat Care 2005;22(6):415-8
<15 trained physicians, No comparison

Kauth M R, Sullivan G, Henderson K L. Supporting clinicians in the development of best practice innovations in education. Psychiatr Serv 2005;56(7):786-8
No original data, No evaluation, Does not apply

Kemper K J, Amata-Kynvi A, Sanghavi D et al. Randomized trial of an internet curriculum on herbs and other dietary supplements for health care professionals. Acad Med 2002;77(9):882-9
<15 trained physicians

Kennedy A, Gask L, Rogers A. Training professionals to engage with and promote self-management. Health Educ Res 2005;20(5):567-78
Not US or Canada

Keyserling T C, Ammerman A S, Davis C E et al. A randomized controlled trial of a physician-directed treatment program for low-income patients with high blood cholesterol: the Southeast Cholesterol Project. Arch Fam Med 97;6(2):135-45
<15 trained physicians, PI or QI, Other

Khan M S, Bann S D, Darzi A et al. Assessing surgical skill. Plast Reconstr Surg 2003;112(7):1886-9
No training, No evaluation

Khan M S, Bann S D, Darzi A et al. Assessing surgical skill. Plast Reconstr Surg 2003;112(7):1886-9
No original data

Kiessling A, Henriksson P, O"Malley P G et al. Case method learning for general practitioners reduces cholesterol concentrations in coronary artery disease. Evid.-Based Med. 2003;8(3):95
No original data, Not US or Canada

Kim M, Kim Y, Park J H. Development and utilization of computer-assisted learning (CAL) program for medical education.. Medinfo 95;8 Pt 2(-):1173-1176
Not US or Canada

Kinsinger L S, Harris R, Qaqish B et al. Using an office system intervention to increase breast cancer screening. J Gen Intern Med 98;13(8):507-14
PI or QI

Kirby R L. Inspection-palpation-percussion-auscultation and an outcome-oriented alternative approach to the musculoskeletal examination. MED. EDUC. 81;15(2):106-109
<15 trained physicians

Kjeldmand D, Holmstrom I, Rosenqvist U. Balint training makes GPs thrive better in their job. Patient Educ Couns 2004;55(2):230-5
Not US or Canada

Klein L E, Charache P, Johannes R S. Effect of physician tutorials on prescribing patterns of graduate physicians. J Med Educ 81;56(6):504-11
<15 trained physicians

Knapp J F, Dowd M D, Kennedy C S et al. Evaluation of a curriculum for intimate partner violence screening in a pediatric emergency department. Pediatrics 2006;117(1):110-6
No comparison

Knox J D E. Training of teachers in general medical practice. MED. EDUC. 84;18(5):379-380
Not US or Canada, Does not apply

Kort W J, Marquet R L, Smith A R et al. Evaluation of five training courses in microsurgery. Neth J Surg 88;40(3):90-2
Not US or Canada, No comparison

Kramer J. Teaching and learning in rural general practice. Aust Fam Physician 2004;33(9):737-9
No original data, No training, No evaluation, Not **US or Canada, Does not apply**

Kristofco R E, Hall S A, Chick E. Needs assessment survey. CME preferences, practices of West Virginia physicians. W V Med J 87;83(5):223-5
No training, Does not apply

Krombach G, Ganser A, Fricke C et al. Virtual placement of frontal ventricular catheters using frameless neuronavigation: an "unbloody training" for young neurosurgeons. Minim Invasive Neurosurg 2000;43(4):171-5
Not US or Canada

Kuban K C, O'Shea M, Allred E et al. Video and CD-ROM as a training tool for performing neurologic examinations of 1-year-old children in a multicenter epidemiologic study. J Child Neurol 2005;20(10):829-31
No comparison

Labelle M, Beaulieu M, Paquette D et al. An integrated approach to improving appropriate use of anti-inflammatory medication in the treatment of osteoarthritis in Quebec (Canada): the CURATA model. Med Teach 2004;26(5):463-70
No comparison

LaDuca A, Leone-Perkins M, De Champlain A. Evaluating continuing competence of physicians through multiple assessment modalities: the Physicians" Continued Competence Assessment Program (PCCAP). Acad Med 97;72(5):457-8
No evaluation, No comparison

Ladyshewsky R. Simulated patients and assessment. Med. Teach. 99;21(3):266-269
No original data, Not US or Canada

Lalonde J. How physicians learn. Better methods of delivering CME using online practice-based learning. Cost Qual 2000;6(3):29-31
No original data, No evaluation

Lang L. CME series focuses on Patient-Centered GI Practice. Gastroenterology 2004;127(1):5
No original data

Lau M A, Dubord G M, Parikh S V. Design and feasibility of a new cognitive-behavioural therapy course using a longitudinal interactive format. Can J Psychiatry 2004;49(10):696-700
No comparison

Laube D W, Kretzschmar R M, Guenther S M et al. A clinical skills instruction program: the acute abdomen. J Med Educ 82;57(9):726-8
<15 trained physicians

Lawson K A, Wilcox R E, Littlefield J H et al. Educating treatment professionals about addiction science research: demographics of knowledge and belief changes. Subst Use Misuse 2004;39(8):1235-58
<15 trained physicians, No comparison

Lee E, McNally D L, Zuckerman I H. Evaluation of a physician-focused educational intervention on medicaid children with asthma. Ann Pharmacother 2004;38(6):961-6
No comparison

Lehmann H P, Lehmann C U, Freedman J A. The use of simulations in computer-aided learning over the World Wide Web. JAMA 97;278(21):1788
No original data

Lennard M. Vocational training for general practice--achievements of the last 15 years. Bristol Med Chir J 85;100(375):72-3
No original data, No evaluation

Lenow J L, Bales R, Smullens S N. The JeffCare preceptor model for asthma: a primary care physician tutorial training model. Dis Manag 2003;6(1):35-42
No comparison

Leviton L C, Goldenberg R L, Baker C S et al. Methods to encourage the use of antenatal corticosteroid therapy for fetal maturation: a randomized controlled trial. JAMA 99;281(1):46-52
<15 trained physicians

Levy K, Aghababian R V, Hirsch E F et al. An Internet-based exercise as a component of an overall training program addressing medical aspects of radiation emergency management. Prehospital Disaster Med 2000;15(2):18-25
Not US or Canada

Lewis C C, Pantell R H, Sharp L. Increasing patient knowledge, satisfaction, and involvement: randomized trial of a communication intervention. Pediatrics 91;88(2):351-8
<15 trained physicians

Linder J F, Blais J, Enders S R et al. Palliative education: a didactic and experiential approach to teaching end-of-life care. J Cancer Educ 99;14(3):154-60
No comparison

Lloyd-Jones G, Margetson D, Bligh J G. Problem-based learning: a coat of many colours. Med Educ 98;32(5):492-4
No original data

Lorenz R A. Training health professionals to improve the effectiveness of patient education programs. Diabetes Educ 86;(12 Suppl):204-9
No original data

Love R R. Changing the health promotion behaviors of primary care physicians: lessons from two projects. Jt Comm J Qual Improv 95;21(7):339-43
No original data, No comparison

Lowy L. Continuing education in the later years: learning in the third age. Gerontol Geriatr Educ 83;4(2):89-106
No original data

Lozano P, Finkelstein J A, Carey V J et al. A multisite randomized trial of the effects of physician education and organizational change in chronic-asthma care: health outcomes of the Pediatric Asthma Care Patient Outcomes Research Team II Study. Arch Pediatr Adolesc Med 2004;158(9):875-83
<15 trained physicians, Other

Lyden P, Raman R, Liu L et al. NIHSS training and certification using a new digital video disk is reliable. Stroke 2005;36(11):2446-9
No comparison

Lytle J S, Lytle B V, Youmans K G. Learning at a distance: people, technology, and learning experiments. J AHIMA 95;66(7):64-7
No original data

Mackay D M, Hardy S. Learning and teaching resource discovery in the Health and Life Sciences--partnership and interoperability. Health Info Libr J 2005;22 Suppl 270-4
Not US or Canada

Madridejos-Mora R, Amado-Guirado E, Perez-Rodriguez M T. Effectiveness of the combination of feedback and educational recommendations for improving drug prescription in general practice. Med Care 2004;42(7):643-8
Not US or Canada

Mainous A G, 3rd Hueston W J, Love M M et al. An evaluation of statewide strategies to reduce antibiotic overuse. Fam Med 2000;32(1):22-9
PI or QI

Makam R, Rajan C S, Brendon T et al. Training and assessment of psychomotor skills for performing laparoscopic surgery using BEST-IRIS virtual reality training simulator. Stud Health Technol Inform 2004;98228-30
<15 trained physicians, Not US or Canada

Manfredi C, Czaja R, Freels S et al. Prescribe for health. Improving cancer screening in physician practices serving low-income and minority populations. Arch Fam Med 98;7(4):329-37
<15 trained physicians

Manley M, Epps R P, Husten C et al. Clinical interventions in tobacco control. A National Cancer Institute training program for physicians. JAMA 91;266(22):3172-3
No original data, No evaluation

Margalit A P, Glick S M, Benbassat J et al. Effect of a biopsychosocial approach on patient satisfaction and patterns of care. J Gen Intern Med 2004;19(5 Pt 2):485-91
Not US or Canada

Margolis K L, Money B E, Kopietz L A et al. Evaluation of two interventions to improve physician diagnostic accuracy in recognizing glaucomatous changes of the optic disk.. Proc Annu Conf Res Med Educ 87;26(-):28-33
<15 trained physicians

Marguet C G, Young M D, L'Esperance J O et al. Hand assisted laparoscopic training for postgraduate urologists: the role of mentoring. J Urol 2004;172(1):286-9
No training, No comparison

Markert R J, Barton J C, Rodin A E. Measuring participant learning and change in practice behavior for continuing medical education programs. Annu Conf Res Med Educ 81;2034-9
No original data, No comparison

Markert R J, O'Neill S C, Bhatia S C. Using a quasi-experimental research design to assess knowledge in continuing medical education programs. J Contin Educ Health Prof 2003;23(3):157-61
Other

Massey R U. Problem-based learning: a better way?. Conn Med 94;58(12):753
No original data, Does not apply

Mast L. Application of the problem-based learning model for continuing professional education: a continuing medical education program on managed care issues--Part II. Am J Manag Care 97;3(1):77-82
<15 trained physicians, No comparison

Mathers N J, Challis M C, Howe A C et al. Portfolios in continuing medical education--effective and efficient?. Med Educ 99;33(7):521-30
Not US or Canada

Mayooran Z, Rombauts L, Brown T I et al. Reliability and validity of an objective assessment instrument of laparoscopic skill. Fertil Steril 2004;82(4):976-8
Not US or Canada

Mazze R, Deeb L, Palumbo P J. Altering physicians' practice patterns--a nationwide educational experiment: evaluation of the Clinical Education Program of the American Diabetes Association. Diabetes Care 86;9(4):420-5
No comparison

McBride P, Underbakke G, Plane MB et al. Improving prevention systems in primary care practices: the Health Education and Research Trial (HEART) [see comment]. The Journal of family practice. 2000;49(2):115
Other

McKenzie A, Ngobeni O, Bonongo F. Is health education effective?. Nurs RSA 92;7(7):26-7
No original data, No training, No evaluation

McNabb W L, Cook S, Fischer B et al. Dissemination of a continuing education program in diabetes to health care professionals. Diabetes Educ 94;20(1):35-40
<15 trained physicians

Medicare learning online. Optometry 2004;75(10):658-9
Does not apply

Mendoza N, Park CL, Thammasitboon S et al. Physician education using case-based learning seminar in peditric asthma management. Pediatric research. 2001;49(4):138A
Abstract, <15 trained physicians

Merckaert I, Libert Y, Delvaux N et al. Factors that influence physicians' detection of distress in patients with cancer: can a communication skills training program improve physicians' detection?. Cancer 2005;104(2):411-21
Not US or Canada

Modell H I. Use of computer simulations to promote active learning in multiple teaching settings.. Physiologist 85;28(5):445-446
No evaluation, No comparison

Modell H I. Use of computer simulations to promote active learning in multiple teaching settings.. Physiologist 85;28(5):445-446
<15 trained physicians

Monette J, Tamblyn R M, McLeod P J et al. Do medical education and practice characteristics predict inappropriate prescribing of sedative-hypnotics for the elderly?. Acad Med 94;69(10 Suppl):S10-2
No training, No evaluation, Does not apply

Moody L, Waterworth A. A flexible virtual reality tutorial for the training and assessment of arthroscopic skills. Stud Health Technol Inform 2004;98244-6
No original data, Not US or Canada

Moonie S A, Strunk R C, Crocker S et al. Community Asthma Program improves appropriate prescribing in moderate to severe asthma. J Asthma 2005;42(4):281-9
<15 trained physicians

Moore M, Van Schaik J, Montgomery C L. Physician retraining, lifelong learning, and the library. Bull Med Libr Assoc 92;80(4):374-6
No original data, No evaluation

Moore R. Continuing education in practice. Practitioner 91;235(1506):663-5
No evaluation, Does not apply

Moorthy K, Jiwanji M, Shah J et al. Validation of a web-based training tool for lumbar puncture. Stud Health Technol Inform 2003;94219-25
<15 trained physicians, Not US or Canada

Moral R R, Alamo M M, Jurado M A et al. Effectiveness of a learner-centred training programme for primary care physicians in using a patient-centred consultation style. Fam Pract 2001;18(1):60-3
Not US or Canada

Moran T. A new approach. Physicians learn to better care for the dying. Tex Med 99;95(4):42-7
No original data

Morris P D, Pracy R. Training for ENT problems in general practice. Practitioner 83;227(1380):995-9
No original data, Does not apply

Morrison J C, Sumrall D D, Chevalier S P et al. The effect of provider education on blood utilization practices. Am J Obstet Gynecol 93;169(5):1240-5
No comparison

Mozes B, Lubin D, Modan B et al. Evaluation of an intervention aimed at reducing inappropriate use of preoperative blood coagulation tests. Arch Intern Med 89;149(8):1836-8
Not US or Canada

Mozes B, Lubin D, Modan B et al. Evaluation of an intervention aimed at reducing inappropriate use of preoperative blood coagulation tests. Arch Intern Med 89;149(8):1836-8
No comparison

Murphy A W, Bury G, Dowling J et al. The teaching of immediate cardiac and trauma care to general practitioners in a skills-based outreach format: an assessment in terms of information gain. Med Educ 99;33(10):774-6
Not US or Canada

Murphy P S. Effect of nutrition education on nutrition counseling practices of family physicians. Acad Med 89;64(2):98-102
<15 trained physicians, Does not apply

Mutch P B, Wenberg B G. Continuing learning needs assessment for Michigan practitioners. J Am Diet Assoc 86;86(2):247-9
<15 trained physicians, Does not apply

Myers P, Mahmood K. Teaching exchange. GP educational needs assessment: The identification of "key facts". EDUC. GEN. PRACT. 97;8(3):238-241
Not US or Canada, Does not apply

Naimark D M J, Bott M T, Tobe S W et al. Promotion of urine microalbuminuria screening among primary care physicians: a randomized, controlled, educational intervention trial [abstract]. Journal of the American Society of Nephrology : JASN. 2001;12(Program and Abstracts):231A
Abstract

Naimark D M J, Bott M T, Tobe S W. Facilitating the adoption of microalbuminuria (mau) screening among type II diabetic patients in primary care: preliminary results of a randomized educational intervention trial [abstract]. Journal of the American Society of Nephrology : JASN. 2002;13(September, Program and AbstractsAlbuminuria; di [Diagnosis]; Kidney; Patient Education; Diabetes Mellitus,Non-Insulin-Dependent):
Abstract

Nakada S Y, Hedican S P, Bishoff J T et al. Expert videotape analysis and critiquing benefit laparoscopic skills training of urologists. JSLS 2004;8(2):183-6
No comparison

Nasmith Louise, Steinert Yvonne. The evaluation of a workshop to promote interactive lecturing.. Teaching and Learning in Medicine 2001;13(1):43-48
Other

Neff J A, Gaskill S P, Prihoda T J et al. Continuing medical education versus clinic-based STD and HIV education interventions for primary care service providers: replication and extension. AIDS Educ Prev 98;10(5):417-32
<15 trained physicians

Neff James, Alan Amodei, Nancy Martinez et al. HIV/AIDS mental health training for health care providers: An evaluation of three models.. American Journal of Orthopsychiatry 99;69(2):240-246
No original data, <15 trained physicians

Neff James, Alan Amodei, Nancy Martinez et al. HIV/AIDS mental health training for health care providers: An evaluation of three models.. American Journal of Orthopsychiatry 99;69(2):240-246
No comparison

Neff James, Alan Gaskill, Sharon P et al. Preliminary evaluation of continuing medical education-based versus clinic-based sexually transmitted disease education interventions for primary care practitioners.. Teaching and Learning in Medicine 98;10(2):74-82
<15 trained physicians

Neff-Smith M, Scott G, Spencer E M et al. Ethics program evaluation: The Virginia hospital ethics fellows example. HEC FORUM 97;9(4):375-388
No original data, Does not apply, No comparison

Nestel D, Kneebone R, Barnet A. Teaching communication skills for handover: perioperative specialist practitioners. Med Educ 2005;39(11):1157
<15 trained physicians, No comparison

Neumayer L, Wako E, Fergestaad J et al. Impact of journal articles and grand rounds on practice: CT scanning in appendicitis. J Gastrointest Surg 2002;6(3):338-41
No comparison

Newman M, Van den, Bossche P et al. Responses to the pilot systematic review of problem-based learning. Med Educ 2004;38(9):921-3
No original data, Does not apply

Newman P, Peile E. Valuing learners" experience and supporting further growth: Educational models to help experienced adult learners in medicine. Br. Med. J. 2002;325(7357):200-202
No original data

Noguchi M, Minami Y, Iijima T et al. Reproducibility of the diagnosis of small adenocarcinoma of the lung and usefulness of an educational program for the diagnostic criteria. Pathol Int 2005;55(1):8-13
Not US or Canada

Nohr C, Bygholm A. A problem-oriented, project organized, distance learning program in health informatics. Medinfo 95;8 Pt 21274-7
Not US or Canada

Norton P G, Ginsburg L S, Dunn E et al. Educational interventions to improve practice of nonspecialty physicians who are identified in need by peer review. J Contin Educ Health Prof 2004;24(4):244-52
No original data, Does not apply

Nyquist J G, Naylor A J, Woodward-Lopez G et al. Use of performance-based assessment to evaluate the impact of a skill-oriented continuing education program. Acad Med 94;69(10 Suppl):S51-3
<15 trained physicians

O'Connor P J, Desai J, Solberg L I et al. Randomized trial of quality improvement intervention to improve diabetes care in primary care settings. Diabetes Care 2005;28(8):1890-7
PI or QI

O"Dowd T C, Sprackling P D. Continuing medical education in general practice. BMJ 89;298(6686):1472
No original data, Not US or Canada

Olson L, Anctil C, Fullerton L et al. Increasing emergency physician recognition of domestic violence. Ann Emerg Med 96;27(6):741-6
No comparison

Omori J, Jacobs J. Multimedia solutions in a problem-based learning curriculum. Hawaii Med J 2004;63(12):369-70
No original data, Does not apply

Osteen A M, Gannon M I. Continuing medical education. JAMA 88;260(8):1105-9
No original data

Oswald N T, Alderson T S. A core curriculum in general practice. Med Educ 97;31(5):352-3
Not US or Canada

Ota D, Loftin B, Saito T et al. Virtual reality in surgical education. Comput Biol Med 95;25(2):127-37
No original data

Pangaro L. Assessment and outcomes in medical education. Mil Med 2003;168(9 Suppl):21-6
No original data, No training, No evaluation

Panikkar J, Draycott T, Cook J. The evaluation of computer-aided learning in medicine. Postgrad. Med. J. 98;74(878):706-708
No original data

Parslow G R. Computer-based learning. Biochem. Educ. 99;27(3):159
No original data

Parzakonis J. Kidney Learning System: 21st century education. Nephrol News Issues 2004;18(8):49, 51
No original data, Does not apply

Pasternak Nancy, Stern Rau, Lou Ann L et al. From Chaos to Consistency: The Implementation of Wound Treatment TIERS in home care.. Home Health Care Management & Practice 2003;15(4):314-324
<15 trained physicians, No evaluation, Does not apply

Patil N G, Saing H, Wong J. Role of OSCE in evaluation of practical skills. Med. Teach. 2003;25(3):271-272
<15 trained physicians, Not US or Canada

Peters J H, Fried G M, Swanstrom L L et al. Development and validation of a comprehensive program of education and assessment of the basic fundamentals of laparoscopic surgery. Surgery 2004;135(1):21-7
<15 trained physicians, No evaluation, Does not apply

Physician training spreads people skills. Profiles Healthc Mark 92;(45):27
No original data, No evaluation

Pichert J W. Outcomes of a diabetes professional education seminar. Diabetes Educ 84;9(4):37-9
No comparison

Pinsky L, Robins L, benIzzy J. The story in medicine: skills for MDs. Med Educ 2004;38(11):1200-1
<15 trained physicians, No comparison

Portfolio-based learning in general practice. Report of a working group on higher professional education. Occas Pap R Coll Gen Pract 93;(63):1-22
Not US or Canada, Does not apply

Poses R M, Cebul R D, Wigton R S. You can lead a horse to water--improving physicians' knowledge of probabilities may not affect their decisions. Med Decis Making 95;15(1):65-75
<15 trained physicians

Preparing for the certification and recertification examination. J Am Board Fam Pract 2000;13(2):155-8
No original data, No evaluation

Price D W, Xu S, McClure D. Effect of CME on primary care and OB/GYN treatment of breast masses. J Contin Educ Health Prof 2005;25(4):240-7
No comparison

Purkis I E. Commitment for changes: an instrument for evaluating CME courses. J Med Educ 82;57(1):61-3
No original data, No comparison

Puterman M, Gorodischer R, Leiberman A. Tracheobronchial foreign bodies: the impact of a postgraduate educational program on diagnosis, morbidity, and treatment. Pediatrics 82;70(1):96-8
Not US or Canada

QI project improves patient outcomes. Hosp Peer Rev 2002;27(6):77-8
Abstract, No comparison, PI or QI

Raasch B A, Hays R, Buettner P G. An educational intervention to improve diagnosis and management of suspicious skin lesions. J Contin Educ Health Prof 2000;20(1):39-51
Not US or Canada

Ramamurthi B. Postgraduate course in general practice to improve primary level health care. J Indian Med Assoc 94;92(8):275-6
No original data, Not US or Canada, Does not apply

Randell D. E-learning for continuing education: exploring a new frontier. MLO Med Lab Obs 2001;33(8):24-8
No original data, No evaluation

Rappolt S, Pearce K, McEwen S et al. Exploring organizational characteristics associated with practice changes following a mentored online educational module. J Contin Educ Health Prof 2005;25(2):116-24
Does not apply, No comparison

Raskova J, Trelstad R L. Replacing lectures with reading, small-group discussion, and computer-assisted learning. Acad Med 96;71(5):537-8
<15 trained physicians

Raub A C, Bowler F L, Escovitz G H. A physician retraining program. Assessment update. JAMA 82;248(22):2994-8
No comparison

Razavi D, Merckaert I, Marchal S et al. How to optimize physicians' communication skills in cancer care: results of a randomized study assessing the usefulness of posttraining consolidation workshops. J Clin Oncol 2003;21(16):3141-9
Not US or Canada

Razavi Darius, Delvaux Nicole, Farvacques Christine et al. Brief psychological training for health care professionals dealing with cancer patients: A one-year assessment.. General Hospital Psychiatry 91;13(4):253-260
<15 trained physicians, Not US or Canada

Razavi Darius, Delvaux Nicole, Farvacques Christine et al. Immediate effectiveness of brief psychological training for health professionals dealing with terminally ill cancer patients: A controlled study.. Social Science & Medicine 88;27(4):369-375
<15 trained physicians, Not US or Canada

Reeves S. A joint learning venture between new nurses and junior doctors.. Nurs Times 2000;96(38):39-40
<15 trained physicians, Not US or Canada

Regan C, Regan B. Teaching dermatology in general practice: The potential of digital cameras and information technology. Educ. Gen. Pract. 2000;11(2):193-197
No original data, No evaluation

Reid D S, Weaver L E, Sargeant J M et al. Telemedicine in Nova Scotia: report of a pilot study. Telemed J 98;4(3):249-58
No comparison

Reintgen D, Cruse C W, Wells K et al. The effectiveness of skin cancer screening and continuing medical education programs toward increasing the survival of patients with malignant melanoma. Surg Oncol 92;1(6):379-84
No training

Requirements for infection control education and practice compliance established for physicians and other healthcare workers in Minnesota. Infect Control Hosp Epidemiol 93;14(8):503
No original data, No training

Ricci M A, Caputo M P, Callas P W et al. The use of telemedicine for delivering continuing medical education in rural communities. Telemed J E Health 2005;11(2):124-9
No comparison

Richmond R, Mendelsohn C, Kehoe L. Family physicians' utilization of a brief smoking cessation program following reinforcement contact after training: a randomized trial. Prev Med 98;27(1):77-83
Not US or Canada

Ricketts C, Price J, Chamberlain S. Interactive online assessment training for busy practitioners. Med Educ 2005;39(5):525-6
Not US or Canada

Riker R R, White B W. The effect of physician education on the rates of donation request and tissue donation. Transplantation 95;59(6):880-4
<15 trained physicians

Robbins J A. Training the primary care internist to provide care in skilled nursing facilities. J Med Educ 83;58(10):811-3
<15 trained physicians

Robinson G E, Stewart D E. A curriculum on physician-patient sexual misconduct and teacher-learner mistreatment. Part 1: Content.. Can Med Assoc J 96;154(5):643-649
No original data, Does not apply

Robinson K, Sutton S, von Gunten C F et al. Assessment of the Education for Physicians on End-of-Life Care (EPEC) Project. J Palliat Med 2004;7(5):637-45
No comparison

Robinson S, Lawson S. Evaluating the impact of Information Skills Training within primary care. Health Info Libr J 2005;22(1):63-5
Not US or Canada

Rodney W M, Ruggiero C. Outcomes following continuing medical education on flexible sigmoidoscopy. Fam Pract 87;4(4):306-10
No comparison

Roe M H. Short course updates physicians" microbiology skills. MLO Med Lab Obs 91;23(5):37-8, 40, 42-6
No evaluation, No comparison

Rogers J, Swee D, Vallario R. Role of case studies in evaluating medical problem solving. J. FAM. PRACT. 84;18(5):775-778
No original data

Rogers J, Swee D, Vallario R. Role of case studies in evaluating medical problem solving. J. FAM. PRACT. 84;18(5):775-778
Does not apply

Rolfsson G, Nordgren A, Bindzau S et al. Training and assessment of laparoscopic skills using a haptic simulator. Stud Health Technol Inform 2002;85409-11
No original data, No training, Not US or Canada

Rosch J, Hajek M, Svarz R et al. Interactive internet broadcasting of a complex educational interventional radiology symposium. J Vasc Interv Radiol 2003;14(7):833-6
Not US or Canada, No comparison

Rosen G M, Harris I, Mahowald M W. Objective structured clinical examinations (OSCE) for sleep. Sleep Med. 2005;6(1):75-80
<15 trained physicians

Rucker L, Morrison E. A longitudinal communication skills initiative for an academic health system. Med. Educ. 2001;35(11):1087-1088
<15 trained physicians, Not US or Canada, No comparison, Other

Rucker L, Morrison E. The "EBM Rx": an initial experience with an evidence-based learning prescription. Acad Med 2000;75(5):527-8
<15 trained physicians, Does not apply

Rutala P J, Fulginiti J V, McGeagh A M et al. Predictive validity of a required multidisciplinary standardized-patient examination. Acad Med 92;67(10 Suppl):S60-2
<15 trained physicians

Rutherford R B. Physicians in the vascular diagnostic laboratory: educational background, prerequisite skills, credentialing, and continuing medical education. Semin Vasc Surg 94;7(4):217-22
No original data, Does not apply

Ryan C A, Finer N N. Changing attitudes and practices regarding local analgesia for newborn circumcision. Pediatrics 94;94(2 Pt 1):230-3
No comparison

Sanci L A, Day N A, Coffey C M M et al. Simulations in evaluation of training: A medical example using standardised patients.. Evaluation and Program Planning 2002;25(1):35-46
Not US or Canada

Sanders M R, Tully L A, Turner K M et al. Training GPs in parent consultation skills. An evaluation of training for the Triple P-Positive Parenting Program. Aust Fam Physician 2003;32(9):763-8
Not US or Canada

Sandlow L J, Bashook P G, Maxwell J A. Medical care evaluation: an experience in continuing medical education. J Med Educ 81;56(7):580-6
Does not apply

Sandrick K. Effective online CME: it"s only a matter of time. Bull Am Coll Surg 2000;85(4):33-6
No original data

Sandrick K. Effective online CME: it"s only a matter of time. Bull Am Coll Surg 2000;85(4):33-6
No evaluation

Sargeant J M, Purdy R A, Allen M J et al. Evaluation of a CME problem-based learning internet discussion. Acad Med 2000;75(10 Suppl):S50-2
No comparison

Savatsky P D, Haitz M C, Sterns N S. Patterns of continuing medical education: a generation unit analysis of physicians in three community hospitals. Soc Sci Med [A] 81;15(5):665-72
No training, Does not apply

Schatzki S C. The art of learning medicine. AJR Am J Roentgenol 92;158(3):518
No original data, No evaluation

Schectman J M, Schorling J B, Nadkarni M M et al. Can prescription refill feedback to physicians improve patient adherence?. Am J Med Sci 2004;327(1):19-24
<15 trained physicians

Scherer L A, Chang M C, Meredith J W et al. Videotape review leads to rapid and sustained learning. Am J Surg 2003;185(6):516-20
<15 trained physicians

Schoenknecht H. How to use humor to help educate physicians in necessary PPS skills. Hosp Top 85;63(6):30-1, 38-9
No original data, Does not apply

Schramm M, Gollnick H. Continuous education for acne--basics, pathogenesis, differential diagnosis, clinic and therapy. Development of an interactive hypermedia application on CD-ROM for computer-based learning and instruction. Dermatology 98;196(1):100-1
No evaluation

Schroeder S A, Myers L P, McPhee S J et al. The failure of physician education as a cost containment strategy. Report of a prospective controlled trial at a university hospital. JAMA 84;252(2):225-30
<15 trained physicians

Schroeder S A. Strategies for reducing medical costs by changing physicians" behavior: efficacy and impact on quality of care. Int J Technol Assess Health Care 87;3(1):39-50
No original data

Schwid HA, Rooke GA, Ross BK et al. Use of a computerized advanced cardiac life support simulator improves retention of advanced cardiac life support guidelines better than a textbook review.. Critical care medicine. 99;27(4):821-4
<15 trained physicians

Schwiebert L, Peter Davis, Alan. Impact of Feedback on Teaching by Volunteer Faculty in a Third-Year Family Medicine Clerkship.. 93;(4Clinical Experience/Family Practice (Medicine)/Feedback/Medical Education/Supervision/Volunteer Training/Higher Education/Instructional Improvement/Physicians/Professional Education/Volunteers):
<15 trained physicians

Seale J P, Shellenberger S, Boltri J M et al. Effects of screening and brief intervention training on resident and faculty alcohol intervention behaviours: a pre- post-intervention assessment. BMC Fam Pract 2005;646
<15 trained physicians, No comparison

Searle J, Grover S, Santin A et al. Randomised trial of an integrated educational strategy to reduce investigation rates in young women with dysfunctional uterine bleeding. Aust N Z J Obstet Gynaecol 2002;42(4):395-400
Not US or Canada

Sedlack R E, Petersen B T, Kolars J C. The impact of a hands-on ERCP workshop on clinical practice. Gastrointest Endosc 2005;61(1):67-71
No comparison

See W A, Cooper C S, Fisher R J. Predictors of laparoscopic complications after formal training in laparoscopic surgery. JAMA 93;270(22):2689-92
No evaluation

Shade S D, Barber G M. When and where you want it: continuing education from a distance. Gerontol Geriatr Educ 2004;24(4):95-114
No comparison

Shain R N, Crouch S H, Weinberg P C. Evaluation of the gynecology teaching associate versus pelvic model approach to teaching pelvic examination. J. MED. EDUC. 82;57(8):646-647
<15 trained physicians

Shakespeare T P, Mukherjee R K, Lu J J et al. Evaluation of an audit with feedback continuing medical education program for radiation oncologists. J Cancer Educ 2005;20(4):216-21
<15 trained physicians, Not US or Canada

Shannon S. Facilitating learning groups in CME. Lancet 2004;363(9411):826
No original data, No training

Shannon S. Needs assessment for CME. Lancet 2003;361(9361):974
No original data, No evaluation

Shannon S. Practice-based CME. Lancet 2003;361(9357):618
No original data, No evaluation

Shapiro M J, Morey J C, Small S D et al. Simulation based teamwork training for emergency department staff: does it improve clinical team performance when added to an existing didactic teamwork curriculum?. Qual Saf Health Care 2004;13(6):417-21
<15 trained physicians

Shapiro S L, Schwartz G E. Mindfulness in medical education: Fostering the health of physicians and medical practice. Integr. Med. 98;1(3):93-94
No original data, <15 trained physicians

Shifman L, Scott C S, Fawcett N et al. Utilizing a game for both needs assessment and learning in adolescent sexuality education. Soc Work Groups 86;9(2):41-56
<15 trained physicians, Does not apply

Shunk R. A cardiac physical examination curriculum.. Acad Med 2000;75(5):552-553
<15 trained physicians

Simpson D E, Ullian J A. Curriculum design and evaluation in faculty development. Fam Med 97;29(4):251
No original data, Does not apply

Singh N P, Gupta S. Objective structured clinical examination.. J Assoc Physicians India 98;46(7):645-652
No original data, Does not apply

Skeff K M, Campbell M, Stratos G. Assessment by attending physicians of a seminar method to improve clinical teaching. J. MED. EDUC. 84;59(12):944-950
Other

Skeff K M, Stratos G, Campbell M et al. Evaluation of the seminar method to improve clinical teaching. J Gen Intern Med 86;1(5):315-22
Does not apply, Other

Sliwa J A, Makoul G, Betts H. Rehabilitation-specific communication skills training: improving the physician-patient relationship. Am J Phys Med Rehabil 2002;81(2):126-32
<15 trained physicians, No comparison

Sloan R E, McMillan J. Developing mentoring skills for general practitioners using a simulated doctor. Med Educ 2003;37(11):1044-5
Not US or Canada

Sloan R E, McMillan J. Developing mentoring skills for general practitioners using a simulated doctor. Med Educ 2003;37(11):1044-5
<15 trained physicians

Smedley R R. Analyzing the questions of physicians participating in CME programs. Acad Med 97;72(5):456
No evaluation, Does not apply

Smith W D, Berguer R. A simple virtual instrument to monitor surgeons' workload while they perform minimally invasive surgery tasks. Stud Health Technol Inform 2004;98363-9
No training, Does not apply

Smits P B A, Verbeek J H A M, De Buisonje C D. Problem based learning in continuing medical education: A review of controlled evaluation studies. Br. Med. J. 2002;324(7330):153-156
No original data, Not US or Canada, Not US or Canada

Solomon D, Townley P, Dunn K. A distance-learning program for telemedicine presenters. Acad Med 98;73(5):612-3
No evaluation, Does not apply

Sommers L S, Marton K I. The curriculum template: creating continuing medical education curricula for physicians in practice in managed care settings. West J Med 2000;173(5):337-40
No evaluation, Does not apply

Soumerai S B, McLaughlin T J, Gurwitz J H et al. Effect of local medical opinion leaders on quality of care for acute myocardial infarction: a randomized controlled trial. JAMA 98;279(17):1358-63
<15 trained physicians, No comparison, PI or QI

Stammer L. Take-out training. E-learning on the menu can improve the bottom line. Healthc Inform 2001;18(8):19-22, 24
No original data, No evaluation

Steginga S K, Pinnock C, Baade P D et al. An educational workshop on the early detection of prostate cancer--a before-after evaluation. Aust Fam Physician 2005;34(10):889-91
Not US or Canada, No comparison

Stein M R, Parish S J, Arnsten J H. The OSCE as a formative evaluation tool for substance abuse teaching.. Med Educ 2005;39(5):529-530
<15 trained physicians

Steinert Y, Nasmith L, Daigle N. Executive skills for medical faculty: a workshop description and evaluation. Med Teach 2003;25(6):666-8
No comparison

Stevenson G W, Cockshott W P. Continuing medical education and assessment of radiologists. Clin Radiol 88;39(6):575-7
No original data, No evaluation

Straus S E, Ball C, Balcombe N et al. Teaching evidence-based medicine skills can change practice in a community hospital. J Gen Intern Med 2005;20(4):340-3
Not US or Canada, No comparison

Stross J K, Hiss R G, Watts C M et al. Continuing education in pulmonary disease for primary-care physicians. Am Rev Respir Dis 83;127(6):739-46
No comparison

Sullivan S D, Lee T A, Blough D K et al. A multisite randomized trial of the effects of physician education and organizational change in chronic asthma care: cost-effectiveness analysis of the Pediatric Asthma Care Patient Outcomes Research Team II (PAC-PORT II). Arch Pediatr Adolesc Med 2005;159(5):428-34
No evaluation, Does not apply

Sullivan S, Lee T, Blough D et al. Cost-effectiveness of physician peer leader education and practice-based redesign in managed care: the pediatric asthma care PORT-II trial [Abstract]. The Journal of allergy and clinical immunology. 2004;113(2 Suppl):S339
Abstract

Swiggart W, Spickard A, Dodd D T. Lessons learned from a CME course in the proper prescribing of controlled drugs. Tenn Med 2002;95(5):192-3
No evaluation, Does not apply

Symposium: Improving clinical performance assessment: a multi-institutional trial of the OSCE (objective structured clinical examination).. Proc Annu Conf Res Med Educ 87;26(-):267-274
No original data, <15 trained physicians

Szonyi G, Millard R J. Controlled trial evaluation of a General Practitioner education package on incontinence: use of a mailed questionnaire. Br J Urol 94;73(6):615-20
Not US or Canada

Taffinder N, Sutton C, Fishwick R J et al. Validation of virtual reality to teach and assess psychomotor skills in laparoscopic surgery: results from randomised controlled studies using the MIST VR laparoscopic simulator. Stud Health Technol Inform 98;50124-30
<15 trained physicians, Not US or Canada

Teshima D Y, Sekiguchi L. Collaborating with a problem-based learning physician curriculum. CLIN. LAB. SCI. 93;6(5):274-275
<15 trained physicians

The endocrinologist CME examination: July/August 2005. Endocrinologist 2005;15(4):249-251
No original data, No evaluation, Does not apply

Thomas Craig W, Guy Sybille M, Ogilvie Larry P. An evaluation of a practitioner training program designed to assist families of people with severe psychiatric disorders.. Psychiatric Rehabilitation Journal 99;23(1):34-41
<15 trained physicians, Not US or Canada, No comparison

Thompson R S, Michnich M E, Friedlander L et al. Effectiveness of smoking cessation interventions integrated into primary care practice. Med Care 88;26(1):62-76
Does not apply, Other

Tinterow M M. Mandatory CME: an assessment by the Kansas medical profession. J Kans Med Soc 82;83(6):295-8
No evaluation, Does not apply

Townsend R N, Clark R, Ramenofsky M L et al. ATLS-based videotape trauma resuscitation review: education and outcome. J Trauma 93;34(1):133-8
<15 trained physicians

Training and assessment of competence. Surg Endosc 94;8(6):721-2
No original data, Not US or Canada, Does not apply

Trowbridge Randall, Dugan William, Jay Stephen J et al. Determining the effectiveness of a clinical-practice intervention in improving the control of pain in outpatients with cancer.. Academic Medicine 97;72(9):798-800
<15 trained physicians

Ultrasound Quarterly CME Examination December 2005: Postmark Deadline: November 30, 2006. Ultrasound Q 2005;21(4):309-314
No human data, No original data, Does not apply, No comparison

Ultrasound quarterly CME examination September 2005. Ultrasound Q. 2005;21(3):207-208
No original data, Does not apply

Umble K E, Cervero R M, Yang B et al. Effects of traditional classroom and distance continuing education: a theory-driven evaluation of a vaccine-preventable diseases course. Am J Public Health 2000;90(8):1218-24
<15 trained physicians

Use physician education to cut prescription drug costs. Capitation Manag Rep 99;6(7):100-3, 97
No comparison, Other

Vacek J L. Practice-based continuing education combined with process improvement methods improves delivery of preventive services to children. Evid.-Based Healthc. 2004;8(4):177-179
Other

Valdiserri R O, Koziol S M, Korth W W et al. A workshop to improve the teaching skills of physician faculty members. J. MED. EDUC. 86;61(6):469-471
No comparison

van Dulmen A M, Holl R A. Effects of continuing paediatric education in interpersonal communication skills. Eur J Pediatr 2000;159(7):489-95
Not US or Canada

van Olden G D, Meeuwis J D, Bolhuis H W et al. Clinical impact of advanced trauma life support. Am J Emerg Med 2004;22(7):522-5
Not US or Canada

van Os T W, van den, Brink R H et al. Are effects of depression management training for General Practitioners on patient outcomes mediated by improvements in the process of care?. J Affect Disord 2004;80(2-3):173-9
Not US or Canada

Vanchieri C. Virtual reality: will practice make perfect?. J Natl Cancer Inst 99;91(3):207-9
No original data

Vaughan W P, Morlock L L, Lenhard R E et al. Demonstration of the effectiveness of the professional education component of a comprehensive cancer control project using serial "patterns of care" (POC) studies. Prog Clin Biol Res 83;130425-32
No original data, PI or QI

Vegni E, Moja E A. Effects of a course on ophthalmologist communication skills: a pilot study. Educ Health (Abingdon) 2004;17(2):163-71
Not US or Canada

Verstappen W H, van der, Weijden T et al. Improving test ordering in primary care: the added value of a small-group quality improvement strategy compared with classic feedback only. Ann Fam Med 2004;2(6):569-75
Not US or Canada

Walker D E, Balvert L. A practical program to maintain neonatal resuscitation skills. CMAJ 94;151(3):299-304
No original data, <15 trained physicians, No evaluation

Wallace R K, Ford A B, Wallace R W. Geriatric medical education: a project in faculty development. J Am Geriatr Soc 83;31(2):106-8
No evaluation, No comparison

Walsh P L. An assessment of an operational educational accountability system for continuing education in the health professions. Mobius 82;2(4):28-38
No original data, No evaluation

Ward R, Fidler H, Lockyer J et al. Physician outcomes and implications for planning an intensive educational experience on attention-deficit hyperactivity disorder. Acad Med 99;74(10 Suppl):S31-3
No comparison

Warren D K, Zack J E, Mayfield J L et al. The effect of an education program on the incidence of central venous catheter-associated bloodstream infection in a medical ICU. Chest 2004;126(5):1612-8
No comparison, Other

Watts M S. CEHP (continuing education in the health professions)--a new discipline rooted in the practice?. J Contin Educ Health Prof 89;9(1):61-5
No original data, No evaluation

Waxman H S, Kimball H R. Assessing continuing medical education. Am J Med 99;107(1):1-4
No original data

Weir E, Stieb D M, Abelsohn A et al. Design, delivery and evaluation of an email-based continuing professional development course on outdoor air pollution and health. Med Teach 2004;26(2):166-73
No comparison

Weiss K B, Lozano P, Finkelstein J A et al. A randomized controlled clinical trial to improve asthma care for children through provider education and health systems change: A description of the pediatric asthma care patient outcome research team (PAC-PORT II) study design. Health Serv. Outcomes Res. Methodol. 2003;4(4):265-282
No original data, Other

Weller J, Dowell A, Kljakovic M et al. Simulation training for medical emergencies in general practice. Med Educ 2005;39(11):1154
<15 trained physicians, Not US or Canada, No comparison, PI or QI

Wells K, Sherbourne C, Duan N et al. Quality improvement for depression in primary care: do patients with subthreshold depression benefit in the long run?. Am J Psychiatry 2005;162(6):1149-57
<15 trained physicians, No comparison

Wenzel R P. The development of academic programs for quality assessment. Arch Intern Med 91;151(4):653-4
No original data

West R F. A construct validity study of Kolb"s learning style types in medical education. J Med Educ 82;57(10 Pt 1):794-6
<15 trained physicians, Does not apply

Westerhoff K, McCarthy W H, Menzies S W. Increase in the sensitivity for melanoma diagnosis by primary care physicians using skin surface microscopy. Br J Dermatol 2000;143(5):1016-20
Not US or Canada

Wexler R. Open learning. Pointing the way. Nurs Times 91;87(13):32-3
<15 trained physicians, Does not apply

White B D, Zaner R M. Clinical ethics training for staff physicians: designing and evaluating a model program. J Clin Ethics 93;4(3):229-35
No comparison

White M I, Grzybowski S, Broudo M. Commitment to change instrument enhances program planning, implementation, and evaluation. J Contin Educ Health Prof 2004;24(3):153-62
Does not apply, No comparison

White M K, Malik T. Teaching clinician-patient communication in the treatment of breast diseases. J Womens Health 99;8(1):39-44
<15 trained physicians

Whitman N, Magill M K. Is attending a teaching skills workshop worth your time?. Fam Med 98;30(4):255-6
No evaluation, No comparison

Whittle S R, Murdoch-Eaton D G. Development of lifelong learning and self-evaluation skills through special study modules. Med Educ 2001;35(11):1073-4
<15 trained physicians, Not US or Canada

Wilkes M, Bligh J. Evaluating educational interventions. BMJ 99;318(7193):1269-72
No original data

Williams B C, Woolliscroft J O, Heindel J E. A managed care curriculum implemented across four academic departments using mandated evaluation instruments.. Acad Med 99;74(5):604-605
<15 trained physicians, No evaluation

Williams M Q, Olson S. Teaching critical thinking skills through visual formats. CLIN. LAB. SCI. 92;5(6):360-365
No original data, Does not apply

Winston I, Szarek J L. Problem-based learning using a human patient simulator.. Med Educ 2005;39(5):526-527
<15 trained physicians

Wirtschafter D D, Sumners J, Jackson J R et al. Continuing medical education using clinical algorithms. A controlled-trial assessment of effect on neonatal care. Am J Dis Child 86;140(8):791-7
<15 trained physicians

Wolters R, Wensing M, Klomp M et al. Effects of distance learning on clinical management of LUTS in primary care: a randomised trial. Patient Educ Couns 2005;59(2):212-8
Not US or Canada

Worley P, March R, Worley E. Scanning the horizon of training for general practice. Med. Teach. 2000;22(5):452-455
No original data

Wright F C, Law C H, Last L D et al. A blended knowledge translation initiative to improve colorectal cancer staging. BMC Health Serv Res 2006;6(1):4
No evaluation, Other

Yanoff J M, Leedy R F, Seitchik M et al. A model for training family practice preceptors. J Med Educ 82;57(10 Pt 1):809
No evaluation, Does not apply

Yens D P, Peters J T, Stimmel B et al. Evaluation of an innovative self-instructional program in the surgical subspecialties.. Proc Annu Conf Res Med Educ 84;23(-):105-110
<15 trained physicians

Yentis S M. The use of patients for learning and maintaining practical skills. J R Soc Med 2005;98(7):299-302
No training, No evaluation, Does not apply

Young J M, Ward J. Can distance learning improve smoking cessation advice in family practice? A randomized trial. J Contin Educ Health Prof 2002;22(2):84-93
Not US or Canada

Youngblood P, Stringer J, Moreno E. Development and formative evaluation of a longitudinal web-based nutrition curriculum. Acad Med 2000;75(5):540-1
<15 trained physicians, Does not apply

Zak R. Continuing medical education. Interactive technology enhances instruction for both teacher and learner. Healthc Inform 2004;21(7):40
No original data, No training, No evaluation, Does not apply

Zaza C, Sellick S. Assessing the impact of evidence-based continuing education on nonpharmacologic management of cancer pain. J Cancer Educ 99;14(3):164-7
No comparison, Other

Zebrack J R, Anderson R C, Torre D. Enhancing EBM skills using goal setting and peer teaching.. Med Educ 2005;39(5):513-514
<15 trained physicians

Zhang H, Payandeh S, Dill J et al. Acquiring laparoscopic manipulative skills: a virtual tissue dissection training module. Stud Health Technol Inform 2004;98419-21
No original data, No original data

Zwar N A, Gordon J J, Sanson-Fisher R W. Evaluation of an educational program in rational prescribing for GP trainees. Aust Fam Physician 95;24(5):833-8
<15 trained physicians, Not US or Canada

Zwar N, Henderson J, Britt H et al. Influencing antibiotic prescribing by prescriber feedback and management guidelines: a 5-year follow-up. Fam Pract 2002;19(1):12-7
Not US or Canada

Previewing Only: You cannot submit data from this form

Previewing at Level 2

Refid: 1, Fernandez, I. and Frenking, G., Direct Estimate of the Strength of Conjugation and Hyperconjugation by the Energy Decomposition Analysis Method, *Chemistry*, 2006
State: Excluded, Level: 1

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For articles with refid<100000, please answer Q1 or Q2. Otherwise, skip to Q3.

1. QUESTION 1.
Do not review article because article **(check 1 or more)**:

- ☐ Not in **English**
- ☐ Does not include **human** data
- ☐ No **original** data and does **not** apply to KQ3
- ☐ No **original** data, but **may apply** to KQ3
- ☐ Meeting **abstract** (no full article for review)
- ☐ Does not include **at least 15 fully trained physicians** (includes only medical students or physicians-in-training, other non-physician providers, or patients)
- ☐ Does not include **training or education**
- ☐ No **evaluation** of an educational activity
- ☐ Published prior to **1981**
- ☐ Not conducted in **US or Canada** (and no other exclusion criteria apply)
- ☐ **Does not apply** to a key question
- ☐ Evaluation does not include data from a **concurrent or historical comparison group**
- ☐ **Other** (please specify):
- ☐ **Unclear**: retrieve article to decide

2. QUESTION 2.
Article relates to Key Question **(check all that apply):**

- ☐ Effectiveness of a method of CME (KQ1)
- ☐ Retention of effectiveness of CME over time (KQ2)
- ☐ Characteristics of the audience (KQ4)
- ☐ External factors (KQ5)

For articles with refid>100000, please answer Q3 or Q4. Note: Q3 and Q4 applies only to KQ3.

3. QUESTION 3.
Do not review article because article **(check 1 or more)**:

- ☐ Not in **English**
- ☐ Does not include **human** data
- ☐ Not a **systematic review** (i.e., identifies a question, describes a search strategy, describes eligibility criteria, AND synthesizes results either quantitatively or qualitatively)
- ☐ Meeting **abstract** (no full article for review)

☐ Does not include **medical students or physicians-in-training** (the review could also include other health professionals so long as medical students or physicians-in-training are included as well)

☐ Does not include **medical training** or **education**

☐ No **evaluation** of an educational activity

☐ Does not involve **simulation, virtual reality, manikins, or standardized patients**

☐ Published prior to **1990**

☐ **Does not apply** to KQ3 (effectiveness of simulation methods in medical education)

☐ Only includes **fully trained physicians or CME** but could apply to the other key questions

☐ **Other** (please specify:)

☐ **Unclear**: retrieve article to decide

4. QUESTION 4.
Article relates to Key Question **(check all that apply):**

☐ Effectiveness of simulation methods in medical education (KQ3)

☐ May not apply to KQ3, but could apply to the other key questions

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Previewing at Level 9

Refid: 1, Fernandez, I. and Frenking, G., Direct Estimate of the Strength of Conjugation and Hyperconjugation by the Energy Decomposition Analysis Method, *Chemistry*, 2006
State: Excluded, Level: 1

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Reporting of Adult Learning Principles (formerly known as Quality of CME Activity Form)

Please complete this form for ALL included articles. Please complete this form independently.

1. To what extent does the curriculum enable learners to be active contributors to their learning?

- Good (Two or more of the following: leaners identify/choose a question OR actively contribute to finding the answer OR teach the results of their learning to others)
- Fair (Only one of the above OR none of the above but the curriculum employed partially active learning methods such as interactive lectures or group discussions)
- Poor (None of the above are described)

Clear Selection

2. To what extent does the curriculum relate to learners' current work or life experiences?

- Good (Learners would recognize the curriculum as having practical or immediate value to their work or lives)
- Fair (Learners would recognize the curriculum as having theoretical or future value to their work or lives)
- Poor (Learning addresses an issue that the learners do not recognize as having value to their work or lives OR the curriculum's relevance to the learners is not clear)

Clear Selection

3. To what extent is the curriculum tailored to learners' current or past experiences?

- Good (Authors describe a needs assessment AND describe how the curriculum is tailored towards the needs of the learners)
- Fair (Authors describe only one of the above)
- Poor (Authors NEITHER describe a needs assessment NOR do they describe how the curriculum is tailored towards the needs of learners)

Clear Selection

4. To what extent does the curriculum allow learners to identify their own learning goals and direct their education?

- Good (Learners received complete freedom to pursue independent studies or projects during part or all of the curriculum)
- Fair (Learners may choose from a range of learning methods or projects, but the range is limited)
- Poor (Learners are limited to a single curriculum plan OR not described)

Clear Selection

5. To what extent does the curriculum allow learners to practice what they learn?

- Good (Learners engage in applied or simulated activities during at least 50% of curriculum time)
- Fair (Learners engage in applied or simulated activities during <50% of curriculum time)
- Poor (The curriculum does not provide opportunities for practicing knowledge or skills OR not described)

Clear Selection

6. To what extent does the curriculum provide support to self-directed learners?

- Good (Curriculum specifically allots faculty time/resources for supporting learners during independent learning of projects)
- Fair (Curriculum provides only self-learning materials (e.g., online library or bulletin boards) OR faculty are available for but not dedicated to supporting self-directed learning)

Poor (Curriculum provides none of the above OR not described)

Clear Selection

7. To what extent do learners receive feedback from teachers and/or peers during active learning?

Good (Curriculum includes mechanisms for providing formative AND summative feedback to learners

Fair (Curriculum only includes mechanisms for providing one of the above)

Poor (Feedback to learners is not provided OR is not described)

Clear Selection

For the purpose of our review:

Formative feedback is defined as feedback that is intended to help learners adjust their learning or activities *prior to completion of the curriculum*.

Summative feedback is defined as feedback intended to inform learners of their progress *upon completion of the curriculum*.

For example, feedback on a QI project that is provided to learners at the end of a curricular program will be considered summative feedback, even if the learners use this feedback to modify their project on their own after the curriculum.

8. To what extent does the curriculum allow learners to reflect on their learning?

Good (Curriculum describes mechanisms that are specifically intended to help learners reflect on their learning. These may include structured reflection time and debriefing meetings or presentations that are intended for self-reflection)

Fair (Curriculum describes learning sessions, such as debriefing meetings or summary presentations, which are not specifically intended for reflection on learning but are likely to involve some reflection by learners)

Poor (Opportunities for self-reflection are not included in the curriculum OR are not described)

Clear Selection

9. To what extent can learners observe the faculty role-model behaviors?

Good (Learners observe role models actually practicing goal behavior in clinical settings)

Fair (Learners observe role models in simulated settings)

Poor (Role modeling is not used OR is not described)

Clear Selection

10. Comments:

Enlarge Shrink

11. Reviewed by:

Enlarge Shrink

Save to finish later | Submit Data

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Previewing at Level 3

Refid: 1, Fernandez, I. and Frenking, G., Direct Estimate of the Strength of Conjugation and Hyperconjugation by the Energy Decomposition Analysis Method, *Chemistry*, 2006
State: Excluded, Level: 1

Save to finish later | Submit Data

For articles with refid<100000, please answer Q1 or Q2. Otherwise, skip to Q3.

1. QUESTION 1.
Do not review article because article **(check 1 or more)**:

- ☐ Not in **English**
- ☐ Does not include **human** data
- ☐ No **original** data and does **not** apply to KQ3
- ☐ No **original** data, but **may apply** to KQ3
- ☐ Meeting **abstract** (no full article for review)
- ☐ Does not include **at least 15 fully trained physicians** (includes only medical students or physicians-in-training, other non-physician providers, or patients) OR less than 50% of the CME participants were fully trained physicians or there was not a separate analysis for fully trained physicians
- ☐ Does not include **training or education**
- ☐ No **evaluation** of an educational activity
- ☐ Published prior to **1981**
- ☐ Not conducted in **US or Canada** (and no other exclusion criteria apply)
- ☐ **Does not apply** to a key question
- ☐ Evaluation does not include data from a **concurrent or historical comparison group**
- ☐ Involves **practice improvement or quality improvement**
- ☐ **Other** (please specify):
- ☐ **Unclear**: retrieve article to decide

2. QUESTION 2.
Article relates to Key Question **(check all that apply):**

- ☐ Effectiveness of a method of CME (KQ1)
- ☐ Retention of effectiveness of CME over time (KQ2)
- ☐ Characteristics of the audience (KQ4)
- ☐ External factors (KQ5)

For articles with refid>100000, please answer Q3 or Q4. Note: Q3 and Q4 applies only to KQ3.

3. QUESTION 3.
Do not review article because article **(check 1 or more)**:

- ☐ Not in **English**
- ☐ Does not include **human** data
- ☐ Not a **systematic review** (i.e., identifies a question, describes a search strategy, describes eligibility criteria, AND synthesizes results either quantitatively or qualitatively)

- [ ] Meeting **abstract** (no full article for review)
- [ ] Does not include **medical students or physicians-in-training** (the review could also include other health professionals so long as medical students or physicians-in-training are included as well)
- [ ] Does not include **medical training** or **education**
- [ ] No **evaluation** of an educational activity
- [ ] Does not involve **simulation, virtual reality, manikins, or standardized patients**
- [ ] Published prior to **1990**
- [ ] **Does not apply** to KQ3 (effectiveness of simulation methods in medical education)
- [ ] Only includes **fully trained physicians or CME** but could apply to the other key questions
- [ ] Does not report **separately on the effects of simulation**
- [ ] **Other** (please specify:)
- [ ] **Unclear**: retrieve article to decide

4. QUESTION 4.
Article relates to Key Question **(check all that apply):**

- [ ] Effectiveness of simulation methods in medical education (KQ3)
- [ ] May not apply to KQ3, but could apply to the other key questions

Save to finish later | Submit Data

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Previewing at Level 10

Refid: 1, Fernandez, I. and Frenking, G., Direct Estimate of the Strength of Conjugation and Hyperconjugation by the Energy Decomposition Analysis Method, *Chemistry*, 2006
State: Excluded, Level: 1

KQ4&5 Form

Save to finish later | Submit Data

KQ 4 & 5 Outcomes Form

Audience Characteristics & External Factors Analysis

Please complete this form for ALL included articles.

1. Was an analysis performed to examine which audience characteristics (e.g., age, gender, specialty) or external factors (e.g., regulatory factors, incentives, audits) by themselves or in combination influence the effectiveness of certain educational techniques? (Check all that apply.)

- [ ] Audience characteristics (Continue)
- [ ] External factors (Continue)
- [ ] Neither (Please do NOT fill out remainder of form. Hit Submit.)

2. Was a primary goal of the study or was a subgroup analysis performed to examine which **audience characteristics** by themselves or in combination influence the effectiveness of certain educational techniques?

- ( ) Yes
- ( ) No

Clear Selection

3. Was a primary goal of the study or was a subgroup analysis performed to examine which **external factors** by themselves or in combination reinforce the effects of CME in changing behavior?

- ( ) Yes
- ( ) No

Clear Selection

4. Was the data adjusted for: (Check all that apply)

- [ ] Age
- [ ] Gender
- [ ] Practice setting
- [ ] Years in practice
- [ ] Personal motivation
- [ ] Specialty
- [ ] Non-monetary rewards/motivations
- [ ] Learning satisfaction
- [ ] Knowledge enhancement
- [ ] Years from medical school graduation
- [ ] Foreign medical graduate vs. US graduate
- [ ] Country of practice

- [ ] Regulation
- [ ] State licensing board
- [ ] Professional boards
- [ ] Hospital credentialing
- [ ] External audits
- [ ] Monetary/financial rewards
- [ ] Academic advancement
- [ ] Provision of tools
- [ ] Public demand/patient expectations
- [ ] Other (specify:)
- [ ] Other (specify:)
- [ ] Other (specify:)
- [ ] Other (specify:)
- [ ] Other (specify:)
- [ ] Other (specify:)
- [ ] Other (specify:)
- [ ] Other (specify:)
- [ ] Other (specify:)

5. What outcome is being reported?

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What were the individual audience characteristics or external factors analyzed by the study?

Audience Characteristic or External Factor	Qualitatively summarize the results.
6. (Check all that apply) ☐ Age ☐ Gender ☐ Practice setting ☐ Years in practice ☐ Personal motivation ☐ Specialty ☐ Non-monetary rewards/motivations ☐ Learning satisfaction ☐ Knowledge enhancement ☐ Years from medical school graduation ☐ Foreign medical graduate vs. US graduate ☐ Country of practice ☐ Regulation	7. Enlarge Shrink

- [ ] State licensing board
- [ ] Professional boards
- [ ] Hospital credentialing
- [ ] External audits
- [ ] Monetary/financial rewards
- [ ] Academic advancement
- [ ] Provision of tools
- [ ] Public demand/patient expectations
- [ ] Other (specify:)
- [ ] Other (specify:)
- [ ] Other (specify:)
- [ ] Other (specify:)

8. Comments:

Enlarge Shrink

Thanks!

9. Reviewed by:

Enlarge Shrink

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Previewing Only: You cannot submit data from this form

Previewing at Level 4

Refid: 1, Fernandez, I. and Frenking, G., Direct Estimate of the Strength of Conjugation and Hyperconjugation by the Energy Decomposition Analysis Method, *Chemistry*, 2006
State: Excluded, Level: 1

General Form Part 1

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General Form Part 1

Please complete this form for ALL included articles.

1. **Type of educator teaching CME activity (check all that apply)**

- ☐ Academic (i.e., medical school faculty)
- ☐ Non-faculty physicians
- ☐ Industry (for-profit commercial entity) employee
- ☐ Employee of not-for-profit organization
- ☐ Health plan employee
- ☐ Government employee
- ☐ Other (specify):
- ☐ Not reported

Of all those who were in the study, how many and what percent were physicians who have completed medical training? (If reported by group, then record the range for N and percent.)

	N (If reported by total)	% (If reported by total)	N Range (If reported by group)	% Range (If reported by group)
2. Physicians who have completed medical training				

3. **Which of the following types of health care professionals also attended the CME activity? (Check all that apply)**

- ☐ Physicians-in-training (residents or fellows)
- ☐ Physician assistants
- ☐ Nurse practitioners
- ☐ Nurses
- ☐ Medical students
- ☐ Pharmacists
- ☐ Other (specify)
- ☐ Other (specify)
- ☐ Other (specify)
- ☐ Other (specify)
- ☐ Not reported
- ☐ None

Gender of health professional participating in the study. (If reported by group, then record the range for N and percent.)

	N (If reported by total)	% (If reported by total)	N Range (If reported by group)	% Range (If reported by group)
4. Male				
5. Female				

6. Not reported ☐

Age of learners attending CME activity (If reported by group, then record the range.)

	(If reported by total)	Range (If reported by group)
7. Mean age		

8. Age range

9. Not reported

10. **Specialty of learners in the study. (Check all that apply.)**

- Anesthesiology
- Emergency Medicine
- Family Medicine
- General Practice, not otherwise specified
- Internal Medicine
- Neurology
- Obstetrics and Gynecology
- Pediatrics
- Primary Care Physician, not otherwise specified
- Psychiatry
- Surgery
- Radiology
- Ophthalmology
- Pathology
- Other (specify):
- Not reported
- Not applicable

Please indicate how the time interval from medical training is recorded for the study participants and then enter the mean, range, or other measure in years. (If reported by group, then record the range.)

11.	12. If reported by total:	13. If reported by group:
learners' graduation from medical school	Mean	Mean
learners' completion of residency	Minimum of range	Minimum of range
learners' completion of fellowship	Maximum of range	Maximum of range
not reported	Other	Other
Clear Selection		

14. **How comparable were the study and control leaners? (Major factors include: sex, age/years in practice, profession/specialty, level of training, practice setting, and geographic region)**

- Learner groups were equivalent in all factors OR appropriate adjustments were made
- Learner groups have minor differences in one or more major factors
- Learner groups have large differences in one or more major factors
- Learner characteristics not reported OR no statistical comparisons were made
- Not applicable

Clear Selection

15. **Type of practice of learner (check all that apply)**

- University/medical school faculty
- Private practice
- Hospital staff
- Health plan
- Administrator
- Military/government (VA, Govt. agency, etc.)
- Other (specify)
- Not reported

Participation of learners in this intervention was driven by (Only check factors reported by the authors.)

16. **External factors**

- [ ] State licensing boards
- [ ] Professional boards
- [ ] Hospital credentialing
- [ ] External audits
- [ ] Academic advancement
- [ ] Public demand/patient expectations
- [ ] Quality improvement
- [ ] Other regulatory requirements
- [ ] Other (specify)
- [ ] Not reported

17. **Internal Factors**

- [ ] Monetary/financial gain
- [ ] Reputation enhancement
- [ ] Personal improvement (e.g., learning satisfaction or knowledge enhancement)
- [ ] Other (specify)
- [ ] Not reported

18. **Mark the physical setting(s) where the educational intervention took place. (Check all that apply.)**

- [ ] Home/personal
- [ ] Recreational/resort
- [ ] School/institution
- [ ] Practice setting
- [ ] Other (specify)
- [ ] Not reported
- [ ] Not linked to a physical setting

19. **Are there any external sponsors of the CME activity? (Check all that apply.)**

- [ ] Pharmaceutical industry
- [ ] Medical device industry
- [ ] Other industry (specify)
- [ ] Professional society
- [ ] Government
- [ ] Insurance industry/health plan
- [ ] Not reported

20. Comments:

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Thanks!

21. Reviewed by:

Enlarge Shrink

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Previewing at Level 5

Refid: 1, Fernandez, I. and Frenking, G., Direct Estimate of the Strength of Conjugation and Hyperconjugation by the Energy Decomposition Analysis Method, *Chemistry*, 2006
State: Excluded, Level: 1

General Form Part 2

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General Form Part 2

Please complete this form for ALL included articles.

READ THE INSTRUCTIONS PRIOR TO EACH QUESTION CAREFULLY.

1. **What was the lowest response rate for the evaluation method for the intervention or control arm among those targeted for the evaluation?**

- >=80%
- 60-79%
- 40-59%
- <40%
- Not reported

Clear Selection

2. **Which quantitative evaluation method was used? (Check all that apply.)**

- Participant questionnaire (self-assessment) or test
- Observer assessment
- Performance audit
- Patient assessment
- Other (specify)
- Not reported

3. **Was there a qualitative evaluation?**

- Yes
- No
- Not Reported

Clear Selection

If the evaluation involved a questionnaire or test, answer Q4, 5 and 6. Otherwise, skip to Q7.

4. How was it administered? (Check all that apply)	5. Did the questionnaire evaluate…? (Check all that apply)	6. What kind of response options was used?
Written Computer Oral Other (specify) Not reported	Satisfaction with curriculum Knowledge (self-reported) Knowledge (objective) Attitudes Skill (self-assessed) Behavior (self-assessed) Intent to change	Multiple-choice Dichotomous: e.g., yes/no, true/false Likert scale Open-ended Other (specify) Not reported

	behavior (self-assessed) ☐ Clinical outcomes (self-assessed) ☐ Other (specify:) ☐ Not Reported	

If the evaluation involved observer assessment, answer Q7, 8, and 9. Otherwise, skip to Q10.

7. **What was the skill assessed? (Check all that apply)**	8. **Who was observing? (Check all that apply)**	9. **With what format was the participant observed? (Check all that apply)**
☐ Use of informatics ☐ Procedural skills ☐ Communication skills ☐ Other (specify)	☐ Educational program representative ☐ Employer ☐ Co-worker ☐ Other (specify) ☐ Not reported	☐ Live standardized patient ☐ Computerized standardized patient/Roleplay ☐ Videotaped interaction with real patient ☐ Artificial model ☐ Other (specify) ☐ Not reported

If the evaluation involved a performance audit, answer Q10. Otherwise, skip to Q11.

10. **How was the performance audit conducted? (Check all that apply)**

- ☐ On-the-job observer / rater questionnaire
- ☐ Chart review
- ☐ Health plan database
- ☐ Other (specify)
- ☐ Not reported

If the evaluation involved patient assessment, answer Q11. Otherwise, skip to Q12.

11. **What did the questionnaire/test assess? (Check all that apply)**

- ☐ Patient knowledge, attitude, behavior
- ☐ Provider knowledge, skill, behavior
- ☐ Satisfaction with provider
- ☐ Other (specify)

12. **Was the evaluation conducted:** (Check all that apply)

- ☐ pre and post intervention
- ☐ post intervention only

13. **Was the study design: (Check all that apply)**

- ☐ Randomized controlled trial
- ☐ Non-randomized controlled trial
- ☐ Observational study
- ☐ Other (specify)

14. Comments:

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Thanks!

15. Reviewed by:

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Previewing at Level 6

Refid: 1, Fernandez, I. and Frenking, G., Direct Estimate of the Strength of Conjugation and Hyperconjugation by the Energy Decomposition Analysis Method, *Chemistry*, 2006
State: Excluded, Level: 1

General Form Part 3

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Please complete this form for ALL included articles.

	Group A	Group B	
Specify one intervention group and describe type of control	1. Intervention Concurrent control Historical control Clear Selection	2. Intervention Concurrent control Historical control Clear Selection	
Number assigned to group	7. N Not reported Clear Selection	8. N Not reported Clear Selection	9. N N Clear S
N for the analysis	14. N Not reported Clear Selection	15. N Not reported Clear Selection	16. N N Clear S
Description of groups	21. Enlarge Shrink	22. Enlarge Shrink	
Was the exposure to the CME activity...	27. One time Multiple time or repetitive Other (specify) Not reported Not applicable Clear Selection	28. One time Multiple time or repetitive Other (specify) Not reported Not applicable Clear Selection	29. One Mul repetitiv Oth Not Not Clear Sel
Was the media utilized in the educational intervention (check all that apply)	33. Live Computer-based off-line Internet, real time (e.g., streaming)	34. Live Computer-based off-line Internet, real time (e.g., streaming)	35. Live Con off-line Inte time (e.g

	Internet, not real time Video Audio Handheld Print Other (specify) Not reported Not applicable	Internet, not real time Video Audio Handheld Print Other (specify) Not reported Not applicable	Inte time Vide Aud Han Prin Oth Not Not
What was the technique/ educational method of the educational intervention? (Check all that apply) (See below for definitions)	39. Academic detailing Audience response systems Case-based learning Clinical experiences Demonstration Discussion group Feedback Lecture Mentor/Preceptor Point of care Problem-based learning or team-based learning Programmed learning Readings Role play Simulation (other than standardized patient or role-play) Standardized patient Writing/authoring Other (specify) Not reported Not applicable	40. Academic detailing Audience response systems Case-based learning Clinical experiences Demonstration Discussion group Feedback Lecture Mentor/Preceptor Point of care Problem-based learning or team-based learning Programmed learning Readings Role play Simulation (other than standardized patient or role-play) Standardized patient Writing/authoring Other (specify) Not reported Not applicable	41. Aca detailing Aud respons Cas learning Clin experier Den Disc Fee Lec Mer Poir Prol learning based le Pro learning Rea Role Sim than sta patient c Star patient Writ Oth Not Not
Was the intervention designed for individuals or practice settings/teams? (check all that	45. Individuals Practice setting/teams	46. Individuals Practice settings/teams	

apply)	Not reported Not applicable	Not reported Not applicable	
Average time spent in CME activity. Please record in hours. If you cannot convert to hours, then mark "Not reported." (e.g., If CME activity was 4 hours per day for 4 days, then record 16 hours. If CME activity was 3 days long, then mark "Not reported.")	51. hours Not reported Not applicable Clear Selection	52. hours Not reported Not applicable Clear Selection	53. ho No No Clear S
Was the CME activity accredited?	57. Yes No Not reported Not applicable Clear Selection	58. Yes No Not reported Not applicable Clear Selection	
Average duration of educational intervention (over what length of time administered)? INCLUDE UNITS	63. duration (include units) Not reported Not applicable Clear Selection	64. duration (include units) Not reported Not applicable Clear Selection	65. dura units) Not Not Clear Sel
Number of days/week exposed to activity	69. Once only 1 day/week 2 days/week 3 days/week 4 days/week 5 days/week 6-7 days/week Not reported Not applicable Clear Selection	70. Once only 1 day/week 2 days/week 3 days/week 4 days/week 5 days/week 6-7 days/week Not reported Not applicable Clear Selection	
Length of time from end of CME to last evaluation INCLUDE UNITS	75. duration (include units) Not reported Not applicable Clear Selection	76. duration (include units) Not reported Not applicable Clear Selection	77. dura units) Not Not Not Clear Sel
Was the CME activity a part of a PI or QI (performance or quality improvement)	81. Yes No	82. Yes No	

project?	Unclear Not applicable Clear Selection	Unclear Not applicable Clear Selection

Technique/educational method definitions:

Academic detailing
Detailing provided by an institution or hospital.
Audience response systems
Addresses knowledge objectives. Used in combination with live lectures or discussion groups, these are computerized feedback tools that allow the teacher/instructor to pose a question to a large group and receive immediate feedback from each learner which is collated and presented on a screen. Instructor may choose to alter content based on audience response.
Case-based learning
Addresses higher order knowledge and skill objectives. Actual or authored clinical cases are created to highlight learning objectives; clinical material is presented and followed with questions usually determined by the instructor.
Clinical Experiences
Addresses skill, knowledge and attitudinal objectives. Generally refers to a preceptorship or observership with an expert, as in attending a specialty clinic or operating room.
Demonstration
Addresses skill and or knowledge (knows how) objectives; can be presented live, or with video or audio. Teacher determines amount and pace of content.
Discussion Group
Addresses knowledge, especially application or higher order knowledge, or affective objectives; usually requires preparation with readings, or another experience, such as viewing a videotape, or a role play. Can be facilitated by instructor, but group often determines content.
Feedback
The provision of information about an individual's performance to learners.
Lecture
Presentation of knowledge content; live, video, audio or slide presentation available online. Teacher/instructor determines amount and pace of content.
Mentor/Preceptor
Addresses higher order cognitive, skill and affective objectives. Learner is paired with a mentor who may observe, review documentation of performance, advise, coach, and facilitate learning.
Point of Care
Addresses knowledge and higher order cognitive objectives (decision-making). Information which is provided at the time of clinical need, integrated into chart or electronic medical record
Problem-based learning or Team-based learning
Addresses higher order knowledge objectives, metacognition and some skill (group work) objectives. A clinical scenario is presented to a team, who identify the learning objectives, assign information-seeking tasks, and return to share information and answer questions about the case. Can be facilitated or non-facilitated.
Programmed learning
Addresses knowledge objectives. Content is delivered in sequential steps, which are tested with the learner, before moving to the next, usually more complicated step. Pace is determined by the learner, but objectives are set by the program (teacher). Can be delivered in text or online.
Readings
Presentation of knowledge content or background for attitudinal objectives. Requires learner to complete; can be done at learner's pace. Teacher/instructor directed or self-directed (e.g. journals, newsletters, searching online).
Role Play
Addresses skill, knowledge and affective objectives. Learners assume role of patients and/ or clinicians in practicing focused encounters around training problems, usually when SPs are unavailable. Encounter may be recorded and reviewed or followed with a discussion group. Rarely used as sole method of education.
Simulation (other than standardized patient or role-play)
Addresses knowledge and skill objectives; ability to simulate potentially addresses higher order integrative objectives, such as responding to an emerging clinical situation, understanding the

unfolding of a protein structure, working in teams. Technology can be used for simulation training of procedures, as in endoscopy virtual reality trainers or anesthesia simulators. Includes also models, such as joint injection and suture. Requires active participation of learner; can use multiple learners in some scenarios.

Standardized patient

Addresses skill and some knowledge and affective objectives. Usually used for communication skills training and assessment, the standardized patient (SP) or simulated patient (SP) is trained in a specific patient scenario and presentation of a clinical problem. Encounter may be audio or videotaped and timed. Review offers opportunity for reflection and "replay" of the scenario

Writing/authoring

Addresses knowledge and affective objectives. Can include authoring test items (USMLE) and participation in test development. Journaling is used frequently for affective objectives, and may be followed with discussion groups or review with a mentor.

87.

If the overall goals of the educational intervention are stated in this article, write the broad goals verbatim in the space provided. If the overall goals are not explicitly stated go to question 81.

Enlarge Shrink

88.

If the overall goals were alluded to but not explicitly stated, briefly summarize the broad educational goals

Enlarge Shrink

89. Comments:

Enlarge Shrink

Thanks!

90. Reviewed by:

Enlarge Shrink

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State: Excluded, Level: 1

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Review of Systematic Reviews on the Effectiveness of Simulation in Medical Education

KQ3 General Form

Please complete this form for ALL articles that have been included for KQ3.

1. Please mark which simulation methods were included in this review? **(check all that apply)**

- ☐ **Full simulation** (whole room or whole patient simulations (think of resusci-anne with computer integrated data and feedback)
- ☐ **Partial task simulation** (the use of products to learn or practice a specific skill, such as intubation heads, central venous line chests, intraosseous line legs, umbilical artery cannulation trainers)
- ☐ **Computer simulation** (the use of computer programs that allow the student to practice decision making skills, specific knowledge sets such as ACLS trainers and trauma management trainers)
- ☐ **Virtual reality** (the use of advanced computerized technology to allow students to learn or practice how to perform cardiac catheterizations, colonoscopies, bronchoscopies, ureteroscopies, laparoscopic surgery, hysteroscopy, arthroscopy, ocular surgery, intravenous line placement, etc…)
- ☐ **Standardized patient** (the use of individuals trained to play the roles of patients, family members, or others to allow students to practice physical exam skills, history taking skills, communication skills, etc…)
- ☐ Other (specify:)
- ☐ Other (specify:)
- ☐ Other (specify:)

2. Which of the following types of health care professionals were included in the review? **(check all that apply)**

- ☐ Medical students
- ☐ Physicians-in-training (residents or fellows)
- ☐ Fully trained physicians
- ☐ Physician assistants
- ☐ Nurse practitioners
- ☐ Nurses
- ☐ Pharmacists
- ☐ Other (specify:)
- ☐ Other (specify:)
- ☐ Other (specify:)
- ☐ Other (specify:)

☐ Other (specify:)

3. What study designs were included in the review? **(check all that apply)**

☐ Randomized controlled trials

☐ Nonrandomized controlled trials

☐ Prospective studies

☐ Case-control studies

☐ Case series

☐ Case reports

☐ Other (specify:)

☐ Other (specify:)

☐ Other (specify:)

4. Was the review limited to studies that used blinding?

◯ Yes

◯ No

◯ Not reported

Clear Selection

5. What comparisons were made? **(check all that apply)**

☐ Simulation vs other simulation

☐ Simulation vs other medical education

☐ Simulation vs no education

☐ Other (specify:)

☐ Other (specify:)

☐ Other (specify:)

6. What was the end date for the electronic search (month/year)?

Month

Year

7. How many original articles met eligibility criteria for inclusion in the review?

Enlarge Shrink

8. **Results**

Were any subgroup analyses reported for: **(check all that apply)**

☐ Age

☐ Gender

☐ Practice setting

☐ Stage of training

☐ Personal motivation

☐ Specialty

- Rewards/motivations
- Learning satisfaction
- Knowledge enhancement
- International medical graduate vs. US graduate
- Country of practice
- Monetary/financial rewards
- Provision of tools
- Public demand/patient expectation
- Other (specify:)
- Other (specify:)
- No subgroup analyses were reported

9. If there were subgroup analyses, list any main conclusions:

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10. What sensitivity analyses were done? **(check all that apply)**

- None
- Excluding studies with low study quality
- Excluding long or large studies
- Excluding studies based on language of publication
- Excluding studies based on source of funding
- Excluding studies based on country
- Other (specify:)
- Other (specify:)
- Other (specify:)

11. Did sensitivity analysis change results?

- Yes, please specify
- No

Clear Selection

12. What metaregressions were conducted? **(check all that apply)**

- None
- Trial quality
- Other (specify:)
- Other (specify:)
- Other (specify:)

13. Did metaregression change results?

- Yes (specify:)
- No

Clear Selection

14. Comments:

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State: Excluded, Level: 1

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Review of Systematic Reviews on the Effectiveness of Simulation in Medical Education

KQ3 Outcomes Form

Please complete this form for ALL articles that have been included for KQ3.

PLEASE RECORD ONLY THOSE RESULTS RELATED TO SIMULATION.

Please complete the following for each outcome related to simulation that is reported. Where possible:

- Summarize the results of similar outcome measures,
- Include numerical results (e.g., p-value or confidence intervals) and the number of items that are being summarized, and
- Summarize both within group differences and between group differences.

Example 1: Haque S, Srinivasan S. A meta-analysis of the training effectiveness of virtual reality surgical simulators. IEEE Trans Inf Technol Biomed. 2006;10:51-58.
Example 2: Sutherland LM, Middleton PF, Anthony A, Hamdorf J, Cregan P, Scott D, Maddern GJ. Surgical simulation: a systematic review. Ann Surg. 2006;243:291-300.

Describe the outcome measure (s) related to simulation.	Type of Objective (Check all that apply)	Were the results of individual studies pooled in a meta-analysis?	Were the results of the meta-analysis significant?	Briefly summarize the essence of the results for this objective or set of objectives.
Example: Haque 2006 *Effectiveness of virtual simulation in differentiating between experienced (those who have performed more than 50 such procedures) and novice (those who have performed less than 10 procedures) trainees based on the "task completion time" (amount of time, in seconds or minutes, taken*	*Example: Haque 2006* *Skills*	*Example: Haque 2006* *Yes*	*Example: Haque 2006* *Yes*	*Example: Haque 2006* *Virtual reality simulators help to differentiate between a novice and an experienced trainee as evidenced by the decreased amount of time taken by experienced trainees to complete a given surgical task in a virtual reality simulation environment. Standardized effect size = -1.059 (95%CI; -1.331, -0.786) [fixed-effects model, p = 0.13 for homogeneity; authors report*

by the trainee to complete task)				*performing a random effects model with quite similar results.]*
Example: Haque 2006 *Effectiveness of virtual simulation in differentiating between experienced (those who have performed more than 50 such procedures) and novice (those who have performed less than 10 procedures) trainees based on the "error score" (the number of "wall-strikes" experienced by the trainee or the ratings provided by an external expert of the trainee's performance)*	*Example: Haque 2006* *Skills*	*Example: Haque 2006* *Yes*	*Example: Haque 2006* *Yes*	*Example: Haque 2006* *Virtual reality simulators help to differentiate between a novice and an experienced trainee as evidenced by low error scores of the experienced trainees to complete a given surgical task in a virtual reality simulation environment. Standardized effect size = -1.325 (95%CI; -2.125, -0.525) [Random-effects model, p <0.0001 for homogeneity]*
Example: Sutherland 2006 *Surgical trainees (surgeons, residents, medical students, and others) who were trained on computer simulation were compared with trainees without previous training. Outcomes measured were surgical task performance or satisfaction with surgical techniques or both.*	*Example: Sutherland 2006* *Skills*	*Example: Sutherland 2006* *No*	*Example: Sutherland 2006* *N/A (no meta-analysis conducted)*	*Example: Sutherland 2006* *Those who were trained on computer simulators performed better than those who received no training.*
Example: Sutherland 2006 *Surgical trainees (surgeons, residents, medical*	*Example: Sutherland 2006* *Skills*	*Example: Sutherland 2006* *No*	*Example: Sutherland 2006* *N/A (no meta-*	*Example: Sutherland 2006* *The computer simulation versus "standard" training*

students, and others) who were trained on computer simulation were compared with trainees who had standard training. Outcomes measured were surgical task performance or satisfaction with surgical techniques or both.			*analysis conducted)*	*comparisons varied, potentially confounded by the different components of "standard" training, as well as by the different intensities of time allowed on the simulator in the computer simulation groups.*
Example: Sutherland 2006 *Surgical trainees (surgeons, residents, medical students, and others) who were trained on computer simulation were compared with video simulation-trained trainees. Outcomes measured were surgical task performance or satisfaction with surgical techniques or both*	*Example: Sutherland 2006* *Skills*	*Example: Sutherland 2006* *No*	*Example: Sutherland 2006* *N/A (no meta-analysis conducted)*	*Example: Sutherland 2006* *Computer simulation showed mixed results, superior in some studies, but not others and was inferior to video simulation in one study.*
Example: Sutherland 2006 *Surgical trainees (surgeons, residents, medical students, and others) who were trained on computer simulation were compared with trainees who were trained on a physical trainer or model. Outcomes measured were surgical task performance or satisfaction with*	*Example: Sutherland 2006* *Skills*	*Example: Sutherland 2006* *No*	*Example: Sutherland 2006* *N/A (no meta-analysis conducted)*	*Example: Sutherland 2006* *Only one study was in this comparison and it showed computer simulation training to be superior to training on a physical trainer.*

surgical techniques or both				
Example: Sutherland 2006 ***Surgical trainees (surgeons, residents, medical students, and others) who were trained on one type or level of computer simulation were compared with trainees on another type or level of computer simulation. Outcomes measured were surgical task performance or satisfaction with surgical techniques or both.***	***Example: Sutherland 2006*** ***Skills***	***Example: Sutherland 2006*** ***No***	***Example: Sutherland 2006*** ***N/A (no meta-analysis conducted)***	***Example: Sutherland 2006*** ***Two studies were included in this comparison. One showed that more demanding training may lead to better performance of surgical tasks on MIST-VR. Second study failed to show clear differences between massed and distributed practice on MIST-VR.***
Example: Sutherland 2006 ***Surgical trainees (surgeons, residents, medical students, and others) who were trained on video simulation were compared with trainees who had no previous training. Outcomes measured were surgical task performance or satisfaction with surgical techniques or both.***	***Example: Sutherland 2006*** ***Skills***	***Example: Sutherland 2006*** ***No***	***Example: Sutherland 2006*** ***N/A (no meta-analysis conducted)***	***Example: Sutherland 2006*** ***Video simulation groups did not show consistently better results than groups who did not receive training.***
Example: Sutherland 2006 ***Surgical trainees (surgeons, residents, medical students, and others) who were trained on video simulation were***	***Example: Sutherland 2006*** ***Skills***	***Example: Sutherland 2006*** ***No***	***Example: Sutherland 2006*** ***N/A (no meta-analysis conducted)***	***Example: Sutherland 2006*** ***no differences were seen between video box training and other forms of training such as bench models or standard training.***

compared with trainees who had other forms of training (such as bench models or standard training). Outcomes measured were surgical task performance or satisfaction with surgical techniques or both.				
Example: Sutherland 2006 *Surgical trainees (surgeons, residents, medical students, and others) who were trained on physical or model simulation were compared with trainees who had other forms of training, including no training. Outcomes measured were surgical task performance or satisfaction with surgical techniques or both.*	*Example: Sutherland 2006* *Skills*	*Example: Sutherland 2006* *No*	*Example: Sutherland 2006* *N/A (no meta-analysis conducted)*	*Example: Sutherland 2006* *Studies that were included in this comparison showed mixed results, model training may be better than no training and standard training such as instruction from mentors or manuals.*
Example: Sutherland 2006 *Surgical trainees (surgeons, residents, medical students, and others) who were trained on cadavers were compared with trainees who had standard training. Outcomes measured were surgical task performance or satisfaction with surgical techniques or*	*Example: Sutherland 2006* *Skills*	*Example: Sutherland 2006* *No*	*Example: Sutherland 2006* *N/A (no meta-analysis conducted)*	*Example: Sutherland 2006* *Only one study that reported this comparison found that the cadaver trained group received better scores than the standard training group, which learned independently from the manuals, for the global assessment of operative performance on cadavers.*

both.				
Describe the outcome measure (s) related to simulation.	**Type of Objective (Check all that apply)**	**Were the results of individual studies pooled in a meta-analysis?**	**Were the results of the meta-analysis significant?**	**Briefly summarize the essence of the results for this objective or set of objectives.**
1. Enlarge Shrink	2. Knowledge or cognitive skills; Attitudes; Skills (psychomotor or procedural skills); Practice behaviors; Clinical outcomes; Other (specify:)	3. Yes; No; Unclear; N/A; Clear Selection	4. Yes; No; Unclear; N/A (no meta-analysis conducted); Clear Selection	5. Enlarge Shrink
6. Enlarge Shrink	7. Knowledge or cognitive skills; Attitudes; Skills (psychomotor or procedural skills); Practice behaviors; Clinical outcomes; Other (specify:)	8. Yes; No; Unclear; N/A; Clear Selection	9. Yes; No; Unclear; N/A (no meta-analysis conducted); Clear Selection	10. Enlarge Shrink
11. Enlarge Shrink	12. Knowledge or cognitive skills; Attitudes; Skills (psychomotor or procedural skills); Practice behaviors; Clinical outcomes; Other (specify:)	13. Yes; No; Unclear; N/A; Clear Selection	14. Yes; No; Unclear; N/A (no meta-analysis conducted); Clear Selection	15. Enlarge Shrink
16.	17.	18.	19.	20.

Enlarge Shrink	Knowledge or cognitive skills Attitudes Skills (psychomotor or procedural skills) Practice behaviors Clinical outcomes Other (specify:)	Yes No Unclear N/A Clear Selection	Yes No Unclear N/A (no meta-analysis conducted) Clear Selection	Enlarge Shrink
21. Enlarge Shrink	22. Knowledge or cognitive skills Attitudes Skills (psychomotor or procedural skills) Practice behaviors Clinical outcomes Other (specify:)	23. Yes No Unclear N/A Clear Selection	24. Yes No Unclear N/A (no meta-analysis conducted) Clear Selection	25. Enlarge Shrink
26. Enlarge Shrink	27. Knowledge or cognitive skills Attitudes Skills (psychomotor or procedural skills) Practice behaviors Clinical outcomes Other (specify:)	28. Yes No Unclear N/A Clear Selection	29. Yes No Unclear N/A (no meta-analysis conducted) Clear Selection	30. Enlarge Shrink
31. Enlarge Shrink	32. Knowledge or cognitive skills Attitudes Skills (psychomotor or procedural	33. Yes No Unclear N/A Clear Selection	34. Yes No Unclear N/A (no meta-analysis conducted)	35. Enlarge Shrink

	skills) Practice behaviors Clinical outcomes Other (specify:)		Clear Selection	
36. Enlarge Shrink	37. Knowledge or cognitive skills Attitudes Skills (psychomotor or procedural skills) Practice behaviors Clinical outcomes Other (specify:)	38. Yes No Unclear N/A Clear Selection	39. Yes No Unclear N/A (no meta-analysis conducted) Clear Selection	40. Enlarge Shrink
41. Enlarge Shrink	42. Knowledge or cognitive skills Attitudes Skills (psychomotor or procedural skills) Practice behaviors Clinical outcomes Other (specify:)	43. Yes No Unclear N/A Clear Selection	44. Yes No Unclear N/A (no meta-analysis conducted) Clear Selection	45. Enlarge Shrink

46. Author conclusion/summary:

- Overall improvement after educational intervention
- Partial improvement or mixed results
- No improvement after educational intervention
- Unclear
- Other (specify:)

Clear Selection

47.

Briefly summarize the main conclusions of the study (may cut and paste from abstract or article):

Example Haque 2006:

Virtual reality simulation can help to discriminate between the experienced and the inexperienced trainees.

Example: Sutherland 2006

Computer simulation generally showed better results than no training at all (and than physical trainer/model training in one RCT), but was not convincingly superior to standard training (such as surgical drills) or video simulation (particularly when assessed by operative performance). Video simulation did not show consistently better results than groups with no training at all, and there were not enough data to determine if video simulation was better than standard training or the use of models. Model simulation may have been better than standard training, and cadaver training may have been better than model training.

Enlarge Shrink

48. Comments:

Enlarge Shrink

Save to finish later | Submit Data

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Previewing Only: You cannot submit data from this form

Previewing at Level 17

Refid: 1, Fernandez, I. and Frenking, G., Direct Estimate of the Strength of Conjugation and Hyperconjugation by the Energy Decomposition Analysis Method, *Chemistry*, 2006
State: Excluded, Level: 1

Save to finish later | Submit Data

Review of Systematic Reviews on the Effectiveness of Simulation in Medical Education

KQ3 Quality Form

Please complete this form for ALL articles that have been included for KQ3.

1. Did the authors clearly state the question addressed by the overview at the beginning of the article?

- Yes. The authors stated a focused clinical question about the outcomes of treatment, AND specified a target population
- Partially
- No

Clear Selection

2. Did the authors describe the search methods used to find evidence (original research) on the primary question(s)?

- Yes. Enough information was reported to permit replication
- Partially
- No

Clear Selection

3. Was the search for evidence reasonably comprehensive?

- Yes. Search included MEDLINE (or other electronic database), hand-searching of select journals or reference lists, AND query of 1 or more experts.
- Partially. Search included MEDLINE (or other electronic database), but did not include or did not report including hand-searching of journals or reference lists AND/OR did not include a query of experts.
- No. Search did not include an electronic database of journals.

Clear Selection

4. Did the authors report on the criteria they used for deciding which studies to include in the systematic review?

- Yes. Criteria were specified clearly enough to permit replication.
- Partially. Criteria specified, but without enough detail to permit replication.
- No. Criteria not specified.

Clear Selection

5. Were the inclusion criteria appropriate (aimed at avoiding bias in the included studies)?

- Yes. Inclusion criteria are likely to capture all relevant studies (e.g., included countries other than the U.S.?).
- Partially.
- No. Inclusion criteria likely to lead to biased sampling of studies.
- Cannot tell. Inclusion criteria described inadequately.

Clear Selection

6. Did the authors assess study quality?

- Yes. Criteria to assess study quality were specified with adequate detail to permit replication.
- Partially. Criteria to assess study quality not adequately described.
- No.

Clear Selection

7. Was the quality assessment done appropriately?

- Yes. Quality assessment was done using a validated instrument (with citation) or the authors demonstrated validity of their methods.
- Partially. Authors used their own quality assessment instrument without validation, or another instrument with unknown measurement properties.
- No.
- Cannot tell. There was no quality assessment reported.

Clear Selection

8. Did the authors demonstrate that their methodology was reproducible?

- Yes. The investigators mostly (>50% of the time) agreed on selection of articles, on quality assessment, AND on the data that was extracted.
- Partially. Disagreement occurred the majority of the time either on the selection of articles, quality assessment, or data extraction (but not all 3).
- No. Disagreement occurred the majority of the time on the selection of articles, quality assessment, AND data extraction.
- Can't tell. Authors didn't comment on reproducibility.

Clear Selection

9. Did the authors discuss whether the variation in the results of the original research may be due to differences in study design or population?

- Yes. Text or tables provide comparative information on most of following: study design, populations, interventions, and outcome measures, AND the authors discuss possible sources of heterogeneity
- Partially.
- No.

Clear Selection

10. Were the results of the relevant studies combined appropriately relative to the primary question?

- Yes. The overview included some assessment of the qualitative or quantitative heterogeneity of study results AND used an accepted qualitative or quantitative pooling method (i.e., more than simple addition, such as random effects vs fixed effects model for quantitative data)
- Partially.
- No.
- Cannot tell. No description of the methods used for combining studies.

Clear Selection

11. Were the conclusions of the authors supported by the data and/or analysis reported in the overview?

- Yes.
- Partially.
- No.

Clear Selection

12. Were tests for publication bias conducted?

- Yes
- No

Not reported

Clear Selection

13. If yes, was there publication bias?

Yes (statistical test with p<.05 or reported “yes” by author)

No

Not reported

Clear Selection

14. Additional comments:

Enlarge Shrink

Thank you!

Save to finish later | Submit Data

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Previewing Only: You cannot submit data from this form

Previewing at Level 7

Refid: 1, Fernandez, I. and Frenking, G., Direct Estimate of the Strength of Conjugation and Hyperconjugation by the Energy Decomposition Analysis Method, *Chemistry*, 2006
State: Excluded, Level: 1

Outcomes Form

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Outcomes Form

Please complete this form for ALL included articles.

Please complete the following for each relevant outcome that is reported. Where possible:

- **Summarize the results of similar outcome measures,**
- **Include numerical results (e.g., p-value or confidence intervals) and the number of items that are being summarized, and**
- **Summarize both within group differences and between group differences.**

Please see the example that relates to refid#6833 and 10859.

Describe the main outcome measure.	Type of Objective (check all that apply)	Were one or more of the learning objectives of the CME activity met? (Please use statistical significance to determine this. If not enough data is presented to determine this, then mark "Unclear.")	Briefly summarize the essence of the results for this objective or set of objectives.
Example (Refid #10859) *Physicians' perceptions of self-efficacy in cholesterol-lowering practices, as measured on Likert scale survey (14 items)*	*Example (Refid #10859)* *Attitudes*	*Example (Refid #10859)* *Unclear*	*Example (Refid #10859)* *Overall posttest scores did not differ between intervention and control groups. Intervention groups (workshop and workshop + chart cue) had statistically significantly higher confidence on 1 of 14 practices at posttest 1 (dietary counseling) and 2 of 14 practices at posttest 2 (identifying patients to be screened and interpreting test results to patient). Results possibly due to multiple comparisons.*
Example (Refid #6833)	*Example (Refid #6833)* *Knowledge or cognitive skills*	*Example (Refid #6833)*	*Example (Refid #6833)* *Both enhanced and routine*

Knowledge test		***Unclear***	***group improved from pre to post test, but no comparison between groups was performed.***
Example (Refid #6833) ***Characteristics related to physician action such as use of a screening tool and optimal pharmacotherapy***	***Example (Refid #6833)*** ***Practice behaviors***	***Example (Refid #6833)*** ***Yes***	***Example (Refid #6833)*** ***Enhanced group was more likely to utilize depression diagnostic tool, optimize drug therapy, and use a checklist for adverse events.***
Example (Refid #6833) ***Patient factors such as satisfaction, compliance, treatment outcome, and office visits***	***Example (Refid #6833)*** ***Clinical outcomes***	***Example (Refid #6833)*** ***No***	***Example (Refid #6833)*** ***Patients were satisfied in both groups, but no between group comparison done, no differences were found in compliance or withdrawals. Patients treated by physicians in the enhanced group did make fewer office visits. Both patient groups improved with regard to self reported signs of depression (p<0.001) but the between group comparison showed no differences between groups. Patients treated by physicians in the enhanced group were less likely to be sent for adjunctive psychotherapy, (p <0.0001).***
1. Enlarge Shrink	2. ☐ Knowledge or cognitive skills ☐ Attitudes ☐ Skills (psychomotor or procedural skills) ☐ Practice behaviors ☐ Clinical outcomes ☐ Other (specify:)	3. ☐ Yes ☐ No ☐ Unclear ☐ Not applicable	4. Enlarge Shrink
5. Enlarge Shrink	6. ☐ Knowledge or cognitive skills ☐ Attitudes ☐ Skills (psychomotor or procedural	7. ☐ Yes ☐ No ☐ Unclear ☐ Not applicable	8. Enlarge Shrink

	skills) ☐ Practice behaviors ☐ Clinical outcomes ☐ Other (specify:)		
9. Enlarge Shrink	10. ☐ Knowledge or cognitive skills ☐ Attitudes ☐ Skills (psychomotor or procedural skills) ☐ Practice behaviors ☐ Clinical outcomes ☐ Other (specify:)	11. ☐ Yes ☐ No ☐ Unclear ☐ Not applicable	12. Enlarge Shrink
13. Enlarge Shrink	14. ☐ Knowledge or cognitive skills ☐ Attitudes ☐ Skills (psychomotor or procedural skills) ☐ Practice behaviors ☐ Clinical outcomes ☐ Other (specify:)	15. ☐ Yes ☐ No ☐ Unclear ☐ Not applicable	16. Enlarge Shrink
17. Enlarge Shrink	18. ☐ Knowledge or cognitive skills ☐ Attitudes ☐ Skills (psychomotor or procedural skills) ☐ Practice behaviors ☐ Clinical outcomes ☐ Other (specify:)	19. ☐ Yes ☐ No ☐ Unclear ☐ Not applicable	20. Enlarge Shrink
21.	22.	23.	24.

Enlarge Shrink	☐ Knowledge or cognitive skills ☐ Attitudes ☐ Skills (psychomotor or procedural skills) ☐ Practice behaviors ☐ Clinical outcomes ☐ Other (specify:)	☐ Yes ☐ No ☐ Unclear ☐ Not applicable	Enlarge Shrink
25. Enlarge Shrink	26. ☐ Knowledge or cognitive skills ☐ Attitudes ☐ Skills (psychomotor or procedural skills) ☐ Practice behaviors ☐ Clinical outcomes ☐ Other (specify:)	27. ☐ Yes ☐ No ☐ Unclear ☐ Not applicable	28. Enlarge Shrink
29. Enlarge Shrink	30. ☐ Knowledge or cognitive skills ☐ Attitudes ☐ Skills (psychomotor or procedural skills) ☐ Practice behaviors ☐ Clinical outcomes ☐ Other (specify:)	31. ☐ Yes ☐ No ☐ Unclear ☐ Not applicable	32. Enlarge Shrink
33. Enlarge Shrink	34. ☐ Knowledge or cognitive skills ☐ Attitudes ☐ Skills (psychomotor or procedural skills)	35. ☐ Yes ☐ No ☐ Unclear ☐ Not applicable	36. Enlarge Shrink

	Practice behaviors Clinical outcomes Other (specify:)		
37. Enlarge Shrink	38. Knowledge or cognitive skills Attitudes Skills (psychomotor or procedural skills) Practice behaviors Clinical outcomes Other (specify:)	39. Yes No Unclear Not applicable	40. Enlarge Shrink

41. Author conclusion/summary:

- Overall improvement after educational intervention
- Partial improvement or mixed results
- No improvement after educational intervention
- Unclear
- Other (specify:)

Clear Selection

42. Briefly summarize the main conclusions of the study (may cut and paste from abstract or article):

Enlarge Shrink

43. Comments:

Enlarge Shrink

Thanks!

44. Reviewed by:

Enlarge Shrink

Save to finish later Submit Data

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Previewing Only: You cannot submit data from this form

Previewing at Level 8

Refid: 1, Fernandez, I. and Frenking, G., Direct Estimate of the Strength of Conjugation and Hyperconjugation by the Energy Decomposition Analysis Method, *Chemistry*, 2006
State: Excluded, Level: 1

Quality Form

Save to finish later | Submit Data

Quality of Study Design Form

Please complete this form for ALL included articles. Please complete this form independently.

1. Was the study described as randomized (this includes the use of words such as randomly, random, and randomization)?

- Yes
- No
- Not reported/Can't tell

Clear Selection

2. If yes to q1, was the randomization scheme described AND appropriate?

- Yes: (1) appropriate randomization is if each study participant is allowed to have the same chance of receiving each intervention and the investigators could not predict which treatment was next
- No: (-1) randomization described AND inappropriate (e.g. methods of allocation using date of birth, date of admission, hospital numbers, or alteration should not be regarded as appropriate
- No: (0) randomization methods not described

Clear Selection

3. Was the evaluation of outcome blinded?

- Yes
- No
- Not reported/Can't tell

Clear Selection

4. If yes to Q3, was the method of blinding described AND appropriate?

- Yes: (1) appropriate blinding is if the person evaluating the outcome could not identify the intervention being assessed
- No: (-1) the study was described as blind AND inappropriate
- No: (0) no description of blinding available and unable to tell if appropriate or not

Clear Selection

5. Was there a description of withdrawals and drop-outs of learners?

- Yes: (1) the number and the reasons for withdrawals in each group must be stated or state that there were no withdrawals. If subjects were not included in the analysis, they must state the number and reasons for not including them in the analysis
- No (0)

Clear Selection

6. Did the authors describe their power analysis?

- Yes
- No or unclear

Clear Selection

7. If a power analysis is described, did the evaluation have enough power to show statistical significance?

- Yes
- No or unclear
- Not applicable

Clear Selection

8. Comments:

Enlarge Shrink

Thanks!

9. Reviewed by:

Enlarge Shrink

Save to finish later | Submit Data

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Previewing Only: You cannot submit data from this form

Previewing at Level 1

Refid: 1, Fernandez, I. and Frenking, G., Direct Estimate of the Strength of Conjugation and Hyperconjugation by the Energy Decomposition Analysis Method, *Chemistry*, 2006
State: Excluded, Level: 1

Save to finish later | Submit Data

1. Does this article **potentially apply** to any of our key questions?

- **Potentially eligible**
- Ineligible

Clear Selection

Save to finish later | Submit Data

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Previewing at Level 11

Refid: 1, Fernandez, I. and Frenking, G., Direct Estimate of the Strength of Conjugation and Hyperconjugation by the Energy Decomposition Analysis Method, *Chemistry*, 2006
State: Excluded, Level: 1

KQ6 Form

Save to finish later | Submit Data

KQ 6 Outcomes Form

Validity/Reliability of Tools

Please complete this form for ALL included articles. Please note: If a study mentions that they use a validated measure and provides a reference, mark "Yes" to Q1.

1. Does the study report the validity or reliability of any evaluation method? (Key words may include: content, concurrent, predictive, or construct validity; intra-rater, inter-rater, test-retest, inter-item reliability; percent agreement, correlation coefficient, kappa, Cronbach alpha)

- Yes (Continue with form)
- No (Please do NOT complete the rest of this form. Hit submit.)

Clear Selection

Instructions: Please complete a separate form for each evaluation method for which validity / reliability are reported. Wherever possible, you may report sub-scales and multiple statistical tests for the same method on the same form.

2. Briefly describe the evaluation method:

Enlarge Shrink

3. Does the study describe pilot testing / cognitive testing of this as a new evaluation method?
Pilot testing involves administration of a method in a population prior to use; cognitive testing involves exploring the processes by which pilot populations answer questions. (Collins D, *Quality of Life Research*, 2003)

- Yes
- No
- Unclear

Clear Selection

4. Is this a method that was previously used?

- Yes – Please write the reference number of the article that first used the method:
- No – Created new evaluation method for this study
- Unclear

Clear Selection

5. Does the study change a previously validated / reliable evaluation method for this study?

- Not Applicable (method not previously used)
- Yes - questions
- Yes - response options
- Yes - mode of administration
- No
- Unclear

6. Did the study describe the **validity** of the evaluation method or tool (degree to which method truly measures what it is intended to measure)**?** *Note:* some authors may erroneously report inter-item reliability (Cronbach alpha) as validity; please report this under reliability.

- No (Skip to Q22.)
- Yes - but type of validity not specifically reported (Skip to Q22.)
- Yes - Validity from previous study or in this study reported in this article (Continue)

Clear Selection

If statistics are reported from both prior and current study, record values for current study only. If only previous validity statistics are given, record them.

Type of Validity (Check all that apply)	Comparison Method	Statistics (Check all that apply)	Source of validity
7.	8.	Not applicable	9.

Face / content: degree to which an instrument accurately represents the skill or characteristic it is designed to measure, based on people's experience and available knowledge1	Experts/sources Not reported Clear Selection		Current study Prior study Clear Selection
10. Concurrent Criterion: degree to which an instrument produces the same results as another accepted or proven instrument that measures the same variable1	11. Comparison Not reported Clear Selection	12. Percentage agreement Correlation coefficient Sensitivity Specificity Other (specify:) Statistic not reported	13. Current study Prior study Clear Selection
14. Predictive Criterion: degree to which a measure accurately predicts expected outcomes1	15. Comparison Not reported Clear Selection	16. Percentage agreement Correlation coefficient Sensitivity Specificity Other (specify:) Statistic not reported	17. Current study Prior study Clear Selection
18. Other validity (e.g. construct, discriminant)	19. Comparison Not reported Clear Selection	20. Other (specify:) Statistic not reported	21. Current study Prior study Clear Selection

22. Did the study describe the **reliability** of the evaluation method (consistency or reproducibility of measurements)? (check all that apply)

- No (Skip to Q41.)
- Yes – but type of reliability not specifically reported (Skip to Q41.)
- Yes – Reliability from previous or current study reported in this article (Continue)

If statistics are reported from both prior and current study, record values for current study only. If only previous reliability statistics are given, record them.

Type of reliability	Statistics (check all that apply)	Source of reliability
23. Intra-rater reliability: degree to which measurements are the same when repeated by the same person1	24. Percentage agreement Correlation coefficient Kappa Other (specify:) Statistic not reported	25. Current study Prior study Clear Selection
26. Inter-rater reliability: degree to which measurements are the same when obtained by different persons1	27. Percentage agreement Correlation coefficient Kappa Other (specify:) Statistic not reported	28. Current study Prior study Clear Selection
29.	30.	31.

Test-retest reliability: degree to which the same test produces the same results when repeated under the same conditions1	Percentage agreement Correlation coefficient Kappa Other (specify:) Statistic not reported	Current study Prior study Clear Selection
32. Equivalence reliability: degree to which alternate forms of the same measurement instrument produce the same results1	33. Reliability coefficient Coefficient of stability Kappa Other (specify:) Statistic not reported	34. Current study Prior study Clear Selection
35. Internal consistency (inter-item) reliability: how well items reflecting the same construct yield similar results	36. Cronbach's alpha Split-halves Correlation coefficient Kuder-Richardson method Other (specify:) Statistic not reported	37. Current study Prior study Clear Selection
38. Other reliability	39. Other (specify:) Statistic not reported	40. Current study Prior study Clear Selection

1 Reed D, Price EG, Windish DM, et al. Challenges in systematic reviews of educational intervention studies. *Ann Intern Med*. 2005;142:1080-1089.

41. Comments:

Enlarge Shrink

Thanks!

42. Reviewed by:

Enlarge Shrink

Save to finish later Submit Data

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Evidence table 1. Characteristics of study design and evaluation methods in studies assessing the effectiveness of continuing medical education

Author, year	Study design, when evaluation conducted	Participant questionnaire Administered (A) Evaluated (E) Response options (R)	Observer assessment Skill assessed (S) Observer (O) Format (F)	Performance audit Conducted (C)	Patient assessment Evaluated (E)	Qualitative evaluation	Lowest response rate
Adams, 1998[125]	RCT, post intervention only	NA	NA	NA	E: Provider knowledge, skill, behavior	Yes	>80%
Allison, 2005[147]	RCT, pre and post intervention	NA	NA	C: HEDIS	NA	NR	NR
Andersen, 1990[36]	RCT, pre and post intervention	A: Written E: Knowledge (objective) R: Multiple-choice, dichotomous, Likert scale	NA	NA	NA	No	NR
Anderson, 1996[103]	RCT, pre and post intervention	NA	NA	C: Prescription information collected through the Triplicate Prescription Program provided by the British Columbia College of Physicians and Surgeons	NA	NR	>80%
Beaulieu, 2002[140]	RCT, post intervention only	NA	S: Procedural skills, communication skills O: Educational program representative F: Live standardized patient	NA	NA	No	40-59%
Beaulieu, 2004[44]	Non-RCT, pre and post intervention	A: NR E: Knowledge (self-reported), behavior (self-assessed) R: Multiple-choice	NA	C: Health plan database	NA	No	40-59%

Evidence table 1. Characteristics of study design and evaluation methods in studies assessing the effectiveness of continuing medical education

Author, year	Study design, when evaluation conducted	Participant questionnaire Administered (A) Evaluated (E) Response options (R)	Observer assessment Skill assessed (S) Observer (O) Format (F)	Performance audit Conducted (C)	Patient assessment Evaluated (E)	Qualitative evaluation	Lowest response rate
Bjornson, 1990[14]	RCT, post intervention only	A: Written E: Knowledge (self-reported), attitude, intent to change behavior (self-assessed) R: Likert scale	NA	C: Health plan database	NA	NR	40-59%
Block, 1988[37]	Non-RCT, post intervention only	A: Written E: Knowledge (objective), attitude, behavior (self-assessed) R: Multiple-choice, Likert scale	NA	NA	NA	No	60-79%
Bloomfield, 2005[68]	Overall trial does not appear to be randomized, but one aspect, the provision of prompts was randomized, pre and post intervention	A: NR E: Attitude, behavior (self-assessed) R: NR	NA	C: Chart review	NA	Yes	>80%
Brown, 1999[72]	RCT, pre and post intervention	A: Written E: Satisfaction with curriculum, skill (self-assessed), behavior (self-assessed) R: NR	NA	NA	E: Provider knowledge, skill, behavior, satisfaction with provider	No	>80%

Evidence table 1. Characteristics of study design and evaluation methods in studies assessing the effectiveness of continuing medical education

Author, year	Study design, when evaluation conducted	Participant questionnaire Administered (A) Evaluated (E) Response options (R)	Observer assessment Skill assessed (S) Observer (O) Format (F)	Performance audit Conducted (C)	Patient assessment Evaluated (E)	Qualitative evaluation	Lowest response rate
Brown, 2004[135]	RCT, pre and post intervention	NA	S: Procedural skills, communication skills O: Patients' parents F: Patients' parents live observation of interaction with physician and symptoms of patients	NA	E: Provider knowledge, skill, behavior	Yes	<40%
Browner, 1994[122]	RCT, post intervention only	NA	NA	C: Chart review	NA	No	>80%
Bunting, 2004[123]	Non-RCT, pre and post intervention	NA	NA	C: Health plan database	NA	No	>80%
Carney, 1995[88]	RCT, post intervention only	A: Written E: Knowledge (objective) R: NR	NA	NA	E: Standardized patient assessment using performance checklist	No	NR
Casebeer, 1999[131]	RCT, pre and post intervention	NA	S: Communication skills O: Educational program representative F: Live standardized patient	C: Lipid profile	E: Patient knowledge, attitude, behavior	No	60-79%
Chan, 1999[21]	RCT, pre and post intervention	A: Computer E: Knowledge (self-reported) R: Multiple-choice	NA	NA	NA	Yes	>80%
Chassin, 1986[106]	RCT, pre and post intervention	NA	NA	C: Chart review	NA	No	>80%

Evidence table 1. Characteristics of study design and evaluation methods in studies assessing the effectiveness of continuing medical education

Author, year	Study design, when evaluation conducted	Participant questionnaire Administered (A) Evaluated (E) Response options (R)	Observer assessment Skill assessed (S) Observer (O) Format (F)	Performance audit Conducted (C)	Patient assessment Evaluated (E)	Qualitative evaluation	Lowest response rate
Cherkin, 1991[83]	Observational study, pre and post intervention	A: Written E: Knowledge (self-reported), attitude, skill (self-assessed), behavior (self-assessed) R: NR	NA	NA	NA	NR	NR
Chodosh, 2006[62]	RCT, post intervention only	A: Written E: Knowledge (objective), attitude R: Multiple-choice, dichotomous, Likert scale	NA	NA	NA	No	40-59%
Chung, 2004[54]	RCT, pre and post intervention	A: NR E: Knowledge (self-reported), knowledge (objective) R: Multiple-choice	NA	NA	NA	No	60-79%
Clark, 1998[120]	RCT, pre and post intervention	A: Written E: Knowledge (self-reported), behavior (self-assessed) R: NR	NA	NA	E: Provider knowledge, skill, behavior; parental knowledge of asthma management	No	>80%
Clark, 2000[78]	RCT, pre and post intervention	A: Written, sent by mail E: Behavior (self-assessed), medication use, procedures encouraging self-management for patients R: NR	NA	NA	E: Provider knowledge, skill, behavior; health care utilization: emergency department visits; physician office visits; hospitalizations; communication regarding asthma management	NR	40-59%

Evidence table 1. Characteristics of study design and evaluation methods in studies assessing the effectiveness of continuing medical education

Author, year	Study design, when evaluation conducted	Participant questionnaire Administered (A) Evaluated (E) Response options (R)	Observer assessment Skill assessed (S) Observer (O) Format (F)	Performance audit Conducted (C)	Patient assessment Evaluated (E)	Qualitative evaluation	Lowest response rate
Cohn, 2002[19]	Non-RCT, pre and post intervention	A: NR E: Knowledge (objective), behavior (self-assessed) R: NR	NA	NA	E: Provider knowledge, skill, behavior	No	40-59%
Costanza, 1992[35]	Non-RCT, pre and post intervention	A: Written E: Knowledge (objective), attitude, behavior (self-assessed) R: Likert scale, biographical data entered directly by physician	NA	NA	NA	No	60-79%
Cummings, 1989[112]	RCT, pre and post intervention	A: Written E: Attitude, behavior (self-assessed) R: Multiple-choice, Likert scale	NA	NA	E: Patient knowledge, attitude, behavior; provider knowledge, skill, behavior	No	60-79%
Cummings, 1989[113]	RCT, pre and post intervention	A: Written E: Satisfaction with curriculum, attitude, behavior (self-assessed) R: Multiple-choice, Likert scale	NA	NA	E: Patient knowledge, attitude, behavior; provider knowledge, skill, behavior	No	40-59%
Cummings, 1989[117]	RCT, post intervention only	NA	NA	NA	E: Patient knowledge, attitude, behavior; provider knowledge, skill, behavior	No	60-79%

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Curran, 2000[34]	RCT, pre and post intervention	A: Computer, by phone E: Satisfaction with curriculum, knowledge (self-reported), skill (self-assessed) R: Multiple-choice, dichotomous, Likert scale, open-ended	NA	NA	NA	Yes	>80%
Davis, 2004[101]	Non-RCT, pre and post intervention	NA	NA	C: Health plan database	NA	Yes	60-79%
Derebery, 2002[153]	Non-RCT, pre and post intervention	A: Physicians answered questions about patient management as they were guided through cases and were given feedback about their responses E: Patient management R: NR	NA	C: Health plan database	NA	No	NR
Des Marchais, 1990[61]	RCT, pre and post intervention	NA	NA	C: Interpersonal skill assessment scores	NA	NR	NR

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Dietrich, 2000[110]	RCT, pre and post intervention	A: Written E: Behavior (self-assessed) R: Likert scale	S: Observations of office availability and use of tools O: Educational program representative F: Observations of office	NA	E: Provider knowledge, skill, behavior	No	40-59%
Dormuth, 2004[15]	RCT, pre and post intervention	NA	NA	C: Health plan database	NA	No	NR
Doucet, 1998[40]	Non-RCT, some evaluations conducted pre and post intervention and some conducted post intervention only	A: Written E: Satisfaction with curriculum, knowledge (objective), clinical reasoning assessed by "Key Feature Problems" R: Multiple-choice, Likert scale	NA	NA	NA	No	60-79%
Elliott, 1997[55]	RCT, pre and post intervention	A: Written, telephone E: Knowledge (objective), attitude R: Dichotomous, Likert scale	NA	NA	E: Amount of pain	No	60-79%
Evans, 1986[56]	RCT, post intervention only	A: Written E: Knowledge (objective) R: Multiple-choice	NA	C: Chart review	E: Patient knowledge, attitude, behavior; provider knowledge, skill, behavior; patient blood pressure	No	>80%

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Fordis, 2005[42]	RCT, pre and post intervention	A: Written, computer E: Knowledge (objective) R: Multiple-choice	NA	C: Chart review	NA	No	>80%
Frush, 2006[87]	RCT, pre and post intervention	NA	S: (1) Dosing deviation from accepted dose range; (2) time requested to calculate medication doses during the management of the simulated pediatric stabilization scenario O: Pediatric emergency medicine specialist who served as the facilitator F: Artificial model	NA	NA	No	>80%
Gerbert, 2002[86]	RCT, pre and post intervention	A: Computer E: Satisfaction with curriculum, knowledge (objective), attitude R: NR	NA	NA	NA	No	<40%
Gerrity, 1999[32]	RCT, post intervention only	A: Written E: Knowledge (objective) R: NR	S: Communication skills, diagnostic and treatment skills O: Educational program representative F: Live standardized patient	NA	NA	No	60-79%

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Author, year	Study design, when evaluation conducted	Participant questionnaire Administered (A) Evaluated (E) Response options (R)	Observer assessment Skill assessed (S) Observer (O) Format (F)	Performance audit Conducted (C)	Patient assessment Evaluated (E)	Qualitative evaluation	Lowest response rate
Gerstein, 1999[53]	Non-RCT, pre and post intervention	A: Written E: Knowledge (objective), attitude, behavior (self-assessed) R: Multiple-choice, dichotomous, Likert scale	NA	NA	NA	No	<40%
Gifford, 1996[46]	RCT, post intervention only	A: Written E: Knowledge (objective), intensity of CME R: Multiple-choice, Likert scale, open-ended	NA	NA	NA	No	60-79%
Gifford, 1999[142]	RCT, post intervention only	A: Written E: Knowledge (objective), behavior (self-assessed) R: NR	NA	C: Chart review	NA	Yes	>80%
Goldberg, 2001[93]	RCT, pre and post intervention	NA	NA	C: Health plan database	NA	Yes	NR
Goldstein, 2005[146]	RCT, pre and post intervention	NA	NA	C: Chart review	NA	No	NR
Goldwater, 2001[157]	Non-RCT, post intervention only	NA	S: Clinical outcomes O: NR F: NR	NA	NA	Yes	NR
Gonzales, 1999[111]	Non-RCT, pre and post intervention	NA	NA	C: Chart review, health plan database	NA	NR	NR

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Grady, 1997[79]	RCT, pre and post intervention	A: Written E: Satisfaction with curriculum, behavior (self-assessed) R: Dichotomous, Likert scale	NA	C: Chart review	NA	No	NR
Greenberg, 1985[25]	Non-RCT, some evaluations conducted pre and post intervention and some conducted post intervention only	A: Written E: Knowledge (objective) R: Multiple-choice	S: Communication skills, decision-making skills O: Educational program representative F: Live standardized patient	C: Chart review	NA	No	<40%
Gullion, 1988[132]	RCT, pre and post intervention	NA	NA	C: Chart review	E: Patient knowledge, attitude, behavior; provider knowledge, skill, behavior; measured clinical outcomes: blood pressure and weight	No	>80%
Hagen, 2005[126]	Non-RCT, pre and post intervention	NA	NA	C: Chart review, pharmacy database	NA	No	NR

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Harris, 2002[39]	RCT, pre and post intervention	A: NR E: Satisfaction with curriculum, knowledge (self-reported), attitude, skill (self-assessed), behavior (self-assessed) R: Likert scale	NA	NA	NA	No	40-59%
Harris, 2005[75]	RCT, some evaluations conducted pre and post intervention and some conducted post intervention only	A: Written E: Satisfaction with curriculum R: Likert scale	NA	C: Chart review	NA	Yes	60-79%
Heale, 1988[66]	RCT, post intervention only	A: Written E: Satisfaction with curriculum, knowledge (objective) R: Multiple-choice, Likert scale	S: History, physician examination, investigations, communication with standardized patients in physician practice O: Standardized patients F: Live standardized patient	NA	NA	NR	40-59%
Herbert, 2004[102]	RCT, pre and post intervention	NA	NA	C: Health plan database	NA	No	40-59%

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Hergenroeder, 2002[60]	RCT, pre and post intervention	A: Written E: Satisfaction with curriculum, knowledge (objective), attitude R: Comfort level and evaluation of intervention rated using Likert scale, knowledge questions not specified	S: Procedural skills O: Trained standardized patient at baseline; study coordinator at followup exam F: Live standardized patient	NA	NA	No	60-79%
Howe, 1997[145]	Non-RCT, pre and post intervention	NA	NA	C: Chart review, Illinois Cancer Registry, and direct contact with treating physicians	NA	NR	>80%
Jennett, 1988[76]	RCT, pre and post intervention	A: Written E: Satisfaction with curriculum R: Likert scale	NA	C: Chart review	NA	No	>80%
Juzych, 2005[92]	Non-RCT, pre and post intervention	NA	NA	C: Chart review	NA	No	NR
Kemper, 2006[58]	RCT, 2 x 2 factorial design, pre and post intervention	A: NR E: Knowledge (objective), attitude, communication R: Multiple-choice, Likert scale	NA	NA	NA	No	60-79%

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Kiang, 2005[33]	Non-RCT, pre and post intervention	A: Written E: Knowledge (self-reported), attitude, clinical outcomes (self-assessed) R: Dichotomous, Likert scale	NA	NA	NA	No	60-79%
Kim, 1999[137]	RCT, pre and post intervention	NA	NA	C: Chart review	E: Provider knowledge, skill, behavior; satisfaction with provider	No	NR
Kottke, 1989[114]	RCT, pre and post intervention	A: Oral, phone survey E: Attitude, behavior (self-assessed), clinical outcomes (self-assessed) R: NR	NA	NA	E: Provider knowledge, skill, behavior	No	>80%
Kronick, 2003[71]	RCT, pre and post intervention	A: NR E: Satisfaction with curriculum, knowledge (self-reported), skill (self-assessed), behavior (self-assessed) R: NR	NA	NA	NA	Yes	60-79%
Kutcher, 2002[65]	Non-RCT, pre and post intervention	A: Written E: Knowledge (objective) R: NR	NA	C: Chart review	NA	No	>80%

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Labelle, 2004[67]	Non-RCT, pre and post intervention	A: Written E: Knowledge (objective), behavior (self-assessed) R: Multiple-choice, Likert scale, open-ended	S: Procedural skills O: NR F: Live standardized patient	NA	NA	NR	NR
Lane, 1991[69]	RCT, pre and post intervention	A: Written E: Knowledge (self-reported), skill (self-assessed), behavior (self-assessed) R: Dichotomous, Likert scale, self report of percentage of referrals	NA	NA	NA	No	60-79%
Lane, 2001[45]	Non-RCT, pre and post intervention	A: Written E: Satisfaction with curriculum, knowledge (self-reported), behavior (self-assessed), clinical outcomes (self-assessed) R: NR	NA	C: Chart review	NA	No	40-59%
Leopold, 2005[80]	RCT, pre and post intervention	A: Written E: Knowledge (self-reported), confidence R: Likert scale	S: Procedural skills O: Educational program representative F: Artificial model	NA	NA	No	NR

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Levinson, 1993[138]	RCT, pre and post intervention	NA	S: Communication skills O: Educational program representative F: Videotaped interaction with real patient	NA	NA	NR	>80%
Lewis, 1993[70]	Non-RCT, pre and post intervention	A: NR E: Satisfaction with curriculum, attitude R: NR	NA	NA	E: Provider knowledge, skill, behavior	No	60-79%
Lin, 1997[73]	Non-RCT, pre and post intervention	A: NR E: Attitude R: NR	NA	C: Chart review, pharmacy records	E: Patient knowledge, attitude, behavior; satisfaction with provider; measured symptoms of depression	No	60-79%
Lin, 2001[133]	RCT, pre and post intervention	NA	NA	C: Health plan database	NA	No	60-79%
Lindsay-McIntyre, 1987[115]	RCT, post intervention only	A: NR E: Satisfaction with curriculum R: Likert scale	NA	C: Chart review	E: Patient knowledge, attitude, behavior; provider knowledge, skill, behavior	No	NR
Lockyer, 2002[64]	Unclear, pre and post intervention	A: NR E: Knowledge (objective), attitude, behavior (self-assessed) R: Multiple-choice, dichotomous	NA	NA	NA	No	60-79%

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Maclure, 1998[96]	Non-RCT, pre and post intervention	NA	NA	C: Prescription filling records and billing information	NA	No	NR
Macrae, 2004[85]	RCT, post intervention only	A: NR E: Skill (self-assessed), critical appraisal skills measured objectively R: Likert scale, open-ended	NA	NA	NA	No	<40%
Maiman, 1988[47]	RCT, post intervention only	A: Written E: Satisfaction with curriculum, knowledge (self-reported), behavior (self-assessed) R: Dichotomous, Likert scale	NA	NA	E: Patient knowledge, attitude, behavior	Yes	>80%
Mann, 1997[52]	RCT, pre and post intervention	A: NR E: Knowledge (self-reported), knowledge (objective), attitude, behavior (self-assessed) R: Dichotomous, Likert scale, not reported for all subsets of test	NA	NA	NA	No	NR
Margolis, 2004[118]	RCT, pre and post intervention	A: NR E: NR R: NR	NA	C: Chart review	NA	No	>80%

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Maxwell, 1984[57]	Non-RCT, pre and post intervention	A: Written E: Knowledge (objective) R: Multiple-choice	NA	C: Chart review	NA	Yes	NR
Mazmanian, 1998[24]	RCT, post intervention only	A: Written E: Satisfaction with curriculum, attitude R: Likert scale	NA	NA	NA	No	<40%
Mazmanian, 2001[161]	RCT, post intervention only	A: Written E: Behavior (self-assessed), intent to change behavior (self-assessed), clinical outcomes (self-assessed) R: Dichotomous, Likert scale, open-ended	NA	NA	NA	Yes	60-79%
McBride, 2000[144]	RCT, pre and post intervention	A: Written E: Knowledge (self-reported), attitude, behavior (self-assessed) R: NR	NA	C: Chart review	E: Patient knowledge, attitude, behavior	No	>80%
McClellan, 2003[119]	RCT, pre and post intervention	NA	NA	C: Health plan database	NA	No	NR
McMahon, 1988[155]	Non-RCT, pre and post intervention	NA	NA	C: Hospital length of stay statistics	NA	No	NR
Mehler, 2005[99]	RCT, pre and post intervention	NA	NA	C: Chart review	NA	No	NR

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Meredith, 2000[51]	RCT, pre and post intervention	A: Written E: Knowledge (objective) R: Likert scale	NA	NA	NA	No	60-79%
Messina, 2002[156]	Non-RCT, pre and post intervention	NA	NA	NA	E: Patient knowledge, attitude, behavior	Yes	60-79%
Moran, 1996[121]	Non-RCT, pre and post intervention	NA	NA	C: Chart review	NA	No	NR
Mukohara, 2005[13]	RCT, pre and post intervention	A: Computer E: Amount or percentage devoted to finding answers or giving clinical guidance from published research evidence R: Multiple-choice, open-ended	NA	NA	NA	Yes	>80%
Myers, 2004[148]	RCT, pre and post intervention	A: Written E: Clinical outcomes (self-assessed) R: Dichotomous, Open-ended	NA	C: Chart review, patient specific internal chart audit form	NA	NR	<40%
Norris, 2000[81]	RCT, pre and post intervention	A: Written E: Knowledge (self-reported), knowledge (objective), attitude, skill (self-assessed), behavior (self-assessed) R: NR	NA	NA	E: Patient knowledge, attitude, behavior; provider knowledge, skill, behavior	No	>80%

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Ockene, 1996[124]	RCT, post intervention only	NA	NA	NA	E: Provider knowledge, skill, behavior	No	NR
Ozer, 2005[104]	Non-RCT, pre and post intervention	NA	NA	NA	E: Provider knowledge, skill, behavior	No	>80%
Pazirandeh, 2002[128]	Non-RCT, pre and post intervention	NA	NA	NA	E: Physician practices regarding clinical outcomes/ treatment	No	NR
Pereles, 1996[163]	RCT, post intervention only	A: NR E: Behavior (self-assessed) R: NR	NA	NA	NA	No	NR
Perera, 1983[107]	RCT, pre and post intervention	NA	NA	C: Chart review	NA	No	>80%
Pimlott, 2003[143]	RCT, pre and post intervention	NA	NA	C: Health plan database	NA	No	<40%
Pinto, 1998[74]	RCT, pre and post intervention	A: NR E: Satisfaction with curriculum, skill (self-assessed), behavior (self-assessed) R: Likert scale	NA	C: Physician self-report	E: Provider knowledge, skill, behavior; satisfaction with provider	No	60-79%
Premi J, 1993[38]	RCT, pre and post intervention	A: Written E: Knowledge (objective) R: NR	NA	NA	NA	No	60-79%

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Premi, 1994[41]	Non-RCT, pre and post intervention	A: Written E: Satisfaction with curriculum, knowledge (objective), behavior (self-assessed) R: Dichotomous	NA	NA	NA	NR	60-79%
Rabin, 1998[97]	RCT, pre and post intervention	A: Telephone E: Behavior (self-assessed) R: NR	S: Communication skills, inclusion of appropriate STD/HIV history-taking and counseling O: Simulated patient instructor F: Live standardized patient	NA	NA	No	60-79%
Rahme, 2005[100]	RCT, 2 x 2 factorial design, pre and post intervention	NA	NA	C: Chart review	NA	No	NR
Ray, 1985[20]	Non-RCT, pre and post intervention	NA	NA	C: Medicaid prescription records	NA	No	>80%
Ray, 2001[109]	RCT, pre and post intervention	A: Oral, by phone E: Patient pain, functioning, health R: Likert scale	NA	NA	E: Patient pain, functioning, health	No	>80%

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Rodney, 1986[77]	Non-RCT, pre and post intervention	A: Written, phone interview E: Knowledge (objective), skill (self-assessed), behavior (self-assessed), clinical outcomes (self-assessed) R: NR	NA	NA	NA	No	60-79%
Rosenthal, 2005[59]	RCT, post intervention only	NA	NA	NA	E: Patient knowledge, attitude, behavior, satisfaction with provider	No	>80%
Rost, 2001[22]	RCT, pre and post intervention	NA	NA	NA	E: Patient knowledge, attitude, behavior; whether the patients had received psychiatric care or not	No	>80%
Roter, 1995[84]	RCT, post intervention only	A: Written E: Skill (self-assessed), behavior (self-assessed) R: Likert scale, open-ended	S: Communication skills O: Visits were audiotaped and then coded F: Live standardized patient	NA	E: Patient knowledge, attitude, behavior	No	NR
Schectman, 1991[139]	Non-RCT, post intervention only	A: NR E: Satisfaction with curriculum, behavior (self-assessed) R: NR	NA	NA	NA	No	NR
Schectman, 1995[130]	RCT, pre and post intervention	NA	NA	C: Health plan database	NA	No	NR

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Schectman, 1996[16]	Non-RCT, pre and post intervention	NA	NA	C: Health plan database	NA	Yes	>80%
Schectman, 2003[108]	RCT, pre and post intervention	A: NR E: Satisfaction with curriculum R: NR	NA	C: Chart review	E: Patient knowledge, attitude, behavior; satisfaction with provider; measures of clinical outcome	No	NR
Schroy, 1999[82]	Non-RCT, pre and post intervention	A: NR E: Attitude, behavior (self-assessed), cues to action (such as chart or computerized reminders) R: Dichotomous, Likert scale	NA	C: Review of appointment logs at the intervention neighborhood health centers (NHCs) as well as monitoring of off-site referrals for comparison NHCs	NA	No	60-79%
Schwartzberg, 1997[98]	Non-RCT, pre and post intervention	A: Written, telephone E: Knowledge (self-reported), attitude R: Dichotomous, Likert scale, open-ended	NA	NA	NA	No	40-59%
Sharif, 2002[94]	Non-RCT, pre and post intervention	NA	NA	C: Chart review	NA	No	>80%

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Short, 2006[50]	RCT, pre and post intervention	A: Written E: Knowledge (self-reported), knowledge (objective), attitude, behavior (self-assessed) R: Multiple-choice, cases were linear with no alternative outcomes	NA	NA	NA	No	40-59%
Sibley, 1982[136]	RCT, pre and post intervention	A: Written E: Knowledge (objective) R: NR	NA	C: Chart review	NA	NR	>80%
Slotnick, 1993[17]	Non-RCT, post intervention only	A: Written E: Knowledge (objective) R: NR	NA	NA	NA	Yes	>80%
Socolar, 1998[134]	RCT, pre and post intervention	A: Written E: Knowledge (objective) R: Likert scale	NA	C: Chart review	NA	No	40-59%
Solomon, 2004[127]	RCT, pre and post intervention	NA	NA	C: Chart review	NA	No	60-79%
Soumerai, 1987[105]	RCT, pre and post intervention	NA	NA	C: Health plan database	NA	Yes	>80%
Stein, 2001[95]	RCT, pre and post intervention	NA	NA	NA	E: Provider knowledge, skill, behavior; patient health and pain	No	>80%

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Stewart, 2005[43]	RCT, pre and post intervention	A: Written E: Knowledge (objective) R: NR	NA	C: Chart review	E: Provider knowledge, skill, behavior	No	NR
Stross, 1985[116]	RCT, pre and post intervention	NA	NA	C: Chart review	NA	No	NR
Terry, 1981[49]	Non-RCT, pre and post intervention	A: Written E: Knowledge (objective), attitude, behavior (self-assessed) R: Multiple-choice	S: Communication skills, medical decision-making O: Educational program representative F: Live standardized patient, audiotaped standardized patient interaction	NA	NA	NR	<40%
Thom, 2000[129]	Non-RCT, pre and post intervention	NA	NA		E: Satisfaction with provider	NR	NR
Tziraki, 2000[141]	RCT, post intervention only	A: Written E: Attitude, behavior (self-assessed) R: NR	NA	NA	NA	No	60-79%
Wells, 2000[151]	RCT, pre and post intervention	NA	NA	NA	E: Patient knowledge, attitude, behavior; patient health outcomes (depression, QOL); utilization; quality of care; employment	No	>80%

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Author, year	Study design, when evaluation conducted	Participant questionnaire Administered (A) Evaluated (E) Response options (R)	Observer assessment Skill assessed (S) Observer (O) Format (F)	Performance audit Conducted (C)	Patient assessment Evaluated (E)	Qualitative evaluation	Lowest response rate
White, 1985[48]	RCT, pre and post intervention	A: Written E: Satisfaction with curriculum, knowledge (objective), attitude R: Multiple-choice, dichotomous	NA	C: Chart review	NA	No	NR
White, 2004[63]	RCT, pre and post intervention	A: Written E: Knowledge (objective) R: Multiple-choice	NA	NA	NA	Yes	>80%
Wilson, 1988[154]	RCT, post intervention only	NA	NA	C: Chart review	E: Patient knowledge, attitude, behavior	No	>80%
Winickoff, 1984[23]	RCT, pre and post intervention	NA	NA	C: Chart review, health plan database	NA	No	>80%
Worrall, 1999[152]	RCT, pre and post intervention	NA	NA	NA	E: NR	NR	NR
Zuckerman, 2004[18]	Non-RCT, pre and post intervention	NA	NA	C: Health plan database	NA	No	NR

CME = continuing medical education; HEDIS = Health Plan Employer Data and Information Set; NA = not applicable; NR = not reported; QOL = quality of life; RCT = randomized controlled trial; STD/HIV = sexually transmitted diseases/human immunodeficiency virus

Evidence table 10. **Effectiveness Of continuing medical education on short-term and long-term skill outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Skills Objectives Met, Evaluation Duration Not Reported									
Frush, 2006[87]	Int: Internet, not real time, Video CC: NA	Int: Lecture, case-based learning CC: NA	Int: Education was available for 3 months CC: NA	Time to determine dose	Cognitive skills	Yes	We also found a significant decrease in the time it took clinicians to determine (prescribe) a dose in the education group after having received the intervention, as compared with the control group.	The Web-based education program on the proper use of the Broselow Pediatric Resuscitation Tape could improve dosing accuracy and reduce dosing time.	Int: NR CC: NA
Kiang, 2005[33]	Int: NA CC: NA Int: Many things were made available but it is not reported as to which groups used what methods, options included live, regional meetings, CD-ROMs, mailings, grandrounds CC: NA	Int: NA CC: NA Int: Not clear CC: NA	Int: NA CC: NA Int: Not clear CC: Not clear	Responses to adult case scenarios for URI	Cognitive skills	Yes	Both Minnesota and Wisconsin clinicians improved in their responses to the adult case scenarios for URI and bronchitis. The magnitude of improvement was greater for Wisconsin clinicians, but the improvement in Wisconsin was not significant after accounting for the secular trend in Minnesota. In the pediatric case scenarios, Wisconsin clinicians improved from 1999 to 2002 ($p = 0.058$), while the responses of Minnesota clinicians were essentially unchanged ($p = 0.807$).	In conclusion, this study suggests that the WARN campaign had at least a modest positive effect on the knowledge and decision-making of primary care clinicians in Wisconsin.	Int: NA CC: NA Int: NR CC: NA

Evidence table 10. **Effectiveness Of continuing medical education on short-term and long-term skill outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Kiang, 2005[33]	Int: NA CC: NA Int: Many things were made available but it is not reported as to which groups used what methods, options included live, regional meetings, CD-ROMs, mailings, grandrounds CC: NA	Int: NA CC: NA Int: Not clear CC: NA	Int: NA CC: NA Int: Not clear CC: Not clear	Responses to questions about nonpredic-tive clinical factors and social factors	Knowl-edge Cognitive skills	Yes Yes	In Wisconsin, significant improvement occurred in the responses to the 2 questions about nonpredictive clinical factors and the social factor that may increase the likelihood of prescribing antimicrobial agents. Overall, Wisconsin clinicians demonstrated significant improvement regarding the influence of purulent nasal discharge ($p = 0.044$) and productive cough ($p = 0.010$) after accounting for temporal changes in Minnesota.	In conclusion, this study suggests that the WARN campaign had at least a modest positive effect on the knowledge and decision-making of primary care clinicians in Wisconsin.	Int: NA CC: NA Int: NR CC: NA
Gerrity, 1999[32]	Int: Live, Video, Audio, Print CC: NA	Int: Clinical experiences, Discussion group, Feedback, Lecture, Readings, Role play CC: NA	Int: Multiple time or repetitive CC: NA	Communi-cation skills for diagnosis and management of depression, as assessed by unannounc-ed standardized patients' ratings	Cognitive skills	Yes	Intervention physicians performed better than control physicians in 4 of 6 rated areas for female SP: assessing criteria of depression, suicidal ideation, and stress at home and considering diagnosis of depression. Intervention physicians performed better than control physicians in 2 of 6 rated areas for male SP: assessing stress at home and scheduling followup visit in 2 weeks.	The Depression Education Program changed physicians' behavior and may be an important component in the efforts to improve the care of depressed patients.	Int: 2-6 weeks CC: NA

Evidence table 10. **Effectiveness Of continuing medical education on short-term and long-term skill outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Andersen, 1990[36]	Int: Live, Video CC: NA	Int: Case-based learning, Lecture CC: NA	Int: One time CC: NA	Physicians' diagnostic accuracy for psychiatric conditions, as measured by pre and post-tests incorporating multiple clinical vignettes	Knowl-edge Cognitive skills	Yes Yes	Compared with control, intervention physicians had significantly better post-test composite scores for affective and anxiety disorders; differences significant in 2 of 4 affective disorders (major depression and dysthymic disorder but not depression with psychotic features or bipolar), no specific anxiety disorders (0 of 4), and no somatic disorders. Pre-test scores negatively correlated with improvement in accuracy (more improvement on incorrect pre-test cases).	A brief, single-session intervention can have an impact on physicians' psychiatric diagnostic abilities. Additionally, physicians participating in the intervention were more likely to refer psychiatric patients.	Int: 1-8 weeks CC: NA

Evidence table 10. **Effectiveness Of continuing medical education on short-term and long-term skill outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Skills Objectives Met, Evaluation Duration Greater Than 30 Days									
Macrae, 2004[85]	Int: Print CC: Print	Int: Readings, Listserv discussion group with moderator CC: Readings	Int: Multiple time or repetitive CC: Multiple time or repetitive	Skills for critically appraising articles, as measured by examination	Cognitive skills	Yes	In general, surgeons in the intervention group performed better on the test of critical appraisal than did those in the control group (with mean examination scores of 58%+-8 AND 50% +-8, respectively, t=3.92, p<0.0001).	"The results of the trial suggest that the intervention was effective in enhancing critical appraisal skills. The effect size seen in this trial was quite large. In this case, the mean of the treatment group was a full standard deviation higher than the mean of the control group. Despite the large number of potential sources of variation, a large proportion of the variance was accounted for by the training condition (intervention or control group) alone. Thus, enhancing critical appraisal skills in the medical community at large likely is of value, and complements other sources in ensuring high levels of evidence-based care. This study is one of the first in the literature to show that it is possible to enhance the critical appraisal skills of practicing physicians with a targeted, Internet-based intervention that can be undertaken in one's own practice setting."	Int: 6 weeks CC: 6 weeks

Evidence table 10. **Effectiveness Of continuing medical education on short-term and long-term skill outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Gerbert, 2002[86]	Int: Internet, not real time CC: NA	Int: Case-based learning, Feedback, Programmed learning, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Diagnosis and evaluation planning of skin cancer	Cognitive skills	Yes	Overall diagnosis and evaluation planning showed significantly greater improvement from pretest to posttest I comparing the intervention to the control group. There was still greater improvement maintained by posttest II, but only in 5 of 9 outcomes.	"The intervention-group physicians in this study significantly improved in nine of the 14 outcomes, including their overall diagnosis and overall evaluation planning."	Int: 8 weeks CC: 8 weeks

Evidence table 10. **Effectiveness Of continuing medical education on short-term and long-term skill outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Doucet, 1998[40]	Int: Live CC: Live	Int: Problem-based learning or team-based learning CC: Discussion group, Lecture	Int: Multiple time or repetitive CC: One time	The Key Feature Problems examination (evaluation of clinical reasoning skills)	Knowledge Cognitive skills	Yes Yes	Whereas those enrolled in the lecture group had a mean score of 28 (SD = 5.23), participants of the PBL group had a mean examination score of 34.76 (SD = 5.96). This represents a 25% difference, deemed educationally significant. The difference in scores between the intervention and control groups was highly statistically significant (p = 0.001).	"Tests of knowledge acquisition and the KFP tests of clinical reasoning skills indicated that the PBL group benefited more than the lecture group. In addition, physicians participating in the PBL sessions enjoyed the interactive approach and rated the program more highly. Participants in the PBL group rated the program sessions more favorably than did their counterparts in the lecture group across seven of the nine program dimensions. However, physicians in the lecture group did report that the program held their interest, contributed to their knowledge and skills and provided content useful to their practice. Physicians in the lecture group also agreed that the facilitators presented the concepts effectively, but were less inclined to agree that the discussion component of the lecture enhanced their learning."	Int: 3 months CC: 3 months

Evidence table 10. **Effectiveness Of continuing medical education on short-term and long-term skill outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Brown, 1999[72]	Int: Live CC: NA	Int: Clinical experiences, Discussion group, Lecture, Role play, Clinicians audiotaped interaction with patients and listened between workshops CC: NA	Int: Multiple time or repetitive CC: NA	Self-assessment of clinicians' communi-cation skills, attitudes, and behavior, as measured by participant question-naire	Attitudes Skills (psycho motor or procedur-al skills) Practice behavior	Yes Yes Yes	Intervention group noted substantial improvements compared with control in 8 of 24 skills / attitudes / behaviors: awareness of and confidence in dealing with patients whom they found difficult; abilities to compliment patients' efforts, ask open-ended questions, address psychosocial factors, express empathy and reassurance, and clarify expectations. 33% of clinicians reported that fewer than 5% of visits were frustrating after the program (compared with 21% of clinicians at baseline). Three months after the program, clinicians in the intervention group reported that it had improved communication with patients. On average, however, the scores for clinicians' rating of improvement in patient satisfaction and improvement in clinicians' personal satisfaction in their work decreased below the midpoint on the five-point scale (mean rating, 2.85 for both items).	"Thriving in a Busy Practice: Physician-Patient Communication," a typical continuing medical education program geared toward developing clinicians' communication skills, is not effective in improving general patient satisfaction. To improve global visit satisfaction, communication skills training programs may need to be longer and more intensive, teach a broader range of skills, and provide ongoing performance feedback.	Int: >=6 months CC: NA

Evidence table 10. **Effectiveness Of continuing medical education on short-term and long-term skill outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Roter, 1995[84]	Int: Live Int: Live CC: NA	Int: Discussion group, Lecture, Role play, Standardized patient Int: Discussion group, Lecture, Role play, Standardized patient CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NA	Physician use of emotion handling and problem defining skills measured from the audiotape analysis and simulated patients	Cognitive skills	Yes	Emotion handling group used significantly more EH skills than control group; PD group fell in between. Problem defining group used significantly more PD behaviors than the control group with EH group falling between.	Physicians' use of communication skills in their practices changed as a result of an 8-hour CME program. Physicians trained in specific communication skills recognized more psychological problems in their patients than did untrained physicians. Trained physicians showed greater clinical proficiency in the management of a simulated patient compared with control group physicians. The patients of trained physicians compared with untrained physicians showed greater reduction in emotional distress for as long as 6 months after their medical visit.	Int: Participant questionnaire was conducted in between sessions. When the simulated patient occurred was not reported. The last patient assessment was 6 months after their audiotaped visit, which occurred during the CME

Evidence table 10. **Effectiveness Of continuing medical education on short-term and long-term skill outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Roter, 1995[84]	Int: Live Int: Live CC: NA	Int: Discussion group, Lecture, Role play, Standardized patient Int: Discussion group, Lecture, Role play, Standardized patient CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NA	Recognition & management of emotional problems	Cognitive skills	Yes	Recognition of emotional problems and distress was higher among PD physicians than among control physicians. PD physicians also used more management strategies for emotional problems than control group (p=0.03). EH physicians were not significantly different than control physicians in terms of recognizing emotional problems & distress (p=0.18) and using any of the management strategies.	Physicians' use of communication skills in their practices changed as a result of an 8-hour CME program. Physicians trained in specific communication skills recognized more psychological problems in their patients than did untrained physicians. Trained physicians showed greater clinical proficiency in the management of a simulated patient compared with control group physicians. The patients of trained physicians compared with untrained physicians showed greater reduction in emotional distress for as long as 6 months after their medical visit.	Int: Participant questionnaire was conducted in between sessions. When the simulated patient occurred was not reported. The last patient assessment was 6 months after their audiotaped visit, which occurred during the CME

Evidence table 10. **Effectiveness Of continuing medical education on short-term and long-term skill outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Roter, 1995[84]	Int: Live Int: Live CC: NA	Int: Discussion group, Lecture, Role play, Standardized patient Int: Discussion group, Lecture, Role play, Standardized patient CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NA	Clinical proficiency	Cognitive skills	Yes	PD physicians had significantly higher scores than the control group. EH physicians had slightly higher scores than control, but the difference was not statistically significant.	Physicians' use of communication skills in their practices changed as a result of an 8-hour CME program. Physicians trained in specific communication skills recognized more psychological problems in their patients than did untrained physicians. Trained physicians showed greater clinical proficiency in the management of a simulated patient compared with control group physicians. The patients of trained physicians compared with untrained physicians showed greater reduction in emotional distress for as long as 6 months after their medical visit.	Int: Participant questionnaire was conducted in between sessions. When the simulated patient occurred was Not reported. The last patient assessment was 6 months after their audiotaped visit, which occurred during the CME

Evidence table 10. **Effectiveness Of continuing medical education on short-term and long-term skill outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Terry, 1981[49]	Int: Live, Audio, Print Int: Live, Audio, Print Int: Audio, Print Int: Live, Audio, Print CC: Audio, Print	Int: Case-based learning, Discussion group, Feedback Lecture, Readings Int: Case-based learning, Discussion group, Lecture, Readings Int: Case-based learning, Feedback, Lecture, Readings Int: Case-based learning, Lecture, Readings CC: Case-based learning, Lecture, Readings	Int: Multiple time or repetitive Int: Multiple time or repetitive Int: Multiple time or repetitive Int: Multiple time or repetitive CC: Multiple time or repetitive	Knowledge and judgment in COPD manage-ment, as measured by self-assessment question-naires at baseline, 8 months, and 18 months	Knowl-edge Cognitive skills	Yes Yes	Intervention groups showed a 23% significant increase in scores on posttest 1 to match those of pulmonologists, while there was no improvement for control groups (p>0.05 for group differences). Intervention groups receiving feedback had similar scores on posttest 2 to intervention groups not receiving feedback. Among intervention physicians who did not agree to participate in standardized patients, posttest scores dropped to baseline.	Physicians completing a home study AV program increased knowledge about diagnosis and treatment of COPD, but their behavior in simulated exercises was not different from controls. Experimental group physicians did use more patient-education and smoking cessation information during patient visits. Group meetings for needs assessment and feedback (given 2 weeks after tests) had no apparent effect beyond the audiovisual materials.	Int: 6 months Int: 6 months Int: 6 months Int: 6 months CC: 6 months
Skills Objectives Not Met, Evaluation Duration Not Reported									
Muko-hara, 2005[13]	Int: Computer-based off-line CC: Computer-based off-line	Int: Readings CC: Readings	Int: Multiple time or repetitive CC: Multiple time or repetitive	Frequency of finding answers to clinical questions	Cognitive skills	No	By the end of the 3-month trial, there were no significant differences within or between the WBJC and control groups in the frequency of finding an answer to clinical questions.	While doctors appreciated these summaries, which improved their reading efficiency, the intervention had little impact on their use of research evidence in practice.	Int: NR CC: NR

Evidence table 10. **Effectiveness Of continuing medical education on short-term and long-term skill outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Skills Objectives Not Met, Evaluation Duration Greater Than 30 Days									
Rodney, 1986[77]	Int: Live, Video Int: Live, Video CC: NA	Int: Demonstration, Lecture, Simulation (other than standardized patient or role-play) Int: Demonstration, Lecture, Simulation (other than standardized patient or role-play) CC: NA	Int: One time Int: One time CC: NA	Behavior related to flexible sigmoidos-copy use, as measured by phone or written survey	Attitudes Cognitive skills Practice behavior	Yes No Yes	Small group learners were more likely to acquire additional training and teaching attachments for their sigmoidoscopes, and less likely to use small (35 cm) scopes; there was no difference in biopsy utilization. 90% of large group learners acquired scopes after training vs. 40-56% of small groups. Small groups were associated with shorter procedure times (p<0.05) for first 10 procedures, but otherwise no differences in times, insertion depths, or number of exams performed. Compared to a randomly surveyed group of physicians, those with CME were significantly more likely to perform flexible sigmoidoscopy.	Physicians who participate in courses in flexible sigmoidoscopy have a higher probability of office utilization of these skills than those who do not take courses. Minimal differences found between large and small group CME formats.	Int: 12-18 months Int: 12-18 months CC: NA

Evidence table 10. **Effectiveness Of continuing medical education on short-term and long-term skill outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Skills Objectives With Mixed Results, Evaluation Duration Greater Than 30 Days									
Carney, 1995[88]	Int: Live, Video CC: NA	Int: Demonstration, Discussion group, Feedback, Lecture Programmed learning, Role play CC: NA	Int: One time CC: NA	Which CME techniques had the greatest effect on physician cancer screening and prevention counseling skills	Cognitive skills Practice behavior	Mixed Mixed	Performance of intervention physicians was consistently better though only 4 of 19 measured endpoints of the physicians' behavior by the SP reached statistical significance.	Performance based CME techniques have a positive influence on physicians' performance (especially in skills training). Using unannounced standardized patients is a feasible method to assess performance within the practice environment.	Int: 1 year CC: NA

Evidence table 10. **Effectiveness Of continuing medical education on short-term and long-term skill outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Skills Objectives With No Control Group, Evaluation Duration Not Reported									
Leopold, 2005[80]	Int: Print Int: Computer-based off-line Int: Live	Int: Readings Int: Demonstration, Readings Int: Demonstration, Feedback, Mentor/Preceptor, Simulation (other than standardized patient or role-play)	Int: NA Int: NA Int: One time	Competence in task	Skills (psychomotor or procedural skills)	No control group	Before the instruction, competence skills did not differ between the three randomized groups. After the instruction, competence skills increased for all groups.	Even low-intensity forms of instruction improve individuals' confidence, competence, and self-assessment of their skill in performing the fairly straightforward psychomotor task of simulated knee injection. However, men and physicians disproportionately overestimated their skills both before and after training, a finding that worsened as confidence increased. The inverse relationship between confidence and competence that we observed before the educational intervention as well as the demographic differences that we noted should raise questions about how complex new procedures should be introduced and when self-trained practitioners should begin to perform them.	Int: NR Int: NR Int: NR

Evidence table 10. **Effectiveness Of continuing medical education on short-term and long-term skill outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Hergen roeder, 2002[60]	Int: Video, Print Int: Live, Video, Print	Int: Demonstration Int: Demonstration, Feedback, Simulation (other than standardized patient or role-play)	Int: One time Int: One time	Physician skills in performing a physical exam	Skills (psycho motor or procedur-al skills)	No con-trol group	There was a statistically significant increase between baseline and followup in clinical skills assessment examination scores for both intervention groups, and there was a significant difference between the groups at followup.	"This study demonstrated that improvements in physicians' knowledge and skills in performing ankle and knee physical examinations were associated with the physicians' participation in either intervention. The improvements in physicians' knowledge and skills in the ankle and knee examinations were greater in the videotape plus skills intervention group than in the videotape-alone group."	Int: NR Int: NR

AV = audiovisual; CC = concurrent control; CME = continuing medical education; COPD = chronic obstructive pulmonary disease; EH = emotion handling; Int =intervention group; KFP = Key Features Problems; NA = not applicable; NR = not reported; PBL = problem-based learning; PD = problem defining; SD = standard deviation; SP = standardized patient; URI = upper respiratory infection; WARN = Wisconsin Antibiotic Resistance Network

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Practice Behavior Objectives Met, Evaluation Duration Not Reported									
Frush, 2006[87]	Int: Internet, not real time, Video CC: NA	Int: Lecture, Simulated scenario CC: NA	Int: Education was available for 3 months CC: NA	Dosing deviation from accepted dose range	Practice behavior	Yes	In this randomized, controlled clinical trial, we found a significant reduction in medication dosing deviation when emergency providers received education about proper use of one resuscitation aid (the Broselow Pediatric Resuscitation Tape) as compared with no education being offered.	The Web-based education program on the proper use of the Broselow Pediatric Resuscitation Tape could improve dosing accuracy and reduce dosing time.	Int: NR CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Juzych, 2005[92]	Int: Live, Print CC: NA	Int: Case-based learning, Lecture, Readings CC: NA	Int: Single half day session CC: NA	Prescription rates of antibiotics	Practice behavior	Yes	Among physicians in the intervention population, the overall prescribing rates of antibiotics declined 24.6% from 49.9% to 37.6% (P<.0001). Between the control and intervention groups, the decline in prescribing rates for antibiotics was significant (P<.0001). Statistically significant declines in prescribing of antibiotics were seen among physicians in the intervention group for pharyngitis (P=.007), otitis media (P=.001), and URIsnos (P=.001). For bronchitis, there was no significant change in prescribing of antibiotics in the intervention group (P=.84).	This study suggests that an educational intervention on appropriate antibiotic use reduced antibiotic use in treating uncomplicated URIs. A significant difference in changes in prescribing rates between the intervention and control populations was found only for URIsnos. This confirms previous studies of educational interventions to reduce antimicrobial use in treating URIs and demonstrates that a meaningful reduction is achievable when the program is applied to all staff members at a Medicaid HMO. Educational efforts to improve prescribing of antibiotics for treating uncomplicated viral URIs should be expanded, and should include all health care staff. Such programs should provide physicians and staff with the tools to diagnose URIs appropriately and teach them how to convey to patients why antimicrobials may not be appropriate.	Int: NR CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Bloom-field, 2005[68]	Int: Live, Print, Patient letter prompting patient to discuss with provider about letter contents (treatment) Int: Live, Print, Chart reminders appearing on cover page of patient's computerized medical record Int: Live, Print, Progress notes reminding primary care clinician about appropriate approach CC: NA	Int: Discussion group, Lecture, Patient informs provider Int: Discussion group, Lecture, Point of care Int: Discussion group, Lecture, Point of care CC: NA	Int: One time Int: One time Int: One time CC: NA	Prescription rates	Practice behavior	Yes	The prescription rate at the control sites did not change between the two time periods (pre-intervention period 18.9%, intervention period, 17.7%, p=0.19), but it increased from 8.3% to 39.1% (OR=6.5, 95% CI 5.2 to 8.2, p=0.0001) at the intervention sites. There was a significant interaction between group and time period (p=0.0001). The adjusted odds of receiving a prescription during the intervention period was 3.1 times higher at the intervention sites than at the control sites (95% CI 2.1 to 4.7). Overall, there was no statistically significant difference in prescription rates among the three prompt groups (40.7% for progress notes, 36.9% for patient letters, and 39.4% for reminders, p=0.60). However, there was a significant interaction between group and site, indicating that the efficacy of the prompts differed by site.	In conclusion, this study shows that a relatively simple intervention (an educational workshop, opinion leader influence and prompts) based on a theoretical model of provider behavior, which is designed to address empirically identified barriers, can result in substantial improvement in provider prescription behavior.	Int: NR Int: NR Int: NR CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Dor-muth, 2004[15]	Int: Print CC: Print	Int: Readings CC: Readings	Int: Multiple time or repetitive CC: Multiple time or repetitive	Proportion receiving drugs recom-mended from letter	Practice behavior	Yes	A significant change was observed in the proportion of newly treated patients receiving the analysis drugs as first-line therapy. The preference for the analysis drugs was 1.3 times more in the predicted direction in the intervention group of physicians than in the control group (95% CI: 1.13–1.52).	The results of this randomized controlled trial demonstrate a significant change in prescribing to newly treated patients when the impact of a series of 12 letters was subjected to a combined analysis. We conclude that printed letters distributed as an ongoing series from a credible and trusted source can have a clinically significant impact on prescribing to newly treated patients.	Int: NR CC: NR
Gold-berg, 2001[93]	Int: Live, Video, Print CC: NA	Int: Academic detailing, Discussion group, Lecture CC: NA	Int: Multiple time or repetitive CC: NA	Quarterly observations of surgical rates	Practice behavior	Yes	After the intervention, the rates of surgery went down in the intervention group practices, while rates went up in the control group practices. Reduction in surgical rate: 8.9% (p=0.01)	After implementation of the intervention, surgery rates declined in the intervention communities but increased slightly in the control communities. The net effect of the intervention is estimated to be a decline of 20.9 operations per 100,000, a relative reduction of 8.9% (P = 0.01). Conclusion. We were able to use scientific evidence to engender voluntary change in back pain practice patterns across entire communities.	Int: NA CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Gerrity, 1999[32]	Int: Live, Video, Audio, Print CC: NA	Int: Clinical experiences, Discussion group, Feedback, Lecture, Readings, Role play CC: NA	Int: Multiple time or repetitive CC: NA	Participatory decision making	Practice behavior	Yes	Intervention physicians scored higher than control physicians on the Participatory Decision-Making Scale (p=.017 and p=.014 in two SP cases).	The Depression Education Program changed physicians' behavior and may be an important component in the efforts to improve the care of depressed patients.	Int: 2-6 weeks CC: NA
Grady, 1997[79]	CC: Live, Print Int: Live, Print Int: Live, Print	CC: Lecture, Readings Int: Lecture, Point of care, Readings Int: Feedback, Lecture, Point of care, Readings Financial reward for compliance	CC: One time Int: Multiple time or repetitive Int: Multiple time or repetitive	Effect of intervention on mammography referral, completion, and compliance rates at the practice level	Practice behavior	Yes	Mammography referral, completion and compliance were all higher at one year at the experimental groups (i.e. cue) than at the control groups. However, no significant difference was seen between the two experimental groups (i.e. no extra effect from feedback and rewards).	Cueing (posters and chart stickers) had a positive impact on mammography referral, completion, and compliance above and beyond education only. However, there was no added benefit from feedback and financial rewards for compliance. In addition, physician acceptance of the interventions was marginal. There also appears to be a complex impact of the physician characteristics on the results of the intervention	CC: NR Int: NR Int: NR

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Grady, 1997[79]	CC: Live, Print Int: Live, Print Int: Live, Print	CC: Lecture, Readings Int: Lecture, Point of care, Readings Int: Feedback, Lecture, Point of care, Readings Financial reward for compliance	CC: One time Int: Multiple time or repetitive Int: Multiple time or repetitive	Impact of interventions at the physician level	Practice behavior	Yes	Same result as above-the pattern was the same for physicians	Cueing (posters and chart stickers) had a positive impact on mammography referral, completion, and compliance above and beyond education only. However, there was no added benefit from feedback and financial rewards for compliance. In addition, physician acceptance of the interventions was marginal. There also appears to be a complex impact of the physician characteristics on the results of the intervention	CC: NR Int: NR Int: NR
Costanza, 1992[35]	Int: Live, Print CC: NA	Int: Discussion group, Lecture, Point of care, Simulation (other than standardized patient or role-play) CC: NA	Int: Multiple time or repetitive CC: NA	Physician's self report of screening practice changes	Practice behavior	Yes	An adjusted odds ratio of 7.85 was obtained when comparing the improvement in self-reported screening behavior among physicians in the intervention group to that in the control group.	This study demonstrates that primary care physicians will change their screening practice in response to interventions aimed at altering beliefs regarding mammography benefits or to barriers and their sense of consensus development.	Int: NR CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Lane, 1991[69]	Int: Live, Print	Int: Audience response systems, Clinical experiences, Demonstration, Discussion group, Feedback, Lecture, Mentor/Preceptor, Readings	Int: Multiple time or repetitive	Change in mammography referrals	Practice behavior	Yes	Physicians across specialties reported an increase in mammography screening referrals.	Physicians in the interventions reported (self) an increase in the number of mammography referrals.	Int: NR
	Int: Live, Print	Int: Audience response systems, Clinical experiences, Demonstration, Discussion group, Feedback, Lecture, Mentor/Preceptor, Readings	Int: Multiple time or repetitive						Int: NR
	Int: NA	Int: NA	Int: No CME intervention, just free mammography						Int: NA
	CC: NA	CC: NA	CC: NA						CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Ander-sen, 1990[36]	Int: Live, Video CC: NA	Int: Case-based learning Lecture CC: NA	Int: One time CC: NA	Physicians' treatment recommend-ations for psychiatric conditions, as measured by pre- and post-tests incorporating multiple case vignettes	Attitudes Practice behavior	Yes Yes	Compared with control, intervention physicians were significantly more inclined to refer patients to mental health professional and less inclined to treat them in primary care. Referral was high on pretest for both groups, but experimental group showed increase for 6 of 7 (1 tie) disorders while control did for 2 of 5 (3 ties). For medication, there were no significant effects. For behavioral therapy, there were significant increases for intervention group.	A brief, single-session intervention can have an impact on physicians' psychiatric diagnostic abilities. Additionally, physicians participating in the intervention were more likely to refer psychiatric patients.	Int: 1-8 weeks CC: NA
Practice Behavior Objectives Met, Evaluation Duration Less Than or Equal to 30 Days									
Sharif, 2002[94]	Int: Live CC: NA	Int: Lecture, Role play CC: NA	Int: One time CC: NA	Smoking cessation behavior and documenta-tion, as measured by standardized chart abstraction of medical records for all scheduled visits 3 weeks before and 3 weeks after workshop training	Practice behavior	Yes	Posttraining, workshop attendees were significantly more likely to do 3 of 6 behaviors: inquire about parental smoking status (RR 3.06, 1.86-4.87), to identify smokers (RR 8.89, 2.79-28.40), and to offer advice about the effects of environmental tobacco smoke exposure (RR 2.33, 1.15-4.72).	AAPP physician training in smoking cessation counseling was effective in changing physician behavior at this institution	Int: 3 weeks CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Practice Behavior Objectives Met, Evaluation Duration Greater Than 30 Days									
Stein, 2001[95]	Int: Live, Handheld, By phone CC: NA	Int: Readings, study physician visit, algorithm CC: NA	Int: Multiple time or repetitive CC: NA	Amount of NSAID use before and after the intervention	Practice behavior	Yes	The intervention resulted in fewer NSAIDS and more acetaminophen being used in the intervention homes (p=0.0001).	An educational intervention effectively reduced NSAID use in nursing homes without worsening of arthritis pain.	Int: 3 months CC: NA
Maclure, 1998[96]	CC: NA Int: Live, Video CC: NA Int: Live CC: NA Int: Print	CC: NA Int: Lecture, teleconference CC: NA Int: Discussion group, Lecture CC: NA Int: Readings	CC: NA Int: One time CC: NA Int: NR CC: NA Int: Multiple time or repetitive	Pooled impact of all three interventions	Practice behavior	Yes	There was a statistically significant decrease in the prescription of calcium channel blockers (and an increase in the prescription of diuretics) Increase in preference for thiazides by a factor of 1.28 (95% CI 1.02-1.61), and decrease in preference for CCBs by 0.64 (95% CI 0.41-1.0).	There was a general trend toward the desired effect by the educational interventions.	CC: 3 months Int: 3 months CC: 3 months Int: 3 months CC: 3 months Int: 3 months
Rabin, 1998[97]	CC: NA Int: Print Int: Live, Print	CC: NA Int: Readings Int: Readings, Standardized patient	CC: NA Int: NR Int: Multiple time or repetitive	Simulated patient evaluation of physician practice 3 months after the intervention	Practice behavior	Yes	The simulated patient assessment showed significant improvement in physician behaviors related to STD risk in patients in the physician group who received simulated patient instruction during the intervention. There was no significant difference between the education material only group and the control group.	Simulated patient instructors did improve performance relative to no intervention and educational materials only. However, there were still deficiencies in performance which led to the subsequent train-the-trainers intervention that was the focus of the second part of the article.	CC: NA Int: 3 months Int: 3 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Rabin, 1998[97]	CC: NA Int: Print Int: Live, Print	CC: NA Int: Readings Int: Readings, Standardized patient	CC: NA Int: NR Int: Multiple time or repetitive	Physician self-report of practice behaviors	Practice behavior	Yes	Physicians in the educational materials only group did not improve relative to controls. However, physicians who were in the simulated patient groups did show significant improvement in self-rated behaviors relative to the other two groups.	Simulated patient instructors did improve performance relative to no intervention and educational materials only. However, there were still deficiencies in performance which led to the subsequent train-the-trainers intervention that was the focus of the second part of the article.	CC: NA Int: 3 months Int: 3 months
Schwartzberg, 1997[98]	CC: NA Int: Live, Print	CC: NA Int: Case-based learning, Lecture, Readings	CC: NA Int: One time	Physician self-report of home care activity in their practice	Practice behavior	Yes	Physicians in the IG were statistically significantly more likely to report making house calls, referred to community agencies, and changed their office practice at 3 months.	The seminars improved physicians' attitudes toward home care, and provided a change in practice behaviors regarding home care at 3 months relative to controls.	CC: NA Int: 3 months
Lewis, 1993[70]	Int: Live, Video Int: Print CC: NA	Int: Discussion group, Lecture Int: Readings CC: NA	Int: One time Int: One time CC: NA	Percentages of new patients reporting they were asked sexual history questions by their physicians (internists)	Practice behavior	Yes	There was a statistically significant increase in the proportion of new patients seen by internists at the experimental site who reported being asked sexual history questions.	These results suggest that a medical education program that goes beyond standard lectures and incorporates interactive formats can change physician behaviors.	Int: 3 months Int: 3 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Mehler, 2005[99]	Int: Internet, not real time, Print Int: Live, Print CC: NA	Int: Academic detailing, Readings Int: Academic detailing, Lecture CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NA	Likelihood of lipid testing	Practice behavior	Yes	They observed a 3.0 (1.62-5.66) times greater likelihood of lipid testing in the electronic group compared with the control group, adjusting for type of site and race. There was a moderate difference between the direct group and control group (P=.09); however, there was no evidence of a difference between the electronic and direct groups (P=.17). Last, the change in the proportion of patients experiencing at least one of the favorable provider actions for the pre- and post-intervention periods was significantly greater in the combined direct and electronic groups versus control (P=.01).	A simple educational intervention seems to positively influence provider behavior in the area of lipid management in diabetes mellitus. Both electronic and direct detailing seem to be viable approaches. Future studies to determine optimal educational components that facilitate appropriate provider actions to initiate or intensify lipid treatment seem warranted given the burgeoning population of diabetic patients at risk for coronary heart disease morbidity and mortality.	Int: 3 months Int: 3 months CC: 3 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Rahme, 2005[100]	Int: Live, Print Int: Live Int: Print CC: NA	Int: Discussion group, Lecture, Readings Int: Discussion group, Lecture Int: Readings CC: NA	Int: One time Int: One time Int: NA CC: NA	Evaluation of NSAIDS, COX_2 inhibitors and acetamino-phen dispensed prescriptions	Practice behavior	Yes	There was a greater improvement in scores for both NSAIDs and COX-2 inhibitors and an increase in the number of acetaminophen prescriptions in the workshop groups over the control & decision tree groups. The Bayesian hierarchical model showed that there were improvements in all groups over time, with stronger evidence in the workshop & tree group. The adjusted odds (95% CI) of adequate prescribing in the post- versus pre-intervention periods in the workshop & tree group was 1.8 (1.3, 2.4). This odds was higher than that found in the control group 1.3 (0.9, 1.8); but, the odds ratio, 1.5 (0.9, 2.3), indicated only moderate evidence for the workshop & tree group over control.	In summary, this study found some weak evidence that an educational package in which the general practitioner shows an opportunity to discuss related issues can be more effective in changing prescribing practices compared with the distribution of guidelines. Physician attendance is, perhaps, key to the success of any interactive intervention.	Int: 5 months Int: 5 months Int: 5 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Davis, 2004[101]	Int: Live, Video, Audio, Audio teleconferencing CC: NA	Int: Case-based learning, Discussion group, Problem-based learning or team-based learning CC: NA	Int: Multiple time or repetitive CC: NA	Change in prescribing patterns with respect to use of LTRAs	Practice behavior	Yes	A statistically significant ($p<0.005$) increase in LTRAs were prescribed by study physicians after the intervention compared to before the intervention while no statistically significant change in prescribing patterns of LTRAs was experienced by control physicians.	We report the first PBL-style teleconference series to demonstrate a significant change in physician prescribing habits toward better concordance with current asthma guidelines. This study demonstrated the powerful impact that the PBL format has on physician learning that actually translated into action—a measurable change in beliefs and behavior that led to changes in the number of prescriptions written by the participants. Although standard, traditional, didactic lectures remain the norm for CME across the US and credits are given for attendance, many studies have now shown that PBL is actually more effective at enhancing physicians learning. In the US, CME offices should plan more small-group workshops or teleconferences integrating the PBL format, with skilled facilitators trained to develop the cases and moderate the sessions, ultimately to improve the quality of CME in the US.	Int: 6 months CC: 6 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Herbert, 2004[102]	Int: Live	Int: Case-based learning, Clinical experiences, Demonstration, Discussion group, Problem-based learning or team-based learning, Readings	Int: One time	Physician prescribing preference.	Practice behavior	Yes	In the 6 months following the intervention module, physicians' preference for thiazides increased by 6.8% (95% CI: 2.2%, 11.5%) after controlling for the control group's preference. The portrait was similarly associated with a 6.5% increase in preference for thiazides (95% CI: 1.8%, 11.1%). The group of physicians who received both interventions had an 11.5% increase in preference (95% CI: 4%, 18.9%).	"This study demonstrated that educational interventions with clear messages can lead to meaningful changes in physician prescribing behavior. In this trial, both interventions were associated with significant absolute increases in the use of thiazides as first-line therapy for hypertension—modules (6.8%) and portraits (6.5%). The combined intervention, consisting of both the educational module and portrait, had the strongest impact (11.5%)."	Int: 6 months
	Int: Live	Int: Clinical experiences, Feedback, Readings	Int: One time						Int: 6 months
	Int: Live	Int: Case-based learning, Clinical experiences, Demonstration, Discussion group, Problem-based learning or team-based learning	Int: One time						Int: 6 months
	CC: Live	CC: NA	CC: One time						CC: 6 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Beaulieu, 2004[44]	Int: Live, Print Int: Live Int: Print CC: NA	Int: Case-based learning, Discussion, group, Problem-based learning or team-based learning, Programmed learning, Readings Int: Case-based learning, Discussion group, Problem-based learning or team-based learning, Readings Int: Discussion group, Programmed learning, Readings CC: NA	Int: One time Int: One time Int: One time CC: NA	Medication prescriptions	Practice behavior	Yes	In ITT analysis, there was an adjusted statistically significant 8% improvement (p=0.003) on mean scores (scores to evaluate impact on medication prescription) between both the control group and the workshop and workshop and decision tree groups combined. (PP analysis showed a 12% improvement (p=0.008)).	"The results of the initial evaluations have demonstrated that these evidence-based interventions were successful not only in improving physicians' knowledge regarding the diagnosis and management of OA, but also—more importantly—in changing their behavior to make more appropriate therapy choices for their patients. The observed modification of their prescription patterns reflects an improvement in their medical practice, which may lead to better patient outcomes and generate greater cost efficiencies for the health care system."	Int: 6 months Int: 6 months Int: 6 months CC: 6 months
Cohn, 2002[19]	Int: Live, Print Int: Live, Print CC: NA	Int: Academic detailing Int: Academic detailing CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NA	Provider practices	Practice behavior	Yes	Data show evidence that the intervention group providers improved their practices about asking about DES while the control group didn't improve. No mention of statistical significance was made.	"Academic detailing can increase DES knowledge and history taking among primary care providers."	Int: 3-6 months Int: 3-6 months CC: 3-6 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Lane, 2001[45]	Int: Live CC: NA	Int: Lecture, Standardized patient CC: NA	Int: One time CC: NA	One main outcome measure was whether or not physicians referred 90-100% of women over age 50 to get a mammogram every 1-2 years. The other main outcome was a reduction in the score of needing the CME activity (improved knowledge and understanding)	Knowledge Practice behavior	Yes Yes	There was improvement in the need for CME scores of more physicians in the intervention group than the control group. The intervention significantly improved knowledge and behaviors about breast cancer screening practices.	Participation in the CME activity improved physicians' awareness, knowledge, and behaviors regarding clinical breast exams and breast cancer screening practices, as compared to a control group.	Int: 6 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Norris, 2000[81]	Int: Live, Print, F/U phone calls about protocol CC: NA	Int: Lecture, Point of care, Opinion-leader from clinic teaching CC: NA	Int: Multiple time or repetitive CC: NA	Physician behavior in counseling patients about physical activity, as reported on patient question-naire	Practice behavior	Yes	Both intervention and control physicians asked and counseled about physical activity more frequently at 6-month follow-up, but the increase was significantly higher for intervention providers (p=0.001). Inquiring change from baseline to f/u: intervention 48->79% vs. control 64->64% inquiring. Counseling change from baseline to followup: intervention 42->94% vs. control 55->81%.	"A one-time PACE counseling session with minimal reinforcement, in a setting with high baseline levels of activity, does not further increase activity ... Contemplators advanced in stage of behavior change."	Int: 6 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Brown, 1999[72]	Int: Live CC: NA	Int: Clinical experiences, Discussion group, Lecture, Role play, Clinicians audiotaped interaction with patients and listened between workshops CC: NA	Int: Multiple time or repetitive CC: NA	Self-assessment of clinicians' communication skills, attitudes, and behavior, as measured by participant questionnaire	Attitudes Skills (psycho motor or procedural skills) Practice behavior	Yes Yes Yes	Intervention group noted substantial improvements compared with control in 8 of 24 skills / attitudes / behaviors: awareness of and confidence in dealing with patients whom they found difficult; abilities to compliment patients' efforts, ask open-ended questions, address psychosocial factors, express empathy and reassurance, and clarify expectations. 33% of clinicians reported that fewer than 5% of visits were frustrating after the program (compared with 21% of clinicians at baseline). Three months after the program, clinicians in the intervention group reported that it had improved communication with patients. On average, however, the scores for clinicians' rating of improvement in patient satisfaction and improvement in clinicians' personal satisfaction in their work decreased below the midpoint on the five-point scale (mean rating, 2.85 for both items).	"Thriving in a Busy Practice: Physician-Patient Communication," a typical continuing medical education program geared toward developing clinicians' communication skills, is not effective in improving general patient satisfaction. To improve global visit satisfaction, communication skills training programs may need to be longer and more intensive, teach a broader range of skills, and provide ongoing performance feedback.	Int: >=6 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Gifford, 1996[46]	Int: Video, Print CC: NA	Int: Programmed learning, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Neurologists adherences to practice recommendations for movement disorders, as measured by test	Practice behavior	Yes	For 9 of the 16 recommendations, a higher proportion of the intervention group compared with controls reported clinical decisions that were adherent to the practice recommendations; for all 9 differences p<.05. Range of adherence for intervention was 41-98% and for control 22-97%.	The educational course improved neurologists' reported decision-making.	Int: 4-5 months CC: 4-5 months
Anderson, 1996[103]	Int: Live, Video CC: NA CC: NA	Int: Case-based learning, Discussion group, Lecture CC: NA CC: NA	Int: One time CC: NA CC: NA	Change in physician prescribing patterns of regulated drugs	Practice behavior	Yes	There was a 33% reduction in the number of prescriptions written in the education plus notification group, a 25% reduction in the notification only group, and a slight increase in the control group. Both the education plus notification and notification only groups wrote significantly fewer prescriptions than the control group (p<0.003 and p<0.008 respectively). There was not a significant difference between the number of prescriptions written by the education plus notification group and the notification only groups (p<0.719).	Notification that the number of prescriptions they had written was abnormally high was as effective in significantly reducing the number of prescriptions written during the subsequent 6 months as notification combined with a well-designed group-education activity.	Int: 6 months CC: NA CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Mai-man, 1988[47]	Int: Live, Print Int: Print CC: NA	Int: Discussion group, Lecture, Readings Int: Readings CC: NA	Int: Multiple time or repetitive Int: One time CC: NA	Mother report of quantity of physician compliance enhancing behavior	Practice behavior	Yes	Significant association between study group and extent of behaviors reported by mothers (patients).	CME increased physician knowledge and compliance-enhancing practices and resulted in improvement in mothers' adherence to therapy.	Int: 6 months Int: 6 months CC: NA
White, 1985[48]	Int: Live CC: Live, NA Int: Live Int: Live	Int: Case-based learning, Discussion group, Lecture CC: NA Int: NR Int: NR	Int: One time CC: NA Int: One time Int: One time	Desired patient care practices in hospital care of patients with acute myocardial infarction, as measured by chart review	Practice behavior	Yes	Intervention group had statistically significantly higher percent of desired care practices (60%, 56.6-63.3) vs. control group (46.3%, 40.4-52.3)[p-value <0.001 for post-test comparisons). Intervention group had statistically significant gains in 3 of 8 objectives: prophylactic use of lidocaine, avoidance of intramuscular medications, and appropriate length of stay.	"A carefully conceived and executed traditional CME program can result not only in significant increases in physician's knowledge but also in related changes in their patient care practices" ... "both knowledge and behavioral change can persist for at least 6 months"	Int: 6 months CC: NA Int: 6 months Int: 6 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Terry, 1981[49]	Int: Live, Audio, Print	Int: Case-based learning, Discussion group, Feedback, Lecture, Readings	Int: Multiple time or repetitive	Skill and behavior in COPD manage-ment, as measured by analysis of audiotaped standardized patient (SP) interaction	Practice behavior	Yes	Physicians were not blinded due to audiotaping. Intervention and control groups did not differ on diagnostics / therapeutics scores, but intervention group used strategies for patient understanding and compliance more frequently (37% vs. 22%, p<0.01)[9 of 16 specific tasks significantly improved - explaining how medications would help, instructing on use of medications, repeating / summarizing / answering, discussing benefits of smoking cessation].	Physicians completing a home study AV program increased knowledge about diagnosis and treatment of COPD, but their behavior in simulated exercises was not different from controls. Experimental group physicians did use more patient-education and smoking cessation information during patient visits. Group meetings for needs assessment and feedback (given 2 weeks after tests) had no apparent effect beyond the audiovisual materials.	Int: 6 months
	Int: Live, Audio, Print	Int: Case-based learning, Discussion group, Lecture, Readings	Int: Multiple time or repetitive						Int: 6 months
	Int: Audio, Print	Int: Case-based learning, Feedback, Lecture, Readings	Int: Multiple time or repetitive						Int: 6 months
	Int: Live, Audio, Print	Int: Case-based learning, Lecture, Readings	Int: Multiple time or repetitive						Int: 6 months
	CC: Audio, Print	CC: Case-based learning, Lecture, Readings	CC: Multiple time or repetitive						CC: 6 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Cho-dosh, 2006[62]	Int: Live, Internet, not real time, Print CC: NA	Int: Discussion group, Lecture CC: NA	Int: Multiple time or repetitive CC: NA	Quality of care, as measured by adherence to guidelines (as reported in prior manuscript)	Practice behavior	Yes	Intervention group had significantly higher rates of guideline-adherent care for 21 of 29 care processes (e.g., management of behavior problems, use of respite, development of ongoing treatment plan) than usual care group (all p<0.05) at 1-year followup.	Despite a successful intervention demonstrating significant improvements in quality of care for patients with dementia, providers' knowledge and attitudes were minimally affected.	Int: 9 months CC: NA
Ozer, 2005[104]	Int: Live, Print CC: NA	Int: Discussion group, Lecture, Role play, Screening and charting tools CC: NA	Int: One time CC: NA	Screening rates	Practice behavior	Yes	Screening rates for different health behaviors (tobacco use, alcohol use, drug use, sexual behavior, seatbelt and helmet use) increased after the first intervention but remained stable after the second intervention (of screening and charting tools) compared to the comparison group.	The results of the ANCOVAs demonstrated that (1) screening and counseling rates were significantly higher in the intervention group than in the comparison group after the full implementation of the intervention (T2); (2) screening and counseling rates were significantly higher in the intervention group than in the comparison group after the training component alone (T1); and (3) screening and counseling rates did not increase significantly in the intervention group, in relation to the comparison group, after the addition of the tools component.	Int: 8 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Ozer, 2005[104]	Int: Live, Print CC: NA	Int: Discussion group, Lecture, Role play, Screening and charting tools CC: NA	Int: One time CC: NA	Counseling rates	Practice behavior	Yes	Counseling rates for different health behaviors (tobacco use, alcohol use, drug use, sexual behavior, seatbelt and helmet use) increased after the first intervention but remained stable after the second intervention (of screening and charting tools) compared to the comparison group.	The results of the ANCOVAs demonstrated that (1) screening and counseling rates were significantly higher in the intervention group than in the comparison group after the full implementation of the intervention (T2); (2) screening and counseling rates were significantly higher in the intervention group than in the comparison group after the training component alone (T1); and (3) screening and counseling rates did not increase significantly in the intervention group, in relation to the comparison group, after the addition of the tools component.	Int: 8 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Sou-merai, 1987[105]	Int: Live, Print Int: Print CC: NA	Int: Academic detailing, Readings, Brochures Int: Readings, Brochures CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NA	To reduce inappropriate prescribing of 3 target drugs.	Practice behavior	Yes	Reduction in prescribing was highly significant -8 to -20%, p<.025) in 11 of the 14 physician groups. The presence of a followup reinforcement visit was strong independent predictor of prescribing change (p<0.05)	Face to face pharmaceutical education is an effective quality-assurance and cost-containment strategy for a wide variety of physicians, regardless of their background and baseline prescribing practices. Reinforcement visits may be necessary to achieve economically or clinically important improvements in physician drug prescribing patterns. An increase from one visit to 2 visits was associated with an approximate doubling of the size of the program effect. Long visits with physicians (more than 10-15 minutes) do not appear to increase prescribing improvements.	Int: 9 months Int: 9 months CC: 9 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Chas-sin, 1986[106]	Int: Live, Print CC: NA	Int: Feedback, Lecture, 16 of 64 hospitals received only print mailings to physicians with privileges, without lecture CC: NA	Int: One time CC: NA	Pelvimetry rates, as measured by chart abstraction from radiology and obstetrical delivery logs	Practice behavior	Yes	Intervention group hospitals had 86% reduction in pelvimetry rate compared with 53% in control group ($p<0.00001$). Findings slightly tempered by increased baseline pelvimetry rate in control group ($p<0.001$) and general trend toward decreased pelvimetry in both groups prior to intervention.	An educational program followed by feedback of data can markedly improve physician performance by decreasing inappropriate pelvimetry at a hospital level.	Int: 10 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Perera, 1983[107]	Int: Live Int: Live CC: NA	Int: Clinical experiences, Demonstration Int: Clinical experiences, Demonstration CC: NA	Int: One time Int: One time CC: NA	Sigmoidoscopy rate and sigmoidoscopy: barium enema ratio, as measured by clinic nurses before and after training	Practice behavior	Yes	Baseline rates were similar between two intervention groups and control. Intervention group had significantly higher post-intervention sigmoidoscopy rate (13.5/1000 vs. 9.8/1000 pre-intervention, p <0.05). The rate in the intervention group declined to 11.1/1000 by 7-10 months. The group receiving training later increased from 6.2 to 8.4/1000, and the control decreased from 8.5 to 7.4/1000. The sigmoidoscopy to barium enema ratio significantly increased in first study group from 0.62 to 0.90 (p < .05). The second study group increased from 0.59 to 0.79, and the control group decreased from 0.69 to 0.67.	"program increases the rate of sigmoidoscopies done by physicians and improves the process of medical care (at least over the short term)"	Int: 7-10 months Int: 3 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Schect-man, 2003[108]	Int: Live, Video, Print CC: Video, Print, NA	Int: Lecture, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Physician behaviors: the adherence of utilization services to guidelines for low back pain.	Practice behavior	Yes	There was a significant increase in guideline-consistent behavior among intervention physicians while there was a decrease in the control group.	"An intervention based on accepted strategies of physician education, practice audit with performance feedback, and peer opinion leader use produced a modest but significant increase in physician actions consistent with a clinical guideline for the care of acute low back pain."	Int: 1 year CC: 1 year
Ray, 2001[109]	Int: Live, Print CC: NA	Int: Academic detailing, Readings, Chart reminders CC: NA	Int: Multiple time or repetitive CC: NA	Change between baseline and follow-up years in: days of prescribed NSAIDs, acetamino-phen, other drugs for musculoskel-etal disorders, and GI drugs; outpatient visits and inpatient days of stay	Practice behavior	Yes	Intervention-attributable reduction of 7% (95% CI, 3% to 11%) in days of prescribed NSAIDs use with concomitant increase in acetaminophen use.	The educational program modestly reduced NSAID exposure in community-dwelling elderly patients without undesirable substitution of other medications or detectable worsening of musculoskeletal symptoms.	Int: 1 year CC: NA

Evidence table 11. Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Dietrich, 2000[110]	Int: Live, Print, Telephone call CC: NA	Int: Academic detailing, Lecture, Problem-based learning or team-based learning, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Percent of parents counseled on sun protection by clinicians, as measured by parent self-report survey	Practice behavior	Yes	Intervention community parents reported similar rates of counseling to control parents (25% and 26%, p=0.68), but significantly higher counseling after intervention (34% vs. 27%, p=0.03).	The SunSafe primary care intervention increased sun protection counseling activities of participating clinicians. Conclusions limited by participation rate in survey (69% for baseline survey; of intervention community clinicians who participated in baseline, only 59% on f/u survey). Also unclear what component of parent report may relate to other community interventions, rather than practice intervention.	Int: about 1 year CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Dietrich, 2000[110]	Int: Live, Print, Telephone call CC: NA	Int: Academic detailing, Lecture, Problem-based learning or team-based learning, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Improvement from baseline in provision of sun protection services to patients / families, as measured by clinician self-report	Practice behavior	Yes	Greater improvement for intervention vs. control clinicians in the availability of educational materials (91% vs. 43%, p=0.02), distribution (74% vs. 0%, p=0.001) of educational materials, and distribution of sunscreen samples (69% vs. 13%, p=0.02). Unclear if intention-to-treat analysis done for providers in intervention communities who declined to participate in practice intervention. Consideration of baseline practices unclear in the calculation of "improvement from baseline."	The SunSafe primary care intervention increased sun protection counseling activities of participating clinicians. Conclusions limited by participation rate in survey (69% for baseline survey; of intervention community clinicians who participated in baseline, only 59% on f/u survey). Also unclear what component of parent report may relate to other community interventions, rather than practice intervention.	Int: about 1 year CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Schroy, 1999[82]	Int: Live CC: NA	Int: Academic detailing, Discussion group, Lecture CC: NA	Int: One time CC: NA	Provider utilization of screening sigmoidos-copy as determined by appointment schedules	Practice behavior	Yes	Use of on-site sigmoidoscopy was monitored by review of appointment schedules every 3 months after initiation of the program (for the intervention sites). Use of outside sigmoidoscopy services was monitored through the NHC's scheduling secretary and/or contact with all off-site endoscopists identified by referring primary care providers. There was substantial agreement between self-reported compliance rates and actual utilization; namely, 78% of those reporting compliance with sigmoidoscopy recommendations actually referred 1 or more asymptomatic average-risk persons for screening examinations. 90% of those reporting noncompliance were not referring patients for screening. Overall compliance, using utilization as the outcome of interest, was 47% in the intervention group, vs. 4% in the comparison group at year 1 (p<0.001).	"In summary, this study clearly shows that academic detailing in the form of an outreach didactic educational seminar followed by the implementation of on-site sigmoidoscopy services is an effective strategy for enhancing provider compliance with screening guidelines."	Int: 1 year CC: 1 year

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Gon-zales, 1999[111]	Int: Live, Print Int: Print CC: NA	Int: Academic detailing, Demonstration, Lecture, Point of care Int: Academic detailing, Point of care CC: NA	Int: One time Int: NA CC: NA	Antibiotic prescriptions for incident visits	Practice behavior	Yes	Full intervention demonstrated a significant decrease in the number of prescriptions. Other groups did not show a significant difference.	Antibiotic treatment of adults diagnosed as having uncomplicated acute bronchitis can be safely reduced using a combination of patient and practitioner interventions.	Int: 1 year Int: 1 year CC: NA
Cum-mings, 1989[112]	Int: Live, Video, Print CC: NA	Int: Demonstration, Discussion group, Lecture, Role play CC: NA	Int: Multiple time or repetitive CC: NA	Effective-ness of smoking cessation counseling	Practice behavior	Yes	Physicians participating in the intervention increased their effectiveness of smoking cessation counseling. Specifically, they discussed cessation with patients more often and longer, set more quit dates, and gave out more self-help materials.	Intervention physicians discussed smoking at a greater rate than did control physicians. Intervention physicians spent more time discussing smoking with their patients. More smoking patients of the intervention physicians set quit dates and had more follow-up with their physicians. Rates of smoking cessation among patients at one year were no different between control and intervention physicians.	Int: 1 year CC: 1 year

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Cummings, 1989[113]	Int: Live, Video, Print CC: NA	Int: Case-based learning, Demonstration, Discussion group, Lecture, Role play CC: NA	Int: Multiple time or repetitive CC: NA	Effectiveness of smoking cessation counseling	Practice behavior	Yes	Physicians involved in the intervention improved aspects of their smoking cessation counseling. Specifically, they were more likely to set quit dates, were more likely to use nicotine gum appropriately, spent more time discussing smoking cessation with patients, and gave out more self-help brochures.	Intervention physicians discussed smoking cessation at a higher rate than did control physicians. They spent more time discussing smoking overall, and more of their patients set quit dates. Overall, smoking cessation rates of patients at one year did not differ between groups.	Int: 1 Year CC: 1 year
Kottke, 1989[114]	Int: Live, Print Int: Print CC: NA	Int: Demonstration, Discussion group, Lecture, Readings Int: Readings CC: NA	Int: One time Int: Amount of exposure determined by participant CC: NA	Physician behaviors regarding counseling for smoking cessation	Practice behavior	Yes	Patients of physicians in the workshop group and materials-only group reported their physicians were more likely to have asked them to quit smoking ($p < 0.025$)and were more likely to report agreeing to quit smoking ($p < 0.025$) when compared to the control group. Patients of physicians in the workshop group report they were asked to set a quit date ($p < 0.005$) compared to materials-only group and control group. There was no difference between groups regarding patient reports of being asked if they smoked and patients being given follow-up appointments.	A brief training program and/or the distribution of education materials marginally increased smoking cessation behaviors among volunteer physicians but did not result in increased smoking cessation rates at one year.	Int: 1 year Int: 1 year CC: 1 year

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Jennett, 1988[76]	Int: Live, Print, Teleconference Int: Live, Print, Teleconference CC: NA	Int: Discussion group, Feedback, Mentor/Precep-tor, Readings Int: Discussion group, Feedback Mentor/Precep-tor, Readings CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NA	Percentage of recom-mended behaviors in cancer medicine carried out at the specified time period	Practice behavior	Yes	The performance of study offices improved 6 months following the education by 35%.	A carefully planned CME program, adhering to essential learning principles, was effective in changing office practice of volunteer doctors as long as 12 months after the intervention.	Int: 12 months Int: 12 months CC: 12 months
Jennett, 1988[76]	Int: Live, Print, Teleconference Int: Live, Print, Teleconference CC: NA	Int: Discussion group, Feedback, Mentor/Precep-tor, Readings Int: Discussion group, Feedback Mentor/Precep-tor, Readings CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NA	Performance of recom-mended behaviors in cardio-vascular medicine carried out at the specified time period	Practice behavior	Yes	Performance of recommended behaviors in study offices improved 44.5% as compared to controls, 4.0%.	A carefully planned CME program, adhering to essential learning principles, was effective in changing office practice of volunteer doctors as long as 12 months after the intervention.	Int: 12 months Int: 12 months CC: 12 months
Harris, 2005[75]	Int: Live, Audio, Print, Teleconference CC: NA	Int: Case-based learning, Lecture, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Document-ation of tests performed	Practice behavior	Yes	Significantly more patient records in the intervention group had documentation of BMI, eye exams, communication of a treatment plan, and used a flow sheet.	CME delivered by teleconference was feasible, well attended, well received by participants, and improved some key diabetes management practices and outcomes, although primary goal of improving HbA1C was not achieved.	Int: 12 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Lindsay-McIntyre, 1987[115]	Int: Print Int: Live, Video, Print CC: NA	Int: Point of care Int: Demonstration, Lecture, Point of care, Standardized patient CC: NA	Int: Multiple time or repetitive Int: Training 1 time, cueing with each patient CC: NA	Smoking cessation counseling behaviors by family physicians, as measured by chart review using intervention flowsheet (intervention) or medical records (control)	Practice behavior	Yes	Physician discussed smoking in 85.4% of patients of trained physicians, vs. 70.2% of gum-only physicians and 31.1% of usual care physicians. Gum offered by >60% of gum-only and trained physicians vs. 9% for usual care physicians. Trained physicians reported patients wanted to see them again more often and to offer take-home materials compared with gum only or usual care. (p-values NR)	Nicotine gum with chart cues helped stimulate patient smoking cessation attempts, but physician training in counseling with a more intensive flowsheet produced more successful short-term cessation.	Int: 1 year Int: 1 year CC: NA
Stross, 1985[116]	Int: Live, Print, "Audiovisual materials" CC: NA	Int: Feedback, Readings, Use of "educationally influential" physician CC: NA	Int: Multiple time or repetitive CC: NA	Inpatient care of osteoarthritis patients, as measured by chart audit of hospital and outpatient data	Practice behavior	Yes	Intervention hospitals had statistically significant (all p<0.05) increased use of intraarticular corticosteroids (40% vs. 11%), decreased use of systemic steroids (3% vs. 22%), and increased pre-op PT (97% vs. 40%) compared with control; non-significant in 8 other areas, including pre-op / post-op management and length of stay. Use of intraarticular corticosteroids also increased in outpatients in intervention vs. control (23.9% vs. 14.6%, p<0.05).	Educationally influential physician peers may influence use of intraarticular and systemic steroids in osteoarthritis management within their communities.	Int: 1 year CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Cummings, 1989[117]	Int: Live, Video, Patient education materials CC: NA	Int: Case-based learning, Demonstration, Role play, Self-reflection CC: NA	Int: Multiple time or repetitive CC: NA	Physician smoking cessation counseling behaviors, as measured by patient interviews	Practice behavior	Yes	Intervention group was more likely to discuss smoking with patients who smoked (64% vs. 44%), spent more time counseling smokers about quitting (7.5 vs. 5.2 minutes), helped set more quit dates (29% vs. 5%), gave out more booklets (37% vs. 9%), and more likely to make followup appointments about quitting (19 vs. 11%).	3-hour continuing education program combined with supportive materials for offices changed the way physicians in private practice counseled about smoking, but had no statistically significant effects on patient outcomes. Some significant differences physicians and patients in intervention vs. control group related to drop-out, but adjustment for factors did not affect outcomes.	Int: 1 year CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Schroy, 1999[82]	Int: Live CC: NA	Int: Academic detailing, Discussion group, Lecture CC: NA	Int: One time CC: NA	Provider attitudes or practices related to colorectal cancer screening as determined from a pre-educational vs. post-educational survey instrument, based on an instrument that was similar to one used by the American Cancer Society in 1989	Attitudes Practice behavior	Unclear Yes	At year 1, there were no significant differences in concern about patient fear and discomfort, time, procedural skills, or cost. However, the mean scores for equipment availability, efficacy, and yield were all significantly higher in the noncompliant group than the compliant group (p = 0.001). Most of the compliant providers were at the intervention sites, which indicate that availability of on-site screening may trump perceived barriers for sigmoidoscopy adherence. At baseline, 24% of providers at intervention sites, and 19% at comparison sites, reported recommending screening sigmoidoscopy. Significant differences in compliance were observed at the year 1 follow-up survey. Overall self-reported compliance rates increased by 36% at the intervention site, vs. 7% at the comparison site (p = 0.001).	"In summary, this study clearly shows that academic detailing in the form of an outreach didactic educational seminar followed by the implementation of on-site sigmoidoscopy services is an effective strategy for enhancing provider compliance with screening guidelines."	Int: 1 year CC: 1 year

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Margo-lis, 2004[118]	Int: Live, Organized set of tools otherwise unspecified CC: NA	Int: Academic detailing, Feedback, Lecture, Unspecified organized set of tools CC: NA	Int: Multiple time or repetitive CC: NA	Proportion of children who received all four preventive services (immuniz-ations and screening for anemia, lead, and tuberculosis)	Practice behavior	Yes	The change in the prevalence of all four services between the beginning and end of the study was 4.6 fold greater (95% CI 1.6 to 13.2) in the intervention practices than in the control practices.	A continuing education program designed to assist primary care practices in testing and implementing office systems for preventive health care produced clinically and statistically significant improvement in rates of preventive care for children.	Int: 18 months (30 months-12 months of implementati on) CC: NA
McClel-lan, 2003[119]	Int: Video, Print CC: NA	Int: Feedback, Readings CC: NA	Int: Multiple time or repetitive CC: NA	HbA1c tests ordering	Practice behavior	Yes	Statistically significant increase	"The main result of our study was that a population-based quality improvement intervention based on applying the HCQIP model to ambulatory care was associated with improved processes of care of diabetes mellitus."	Int: 1.5-2 years CC: 1.5-2 years

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
McClel-lan, 2003[119]	Int: Video, Print CC: NA	Int: Feedback, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Usage related to physician behavior in monitoring diabetic patients	Practice behavior	Yes	Usage of HbA1c testing increased among both the intervention and control groups; usage among the intervention group was statistically significantly greater than the control group (p=0.02 unadjusted, p=0.03 adjusted). Other indicators (eye examinations, urine testing) also increased in both groups, though the differences between intervention and control were positive, but not statistically significant.	"The main result of our study was that a population-based quality improvement intervention based on applying the HCQIP model to ambulatory care was associated with improved processes of care of diabetes mellitus."	Int: 1.5-2 years CC: 1.5-2 years

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Mann, 1997[52]	Int: Live, Video, Print	Int: Case-based learning, Demonstration, Discussion group, Readings, Simulation (other than standardized patient or role-play)	Int: Multiple time or repetitive	Physicians dietary counseling practices, as measured by self-report.	Practice behavior	Yes	Physicians in both intervention groups scored statistically significantly higher than the controls in dietary counseling practice evaluation (p=0.0005).	Educational training workshops appear to be effective in changing physician behavior, and should thus, be continued along with additional research on the mechanisms of which behavior change occurs.	Int: 15 months
	Int: Live, Video, Print Cue stickers on medical chart	Int: Case-based learning, Demonstration, Discussion group, Point of care, Readings, Simulation (other than standardized patient or role-play)	Int: Multiple time or repetitive						Int: 15 months
	CC: NA	CC: NA	CC: NR						CC: 15 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Clark, 1998[120]	CC: NA Int: Live, Video	CC: NA Int: Case-based learning, Clinical experiences, Lecture	CC: NA Int: Multiple time or repetitive	Impact if intervention on physician self-report of practice behaviors at 5 months	Practice behavior	Yes	Physicians in the intervention group were significantly more likely to use anti-inflammatory agents, address fears about meds, give written instructions, how to adjust meds in flair. Interestingly, intervention physicians also reported spending less time with asthma patients.	The intervention had a positive impact on both physician and parent reported behaviors, and patient outcomes were also positively impacted by the intervention. In addition, the impact appeared to be more than just that resulting from the increased use of anti-inflammatory medication and the change in practice behavior and the disease management model seems to be important as well.	CC: 22 months Int: 22 months
Clark, 1998[120]	CC: NA Int: Live, Video	CC: NA Int: Case-based learning, Clinical experiences, Lecture	CC: NA Int: Multiple time or repetitive	Parent (patient) views of physician behavior	Practice behavior	Yes	Intervention physicians were statistically significantly more likely to be reassuring and encouraging, stating a goal that the child be active, were more likely to have prescribed anti-inflammatory medication, and to have provided a written plan.	The intervention had a positive impact on both physician and parent reported behaviors, and patient outcomes were also positively impacted by the intervention. In addition, the impact appeared to be more than just that resulting from the increased use of anti-inflammatory medication and the change in practice behavior and the disease management model seems to be important as well.	CC: 22 months Int: 22 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Moran, 1996[121]	Int: Live CC: Live	Int: Case-based learning Discussion group CC: Case-based learning Discussion group	Int: Multiple time or repetitive CC: Multiple time or repetitive	Changes in score for dimensions of care (clinical patient care), charting, prevention, and drug use	Practice behavior	Yes	Average scores increased significantly and approached average Manitoba scores by 18 months.	This study demonstrates the feasibility of improving physician performance through a form of CME that is designed to be supportive, non-punitive, and learner-focused.	Int: 18 months CC: NR
Browner, 1994[122]	Int: Live, Print Int: Live, Print CC: NA	Int: Lecture, Readings Int: Academic detailing, Case-based learning, Lecture, Point of care, Readings CC: NA	Int: One time Int: Multiple time or repetitive CC: NA	Proportion of patients with high cholesterol management in compliance with NCEP recommendations	Practice behavior	Yes	Trend toward better compliance in the two CME groups (p=.07). Compliance rates were 6% higher (95% CI 1% - 11%, p=.02) in the intensive CME group than in the control group.	CME was not particularly effective in improving compliance with NCEP guidelines among non university affiliated community physicians who practice primary care.	Int: 18 months Int: 18 months CC: NA

Evidence table 11. Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Rodney, 1986[77]	Int: Live, Video Int: Live, Video CC: NA	Int: Demonstration, Lecture, Simulation (other than standardized patient or role-play) Int: Demonstration, Lecture, Simulation (other than standardized patient or role-play) CC: NA	Int: One time Int: One time CC: NA	Behavior related to flexible sigmoidos-copy use, as measured by phone or written survey	Attitudes Cognitive skills Practice behavior	Yes No Yes	Small group learners were more likely to acquire additional training and teaching attachments for their sigmoidoscopes, and less likely to use small (35 cm) scopes; there was no difference in biopsy utilization. 90% of large group learners acquired scopes after training vs. 40-56% of small groups. Small groups were associated with shorter procedure times ($p<0.05$) for first 10 procedures, but otherwise no differences in times, insertion depths, or number of exams performed. Compared to a randomly surveyed group of physicians, those with CME were significantly more likely to perform flexible sigmoidoscopy.	Physicians who participate in courses in flexible sigmoidoscopy have a higher probability of office utilization of these skills than those who do not take courses. Minimal differences found between large and small group CME formats.	Int: 12-18 months Int: 12-18 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Bunting, 2004[123]	Int: Live, Print CC: NA	Int: Feedback, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Physician laboratory test ordering behavior	Practice behavior	Yes	Though both intervention and control group test utilization rate declined soon after the intervention, both also showed trends back towards baseline values with increasing time post intervention. However, the intervention group declined to a greater degree than the control group (which had nonsignificant reductions compared to baseline), and a 7.9% ($p<0.0001$) relative reduction resulted from the intervention.	"We found that a multifaceted education and feedback strategy significantly and persistently decreased laboratory utilization among practicing community physicians. In conclusion, this study showed a statistically significant effect of a simple feedback and education intervention on the ordering of laboratory tests by high-volume community physicians."	Int: 2 years CC: 2 years

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Clark, 2000[78]	Int: Live, Video CC: NA	Int: Case-based learning, Demonstration, Lecture CC: NA	Int: Multiple time or repetitive CC: NA	Physician behavior change in teaching patients and increase in communi-cation skills	Practice behavior	Yes	Intervention physicians were more likely to use protocols for delivering asthma education (OR 4.9, p=.2), write down for patients how to adjust medicines when symptoms change (OR 5.8, p=.05), and provide more guidelines for modifying therapy (OR 3.8, p=0.06). Increase in communication skills in the intervention group: more wrote down dose adjustment and timing info for patients; provided guidelines for patients to use when conditions change. No difference in the amount of time physicians spent with patients between groups and no difference in the proportion of physicians prescribing anti-inflammatories.	Participating physicians reported that they communicated and taught patients in a more sophisticated way. Parents of intervention patients reported that physicians used a range of communication and education strategies to enhance patient learning and satisfaction. Intervention patients showed a decrease in hospitalization.	Int: 2 years CC: 2 years

Evidence table 11. Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Ger-stein, 1999[53]	Int: Live CC: NA	Int: Case-based learning, Discussion group CC: NA	Int: One time CC: NA	Knowledge, attitudes, and practice behavior regarding diabetes care, based on participant question-naire	Knowledge Attitudes Practice behavior	Yes Yes Yes	After 40 days, participants' overall scores improved significantly while there was no change in the controls' scores (F =24.14; p<0.0001). Significant improvement was also noted in domains of attitude (F=31.75; p<0.0001), knowledge (F=4.23; P =0.041), and practice behavior (F=10.43; p=0.0014). However, improvement was not apparent after a year. Participants who completed 425-day assessment scored lower in attitude subscale compared to controls, despite having initially scored higher at the 40-day assessment.	An interactive, small group, diabetes continuing education program effectively disseminates practice guidelines to family physicians. The impact of such a program declines after 1 year.	Int: 24 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Ock-ene, 1996[124]	CC: NA Int: Live, Video Int: Live, Video	CC: NA Int: Feedback, Lecture, Role play, Standardized patient Int: Feedback, Lecture, Role play, Standardized patient	CC: NA Int: 2 types of training sessions, each provided once Int: 2 types of training sessions, each provided once	Mean number of physician nutrition counseling steps	Practice behavior	Yes	Physicians who received both the nutrition counseling training and the practice management system performed, on average, more counseling steps (adjusted mean = 6.28 out of a possible 10 steps, p<0.0001). Those who received no intervention or who received nutrition counseling training only performed fewer steps.	Primary care internists, when provided with both training in counseling techniques and a supportive office environment, will carry out patient counseling appropriately. Training alone, however, is not sufficient and may be counterproductive.	CC: NA Int: evaluation was conducted over a 2 year time span Int: evaluation was conducted over a 2 year time span
Adams, 1998[125]	CC: Live Int: Live	CC: Lecture Int: Lecture, Mentor/Precep-tor, Office system: cuing	CC: NR Int: Multiple time or repetitive	Impact of educational intervention on patient exit interview rating of physician counseling behaviors	Practice behavior	Yes	There was a statistically significant increase in physician counseling ratings by patients in the intervention group. The mean number of patient exit interview steps completed (total possible 15) was 2.4 in Usual Care group vs. 10.3 in Special Intervention group (p = .0001) In addition, this effect remained constant for the full 32 months that patients exit interviews continued to be monitored.	The educational intervention did improve patient-rated physician performance of counseling on alcohol use.	CC: 32 months Int: 32 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Myers, 2004[148]	Int: Live, Audio, Print CC: NA	Int: Academic detailing, Feedback, Lecture, Readings CC: Readings	Int: Multiple time or repetitive CC: NA	Complete diagnostic exam (CDE) performance rates	Practice behavior	Yes	CDE performance rates for eligible patients increased for both intervention and control group, but only to a statistically significant degree among the intervention group (adjusted post/pre OR = 1.71, p<0.03). Intervention to control group OR of CDE recommendation was 1.63, p=0.03.	"Use of a physician-oriented intervention substantially and significantly increased CDE recommendation and performance in Intervention Group practices as compared to Control Group practices. These findings demonstrate that targeting PCPs for delivery of a combined CDE reminder feedback and educational outreach intervention can have a meaningful impact on physician behavior and patient followup in colorectal cancer screening. It is notable that the magnitude of the intervention impact was greater for CDE recommendation than CDE performance. The intervention also had a statistically significant impact on CDE recommendation rates when the combined timeframe (Periods 2 and 3) was compared to Period 1."	Int: 6 years CC: 6 years

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Myers, 2004[148]	Int: Live, Audio, Print CC: NA	Int: Academic detailing, Feedback, Lecture, Readings CC: Readings	Int: Multiple time or repetitive CC: NA	Complete diagnostic exam (CDE) recom-mendation rates for eligible patients	Practice behavior	Yes	CDE recommendation rates for eligible patients increased for patients whose physicians received the intervention (adjusted post/pre OR = 2.11, p <0.001), but not for those in the control group. Intervention to control group OR of CDE recommendation was 2.28, p=0.002.	"Use of a physician-oriented intervention substantially and significantly increased CDE recommendation and performance in Intervention Group practices as compared to Control Group practices. These findings demonstrate that targeting PCPs for delivery of a combined CDE reminder feedback and educational outreach intervention can have a meaningful impact on physician behavior and patient followup in colorectal cancer screening. It is notable that the magnitude of the intervention impact was greater for CDE recommendation than CDE performance. The intervention also had a statistically significant impact on CDE recommendation rates when the combined timeframe (Periods 2 and 3) was compared to Period 1."	Int: 6 years CC: 6 years

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Practice Behavior Objectives Not Met, Evaluation Duration Not Reported									
Muko-hara, 2005[13]	Int: Computer-based off-line CC: Computer-based off-line	Int: Readings CC: Readings	Int: Multiple time or repetitive CC: Multiple time or repetitive	Proportion of patients for whom physicians incorpor-ated or read published evidence for medical decision making	Practice behavior	No	There were no significant differences within or between groups in the proportion of patients for whom they incorporated or read published evidence for medical decision making.	While doctors appreciated these summaries, which improved their reading efficiency, the intervention had little impact on their use of research evidence in practice.	Int: NR CC: NR
Schect-man, 1991[139]	Int: Print CC: NA CC: NA	Int: Readings,: Directed physicians to use ATPs CC: NA CC: NA	Int: NR CC: NA CC: NA	Prescribing patterns of antihistamin es	Practice behavior	No	There were no significant differences between the three groups in the rate of prescribing more expensive antihistamines compared to the preferred antihistamines in the study.	The intervention was met favorably by the physicians, but there was no impact of the intervention on antihistamine prescribing patterns	Int: NR CC: NA CC: NA
Max-well, 1984[57]	Int: Live CC: NA	Int: Case-based learning, Discussion group CC: NA	Int: Multiple time or repetitive CC: NA	Practice behavior on key topics, as measured by chart review and qualitative interviews	Practice behavior	No	Unsuccessful data collection due to insufficient numbers. Anecdotal evidence of behavior change from stories from 12 committee members.	Medical care evaluation meetings have educational value	Int: NR CC: NR

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Practice Behavior Objectives Not Met, Evaluation Duration Less Than or Equal to 30 Days									
Zucker-man, 2004[18]	Int: Print Int: Print CC: NA	Int: Readings Int: Readings CC: NA	Int: One time Int: One time CC: NA	Patient factors: percent filling prescription for beta-blocker within 7-30 days.	Practice behavior	No	There was an increase in post-AMI hospitalization beta-blocker prescribing after the intervention, though this increase was not statistically significant (p=0.13 at 30 days, p=0.12 at 7 days).	"The systemwide physician education program in Pennsylvania Medicaid program increased beta-blocker prescribing after AMI hospitalization by increasing physicians' awareness of the guidelines for treatment of AMI survivors. The educational intervention also improved patients' compliance with beta-blocker therapy. These effects are likely to apply to AMI patients well beyond the study population. Besides clinical effects, this intervention program also led to cost savings for the Pennsylvania Medicaid program, as well as avoidance of a few deaths."	Int: 30 days Int: 30 days CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Levinson, 1993[138]	Int: Live CC: NA	Int: Case-based learning, Lecture CC: NA	Int: One time CC: NA	Change scores in 34 categories of physician-patient communication	Practice behavior	No	There was no evidence of an effect from the short program training in any of the RIAS content analyses, looking at differences in posttest scores between groups, controlling for pretest scores as a covariate.	The study concluded that the long program resulted in significant changes in physicians and patients communication, looking at pre/post comparisons only (no control). The authors wrote, This study demonstrates some potentially important changes in physicians' and patients' communication after a 2.5 day CME program. The changes demonstrated in both content and affect may have important influences on both biologic outcome and physician and patient satisfaction. However, in the study that was abstracted (i.e. the one with a control group) no impact of the short CME intervention was seen.	Int: 1 month CC: 1 month

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Practice Behavior Objectives Not Met, Evaluation Duration Greater Than 30 Days									
Mehler, 2005[99]	Int: Internet, not real time, Print Int: Live, Print CC: NA	Int: Academic detailing, Readings Int: Academic detailing, Lecture CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NA	Proportion of patients receiving lipid testing	Practice behavior	No	A favorable trend was observed for a larger increase in frequency of lipid testing at intervention sites (+23% combination of electronic and direct detailing) compared with control sites (+11%), although the difference was not statistically significant (p = 0.06).	A simple educational intervention seems to positively influence provider behavior in the area of lipid management in diabetes mellitus. Both electronic and direct detailing seem to be viable approaches. Future studies to determine optimal educational components that facilitate appropriate provider actions to initiate or intensify lipid treatment seem warranted given the burgeoning population of diabetic patients at risk for coronary heart disease morbidity and mortality.	Int: 3 months Int: 3 months CC: 3 months
Maclure, 1998[96]	CC: NA Int: Live, Video CC: NA Int: Live CC: NA Int: Print	CC: NA Int: Lecture, Teleconference CC: NA Int: Discussion group, Lecture CC: NA Int: Readings	CC: NA Int: One time CC: NA Int: NR CC: NA Int: Multiple time or repetitive	Impact of teleconference on prescribing pattern	Practice behavior	No	There was a trend toward increased use of calcium channel blockers, but it was not statistically significant. Participants in the teleconference showed a shift from ACEI to thiazides, compared with matched controls.	There was a general trend toward the desired effect by the educational interventions.	CC: 3 months Int: 3 months CC: 3 months Int: 3 months CC: 3 months Int: 3 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Maclure, 1998[96]	CC: NA Int: Live, Video CC: NA Int: Live CC: NA Int: Print	CC: NA Int: Lecture, Teleconference CC: NA Int: Discussion group, Lecture CC: NA Int: Readings	CC: NA Int: One time CC: NA Int: NR CC: NA Int: Multiple time or repetitive	Impact of newsletters on prescribing pattern	Practice behavior	No	There was a trend to decreased prescribing of calcium channel blockers, (shift from preference for first-line CCBs to first-line thiazides) but it was not statistically significant	There was a general trend toward the desired effect by the educational interventions.	CC: 3 months Int: 3 months CC: 3 months Int: 3 months CC: 3 months Int: 3 months
Maclure, 1998[96]	CC: NA Int: Live, Video CC: NA Int: Live CC: NA Int: Print	CC: NA Int: Lecture, Teleconference CC: NA Int: Discussion group, Lecture CC: NA Int: Readings	CC: NA Int: One time CC: NA Int: NR CC: NA Int: Multiple time or repetitive	Impact of small group on prescribing pattern	Practice behavior	No	There was a trend to decreased prescribing of calcium channel blockers, (a shift from preference for first-line CCBs to first-line thiazides) but it was not statistically significant	There was a general trend toward the desired effect by the educational interventions.	CC: 3 months Int: 3 months CC: 3 months Int: 3 months CC: 3 months Int: 3 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Lewis, 1993[70]	Int: Live, Video Int: Print CC: NA	Int: Discussion group, Lecture Int: Readings CC: NA	Int: One time Int: One time CC: NA	Percentages of new patients reporting they were asked sexual history questions by their physicians (family physicians)	Practice behavior	No	The program had no apparent impact on family physicians.	These results suggest that a medical education program that goes beyond standard lectures and incorporates interactive formats can change physician behaviors.	Int: 3 months Int: 3 months CC: NA
Lewis, 1993[70]	Int: Live, Video Int: Print CC: NA	Int: Discussion group, Lecture Int: Readings CC: NA	Int: One time Int: One time CC: NA	Percentages of new patients reporting they were asked sexual history questions by their physicians (obstetric-cians/gyne-cologists)	Practice behavior	No	Practitioners of obstetrics and gynecology at all sites demonstrated a relatively high frequency of asking sexual history questions before the program, but these rates did not change.	These results suggest that a medical education program that goes beyond standard lectures and incorporates interactive formats can change physician behaviors.	Int: 3 months Int: 3 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Hagen, 2005[126]	Int: Live, Print, laminated copies to be posted at stations and in charts CC: NA	Int: Lecture, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Dose of benzodia-zepines	Practice behavior	No	The total doses of benzodiazepines remained largely unchanged over time in control and experimental facilities, although the control group experienced two decreases post-intervention at Times 4 and 6. R-ANOVA conducted for 4 months post-intervention (Time 3 vs. Time 5) found no significant effects for either time (F (1.734)=2.08, p=0.15) or time by facility (F (1.734)=3.00, p=0.083). R-ANOVA conducted for 6 months post-intervention (Time 3 vs. Time 6) revealed significant effects for time by facility (F (1.699)=4.77, p=0.029) but not for time alone (F (1.699)=0.18, p=0.67).	Our finding that the intervention did not reduce the percentage of residents on neuroleptics or benzodiazepines or the dosages administered, is inconsistent with the findings of Avorn et al. (1992), who reported that provider education reduced the use of psychotropic drugs in nursing homes.	Int: 6 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Hagen, 2005[126]	Int: Live, Print, laminated copies to be posted at stations and in charts CC: NA	Int: Lecture, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Effect of educational intervention upon use of psycho-tropics	Practice behavior	No	The primary hypothesis, that the intervention facilities would show less postintervention use of psychotropics than the control facilities, was not supported. Rather, both control and experimental LTC (long-term care) facilities experienced a small rise in the percentage of residents receiving neuroleptics after the education intervention between Time 3 and Time 4, although the increases were only significant in the control group.	Our finding that the intervention did not reduce the percentage of residents on neuroleptics or benzodiazepines or the dosages administered, is inconsistent with the findings of Avorn et al. (1992), who reported that provider education reduced the use of psychotropic drugs in nursing homes.	Int: 6 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Davis, 2004[101]	Int: Live, Video, Audio, audio teleconferencing CC: NA	Int: Case-based learning, Discussion group, Problem-based learning or team-based learning CC: NA	Int: Multiple time or repetitive CC: NA	Change in prescribing patterns with respect to use of SABAs	Practice behavior	No	Neither the study nor the control group demonstrated a statistically significant change in the use of SABAs before and after the intervention. (Study group prescriptions decreased between 6 months before and 6 months after, while control group prescriptions of SABAs increased. No level of statistical significance was given for these changes.)	"We report the first PBL-style teleconference series to demonstrate a significant change in physician prescribing habits toward better concordance with current asthma guidelines. This study demonstrated the powerful impact that the PBL format has on physician learning that actually translated into action—a measurable change in beliefs and behavior that led to changes in the number of prescriptions written by the participants. Although standard, traditional, didactic lectures remain the norm for CME across the US and credits are given for attendance, many studies have now shown that PBL is actually more effective at enhancing physicians learning. CME offices should plan more small-group workshops or teleconferences integrating the PBL format, with skilled facilitators trained to develop the cases and moderate the sessions, ultimately to improve the quality of CME."	Int: 6 months CC: 6 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Solo-mon, 2004[127]	Int: Live, Print CC: NA	Int: Discussion group, Lecture, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Osteoporosis manage-ment: proportion who underwent bone densitometry	Practice behavior	No	After the intervention, the proportion of patients undergoing bone densitometry was not statistically different between the groups (p=0.9).	"In conclusion, we conducted a randomized controlled trial of a multifaceted intervention for GIOP. This intervention was not associated with any increase in use of osteoporosis medications or bone densitometry over a 6-month postintervention observation period. Based on several potential explanations for these findings, we are considering future interventions that rely on direct-to-patient educational mailings as well as the use of rheumatology nurses to recognize at-risk patients and initiate a diagnostic workup."	Int: 6 months CC: 6 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Solo-mon, 2004[127]	Int: Live, Print CC: NA	Int: Discussion group, Lecture, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Osteoporosis manage-ment: proportion prescribed a medication for osteoporosis	Practice behavior	No	Although the proportion of pts who were prescribed a medication for osteoporosis did increase (between 6 months before and 6 months after the intervention) in both the intervention and control groups, neither of them increased in a statistically significant fashion, nor were they statistically significantly different from one another (p=0.3).	"In conclusion, we conducted a randomized controlled trial of a multifaceted intervention for GIOP. This intervention was not associated with any increase in use of osteoporosis medications or bone densitometry over a 6-month postintervention observation period. Based on several potential explanations for these findings, we are considering future interventions that rely on direct-to-patient educational mailings as well as the use of rheumatology nurses to recognize at-risk patients and initiate a diagnostic workup."	Int: 6 months CC: 6 months
Pazi-randeh, 2002[128]	Int: Live, Print CC: NA	Int: Lecture, Readings, Q & A period CC: NA	Int: One time CC: NA	Physician initiation of osteoporosis discussion and screening orders	Practice behavior	No	The discussion of osteoporosis and orders for bone mineral density tests increased for both control and intervention group. However, this is likely a result of the patient education intervention, not the physician intervention which did not show evidence of affecting practice patterns.	"In summary, in this nonrandomized controlled study, there was some evidence supporting the generally recognized belief that didactic lectures are not effective in modifying physician practice patterns."	Int: 6 months CC: 6 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Thom, 2000[129]	Int: Live, Video CC: NA	Int: Demonstration, Discussion group, Lecture, Role play CC: NA	Int: One time CC: NA	Modification of physician behaviors that affect patient trust	Practice behavior	No	Five behaviors correlated with patient trust: "letting you tell the story"; listening carefully; never interrupting; answering questions clearly showed the least net difference between groups, but are very important to patients.	This study did not find any effect from a one-day physician training intervention on patient-physician trust, physician or patient satisfaction, utilization, continuity or adherence.	Int: 6 months CC: 6 months
Schect-man, 1996[16]	Int: Print, Samples of first generation antihistamines to use with patients CC: NA	Int: Readings CC: NA	Int: One time CC: NA	Antihistamine prescribing costs per member per month, as measured from health plan database.	Practice behavior	No	Education and providing drug samples had no substantial effect on prescribing behavior between intervention and control sites. Both groups decreased costs 2% in the study period.	Education and providing samples did not result in decreased antihistamine prescribing costs. An effective intervention would require targeting of major patient-related barriers (e.g. patient expectations) to clinician behavior change.	Int: 6 months CC: 6 months
Bjorn-son, 1990[14]	Int: Print CC: NA	Int: Readings CC: NA	Int: One time CC: NA	Change in physician prescribing patterns	Practice behavior	No	There was no statistical difference between the number of physicians in the intervention and control groups who made full changes (switching patients to both hydralazine and isosorbide), but the number who made full and partial changes approached significance ($p=0.07$).	The intervention was not successful in modifying the prescribing practices of physicians with respect to CHF patients.	Int: 4 months CC: 4 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Stewart, 2005[43]	Int: Internet, not real time, CC: NA	Int: Case-based learning, Discussion group, Reading CC: NA	Int: Multiple time or repetitive CC: NA	Physician behaviors	Practice behavior	No	Scores on the standardized patient checklist were not significantly different in the intervention group than in the control group.	The case-based on-line discussion demonstrated a mixed effect, with significant differences on only one of two cases and for only two of the three outcomes (family physicians' knowledge and quality of practice). The study identified a promising continuing education format (case-based, on-line learning), as well as questions for future research regarding the content and order of cases presented in on-line education.	Int: 6 months CC: NA
Lin, 1997[73]	CC: NA Int: Live, Video, Print	CC: NA Int: Academic detailing, Feedback, Lecture, Readings, Role play	CC: NA Int: Multiple time or repetitive	Change in depression practice behaviors as a result of the intervention	Practice behavior	No	There was no difference between the two groups in number of follow-up visits for depression, or in the number of educational messages received by patients.	The results do not support the concept that this complex and aggressive intervention effected a sustain change in practice behaviors 6 months after the intervention. In fact, some positive changes were noted immediately after the intervention (i.e. prescribing patterns) but were lost 6 months after the intervention was over.	CC: NA Int: 6 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Schect man, 1995[130]	Int: Print Int: Print Int: Print CC: Print CC: Print CC: Print	Int: Feedback, Readings Int: Feedback, Readings Int: Feedback, Readings CC: Readings CC: Readings CC: Readings	Int: Multiple time or repetitive Int: Multiple time or repetitive Int: Multiple time or repetitive CC: Multiple time or repetitive CC: Multiple time or repetitive CC: Multiple time or repetitive	Change in prescribing patterns of H2 blockers	Practice behavior	No	Education: memo alone v. memo plus feedback; no difference across groups. Group model physicians did respond to the intervention and network physicians did not.	A simple educational intervention to change physician prescribing patterns can be modestly effective. In this study only group-model physicians changed their behavior and individual feedback did not lead to a higher percentage of physicians responding to the intervention among the total study population.	Int: 6 months Int: 6 months Int: 6 months CC: 6 months CC: 6 months CC: 6 months
Case-beer, 1999[131]	Int: Audio, Telephone conferences CC: NA	Int: Case-based learning, Discussion group, Point of care CC: NA	Int: Multiple time or repetitive CC: NA	Physician strategies in enhancing adherence to hypercho-lesterolemic treatment, as measured by standardized patients pre- and 3 months post-intervention	Practice behavior	No	No significant differences between groups in use of seven communication strategies. Intervention group had significant pre- to post- improvements in facilitating patients' understanding of hypercholesterolemia (p=0.009) and interpersonal interaction (p=0.28).	Combining a series of interactive case audio-conferences with chart reminders shows promise in increasing physicians' adherence-enhancing strategies.	Int: 9 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Pinto, 1998[74]	CC: Prin,t Int: Live, Print	CC: Readings, Int: Discussion group, Readings, Role play	CC: Amount of exposure up to the physicians Int: One time	Report of actual counseling activities by physicians	Practice behavior	No	The intervention group had a slight increase in actual self-reported counseling by physicians, but it was not statistically significant over the control group.	The program improved physician confidence in counseling and patient satisfaction, but did not increase the physician reports of exercise counseling provided to all patients.	CC: 8 months Int: 8 months
Gullion, 1988[132]	Int: Print, Telephone conference Int: Print, Telephone conference Int: Print, Telephone conference CC: NA	Int: Discussion group, Feedback, Readings Int: Discussion group, Feedback, Readings Int: Discussion group, Feedback, Readings CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NA	Physician behavior regarding behavioral management of hypertension, as assessed by chart review	Practice behavior	No	Using adjusted p-value (p<0.0025) for multiple comparisons, there were no significant differences. Patients of physicians who received behavioral education had higher weight scores (p<0.005) and were slightly more likely to be heavy drinkers (p<0.09) compared with physicians who did not receive behavioral education. They were also more likely to have received advice about how to take medications (p<0.04), about side effects (p<0.006), and about sodium intake (p<0.04). Patients who were most overweight lost weight if physicians received behavioral education and gained weight if not; slightly overweight patients gained weight regardless of MD training.	An education program combining an individualized feedback report of performance, a peer-reviewed syllabus, and an educational session in the form of a telephone conference call had no significant impact on patients' hypertension.	Int: 11 months Int: 11 months Int: 11 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Gullion, 1988[132]	Int: Print, Telephone conference Int: Print, Telephone conference Int: Print, Telephone conference CC: NA	Int: Discussion group, Feedback, Readings Int: Discussion group, Feedback, Readings Int: Discussion group, Feedback, Readings CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NA	Physician behavior regarding medication management for hypertension, as assessed by chart review	Practice behavior	No	Using adjusted p-value (p<0.0056) for multiple comparisons, there were no significant differences. Physicians receiving medication education were more likely to take correct actions with abnormal labs compared with no medication education groups (p<0.03), but no other significant differences on other 8 measures.	An education program combining an individualized feedback report of performance, a peer-reviewed syllabus, and an educational session in the form of a telephone conference call had no significant impact on patients' hypertension.	Int: 11 months Int: 11 months Int: 11 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Lin, 2001[133]	Int: Live CC: Live NA	Int: Academic detailing, Case-based learning, Demonstration, Discussion group, Role play CC: NA	Int: Multiple time or repetitive CC: Multiple time or repetitive	Characteri-stics related to physician practices regarding diagnosis and treatment of depression	Practice behavior	No	While both groups slightly increased in both their rate of diagnosing depression and the rate of new Rx's of antidepressants for new diagnoses, the intervention group decreased slightly while the usual care group increased slightly in their rate of antidepressant prescriptions. However, pre-to-post changes were not statistically significantly different between intervention and usual care group when it came to any of these 3 outcome measures (rate of diagnosing depression, Rx rate of antidepressant meds, or rate of new Rx of antidepressants for new diagnoses of depression).	"After education on optimal management of depression, intervention physicians did not differ from their usual care colleagues in depression diagnosis or pharmacotherapy."	Int: 1 year CC: 1 year
Soco-lar, 1998[134]	CC: NA Int: Print	CC: NA Int: Feedback, Readings	CC: NA Int: Multiple time or repetitive	Impact of the intervention on history and physical exam scores from the chart audit	Practice behavior	No	There was no difference in charting of the history and physical exam between the groups. Also, there was no difference in the pre and post knowledge tests between the groups.	The intervention seemed to have no effect. However, having CME credit in child abuse was associated with improved documentation which may indicate that the chart audit technique of providing feedback and education may not be the optimal method of providing education.	CC: 1 year Int: 1 year

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Soco-lar, 1998[134]	CC: NA Int: Print	CC: NA Int: Feedback, Readings	CC: NA Int: Multiple time or repetitive	Variables that did correlate with improved documentati on	Practice behavior	No	There was an overall improvement in documentation by both groups during the study, so correlates of this improvement were sought as the intervention itself seemed to have no impact. The statistically significant associations were having obtained CME credit in child abuse evaluation, a structured medical record, and female gender.	The intervention seemed to have no effect. However, having CME credit in child abuse was associated with improved documentation which may indicate that the chart audit technique of providing feedback and education may not be the optimal method of providing education.	CC: 1 year Int: 1 year
Brown, 2004[135]	Int: Live, Video, Print CC: NA	Int: Case-based learning, Demonstration, Lecture, Problem-based learning or team-based learning, Readings CC: NA	Int: Multiple time or repetitive CC: NA	see comments regarding parents and patients	Practice behavior	No	Treatment group parents more often reported that their children were prescribed anti-inflammatory therapy from physicians compared to parents in the intervention group, though these differences were not statistically significant. However, other measures of clinical outcomes, such as urgent health care services were compared, but level of statistical significance was only given within groups (from baseline to follow-up), and not for comparing between intervention and control groups.	"The physician's interactive seminar has been shown to enhance asthma care and outcomes. The impact of the program is not reserved merely for those patients with more resources. The greatest decline in emergency department use was in children from low-income families."	Int: 22 months CC: 22 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
McClellan, 2003[119]	Int: Video, Print CC: NA	Int: Feedback, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Eye exams ordering	Practice behavior	No	not statistically significant	"The main result of our study was that a population-based quality improvement intervention based on applying the HCQIP model to ambulatory care was associated with improved processes of care of diabetes mellitus."	Int: 1.5-2 years CC: 1.5-2 years
McClellan, 2003[119]	Int: Video, Print CC: NA	Int: Feedback, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Quantitative urine ordering	Practice behavior	No	not statistically significant	"The main result of our study was that a population-based quality improvement intervention based on applying the HCQIP model to ambulatory care was associated with improved processes of care of diabetes mellitus."	Int: 1.5-2 years CC: 1.5-2 years
Browner, 1994[122]	Int: Live, Print Int: Live, Print CC: NA	Int: Lecture, Readings Int: Academic detailing, Case-based learning, Lecture, Point of care, Readings CC: NA	Int: One time Int: Multiple time or repetitive CC: NA	Proportion of patients screened for high cholesterol	Practice behavior	No	No differences between control and intervention groups, p>.25.	CME was not particularly effective in improving compliance with NCEP guidelines among non university affiliated community physicians who practice primary care.	Int: 18 months Int: 18 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Brown-er, 1994[122]	Int: Live, Print Int: Live, Print CC: NA	Int: Lecture, Readings Int: Academic detailing, Case-based learning, Lecture, Point of care, Readings CC: NA	Int: One time Int: Multiple time or repetitive CC: NA	Proportion of screened patients who were managed in compliance with NCEP recommend-ations	Practice behavior	No	No difference between groups, p>.25.	CME was not particularly effective in improving compliance with NCEP guidelines among non university affiliated community physicians who practice primary care.	Int: 18 months Int: 18 months CC: NA
Sibley, 1982[136]	Int: Audio, Print CC: NA	Int: Case-based learning, Lecture, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Quality of care processes on common medical conditions, as measured by chart audit	Practice behavior	No	No significant difference in the improvement of proportion of physicians providing adequate or superior care comparing intervention (5% improvement) vs. control (2%). Preplanned analysis revealed equivalent improvements in high-preference topics (6% both groups), but statistically significantly higher improvement for low-preference topics in study (10% improvement) vs. control (1% worsening)[p=0.01].	"Despite statistically significant gains in their knowledge of how to evaluate and manage a variety of indicator conditions, the study physicians in this trial had neither clinically important nor statistically significant improvements in the documented overall quality of care ... wanting continuing education about a high-preference condition was as good as getting it; it worked when it was not particularly wanted; and its effects did not extend beyond the topics covered."	Int: 18 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Evans CE, 1986[56]	Int: Print CC: NA	Int: Readings, Chart cue materials offered, but not necessarily implemented CC: NA	Int: Multiple time or repetitive CC: NA	Proportion of patients prescribed antihypertensive medications by a study physician, as assessed by patient interview and chart audit	Practice behavior	No	Proportion rose from 57 to 76% in the study group and from 54 to 79% in the control group (p<0.01 overall), but difference between groups not significant.	"Our study demonstrates no influence of a mailed continuing medical education program on the practices of physicians or on the control of blood pressure of hypertensive patients referred from a community survey to these physicians after the program was begun."	Int: 21 months CC: 21 months
Kim, 1999[137]	Int: Live, Print CC: Print	Int: Academic detailing, Feedback, Readings CC: Readings	Int: Multiple time or repetitive CC: Multiple time or repetitive	Preventative services, as observed in chart review	Practice behavior	No	No significant increases in offered procedures and actual declines in mammography and clinical breast exam in both groups; discrepancies noted between patient self-report and chart review	A physician-targeted approach of education, peer-comparison feedback, and academic detailing has modest effects on patient satisfaction and possibly on the offering of selected preventative care services. The lack of agreement between patient reports and medical records review raises concerns about current methods of ascertaining compliance with guidelines for preventative care.	Int: 2-2.5 years CC: 2-2.5 years

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Practice Behavior Objectives With Mixed Results, Evaluation Duration Greater Than 30 Days									
Kronick, 2003[71]	Int: Live CC: NA	Int: Case-based learning, Demonstration CC: NA	Int: One time CC: NA	Physician comfort level with accessing medical information via internet.	Attitudes Practice behavior	Yes Mixed	Intervention group physicians increased their frequency of and comfort with accessing Internet medical information. Statistically significant differences in change from baseline between intervention and control group were seen with frequency of use of www to address patient related questions (p=.009), in the comfort level using online databases (p=.032) and in the frequency of accessing online databases (p=.044). Non-statistically significant differences were seen in frequency of accessing email to answer pt-related questions and comfort in using email, the internet, opinion of the value of the internet and in accessing online full-text journals.	"Rural physicians' comfort and competence in use of computers to address patient problems can be improved by an individualized 3-hour training session. These data suggest that physicians distant from medical libraries can have excellent access to evidence-based resources; as connection to the Internet becomes faster, more uniform, and reliable across communities, the training will become easier to deliver."	Int: 3 months CC: 3 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Fordis, 2005[42]	Int: Live, Print, Risk calculator Int: Internet, real time (e.g., streaming), Internet, not real time, Print, Risk calculator CC: NA	Int: Case-based learning, Lecture, Programmed learning, Readings Int: Case-based learning, Lecture, Programmed learning, Readings CC: NA	Int: One time Int: Multiple time or repetitive CC: NA	Appropriate screening and management of high-risk patients, as measured by chart review	Practice behavior	Mixed	For appropriate screening for lipid abnormalities, there were high baseline screening rates >=93% with no significant post-intervention change. The online CME group did not differ significantly from the live CME and control groups (P = .24). The live CME group did not differ from the control group (P=.16). Regarding drug treatment for patients at high risk, there was a statistically significant though relatively small increase (5.0% (95% CI, 1.0%-9.1%); pre 85.3% -> 90.3% post) in the percentage of patients appropriately treated by the online CME group when compared with the live CME and control groups (partial w2=0.16, P=.04). The live CME and control groups did not differ significantly in treatment of patients.	Appropriately designed, evidence-based online CME can produce objectively measured changes in behavior as well as sustained gains in knowledge that are comparable or superior to those realized from effective live activities.	Int: 5 months Int: 5 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Beaulieu, 2002[140]	Int: Live CC: NA	Int: Case-based learning, Problem-based learning or team-based learning, Readings, Role play CC:	Int: One time CC: NA	Guideline-appropriate screening in the periodic health exam, as measured by number of screening items ordered.	Practice behavior	Mixed	Exposure to the workshop had no impact on the total number of items recommended for inclusion in periodic health exam, but did impact the total number of items recommended for exclusion as well as the secondary outcome of total number of other tests ordered.	"Results suggest that a short interactive workshop can decrease the ordering of unnecessary screening tests for adults who consult for check-ups."	Int: 4-6 months CC: 4-6 months
Tziraki, 2000[141]	Int: Live, Print Int: Print CC: NA	Int: Discussion group, Lecture, Problem-based learning or team-based learning, Role play Int: Readings CC: NA	Int: One time Int: One time CC: NA	Adherence to NCI manual's recommendations for nutrition counseling, as measured by physician / office staff questionnaire and blinded observation of practices and charts	Practice behavior	Mixed	Training group had significantly higher adherence (28.5%) to office organization recommendations (3.8% more than manual-only[p=0.005] and 5.5% more than control[p<0.001]). Training group had significantly higher adherence to nutrition screening (2.5% more than manual-only[p=0.046] and 3% more than control[p=0.012]). But no differences in advice/referral (52.3-57% adherence) or patient follow-up (13.6-14.6% adherence).	"The impact of the training was moderate and not statistically significant for nutrition advice/referral or patient follow-up, which are important in achieving long-term dietary change in patients."	Int: 4-6 months Int: 4-6 months CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Gifford, 1999[142]	HC: NA CC: NA Int: Live, Print	HC: NA CC: NA Int: Case-based learning, Discussion group, Lecture, Readings, mailings	HC: NA CC: NA Int: One time	Neurologists' adherence to guidelines, as measured by participant survey using clinical scenarios	Practice behavior	Mixed	Compared with the combined baseline/ control group, the intervention group was significantly more likely to adhere to 3 of 6 practice recommendations: use of neuroimaging (adjusted OR 4.3; 95% CI: 1.9-9.8), referral to the Alzheimer's Association (2.7; 95% CI: 1.5-4.7), and referral to the Safe Return Program (9.7; 95% CI: 3.1-30.5). For the other recommendations, adherence did not differ between groups. For 2 of these, adherence was high (>80%) in all 3 groups. The intervention group had higher adherence with 1 of 3 recommendations designed to reduce overuse (significant for use of neuroimaging but not for use of EEG and APOE genotype testing) and 2 of 3 recommendations designed to increase use (significant for referral to the Alzheimer's Association and the Safe Return Program but not for diagnosis and treatment of depression).	A multifaceted educational program can improve physician adoption of practice guidelines.	HC: NA CC: NA Int: 6 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Lin, 1997[73]	CC: NA Int: Live, Video, Print	CC: NA Int: Academic detailing, Feedback, Lecture, Readings, Role play	CC: NA Int: Multiple time or repetitive	Pattern of antidepres-sant prescriptions	Practice behavior	Mixed	There was an increase in imipramine and a decrease in amitryptilline/doxepin use during the intervention (a goal of the study), but this effect was lost 6 months after the intervention. There was no difference in the use of Prozac between the control and intervention. There was also no difference in adequacy of antidepressant medication use at 6 months between the two groups.	The results do not support the concept that this complex and aggressive intervention effected a sustain change in practice behaviors 6 months after the intervention. In fact, some positive changes were noted immediately after the intervention (i.e. prescribing patterns) but were lost 6 months after the intervention was over	CC: NA Int: 6 months
Carney, 1995[88]	Int: Live, Video CC: NA	Int: Demonstration, Discussion group, Feedback, Lecture, Programmed learning, Role play CC: NA	Int: One time CC: NA	Which CME techniques had the greatest effect on physician cancer screening and prevention counseling skills	Cognitive skills Practice behavior	Mixed Mixed	Performance of intervention physicians was consistently better though only 4 of 19 measured endpoints of the physicians' behavior by the SP reached statistical significance.	Performance based CME techniques have a positive influence on physicians' performance (especially in skills training). Using unannounced standardized patients is a feasible method to assess performance within the practice environment.	Int: 1 year CC: NA

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Ray, 1985[20]	CC: NA Int: Live Int: Live	CC: NA Int: Academic detailing Int: Academic detailing	CC: NA Int: One time Int: One time	Prescribing of contraindicated antibiotics and oral cephalos-porins, as measured by Medicaid data	Practice behavior	Mixed	Drug-educator group produced modest improvement in prescribing in year 1, but not year 2. Physician-counselor group had significant improvements in both drug classes in years 1 and 2 by "average prescription change index," but not by proportion of doctors. Improvements in "average patient change index" in physician-counselor group were attenuated in year 2 for contraindicated antibiotics, but not oral cephalosporins.	"the beneficial impact on prescribing of a single physician-counselor visit of 15 minutes was both strong and lasting" "although some attenuation of effect was seen"; "no lasting beneficial effect of one visit by the drug educator"	CC: NA Int: 2 years Int: 2 years
Kim, 1999[137]	Int: Live, Print CC: Print	Int: Academic detailing, Feedback, Readings CC: Readings	Int: Multiple time or repetitive CC: Multiple time or repetitive	Preventative care services offered, as reported by patient questionnaire	Practice behavior	Mixed	Proportions of patients reporting being offered services increased in both groups for influenza, pneumococcal, and tetanus immunization; in educational only group for mammography and clinical breast exam; in comprehensive group for exercise counseling; and for neither in smoking cessation.	A physician-targeted approach of education, peer-comparison feedback, and academic detailing has modest effects on patient satisfaction and possibly on the offering of selected preventative care services. The lack of agreement between patient reports and medical records review raises concerns about current methods of ascertaining compliance with guidelines for preventative care.	Int: 2-2.5 years CC: 2-2.5 years

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Unclear if Practice Behavior Objectives Met, Evaluation Duration Greater Than 30 Days									
Davis, 2004[101]	Int: Live, Video, Audio, audio teleconferencing CC: NA	Int: Case-based learning, Discussion group, Problem-based learning or team-based learning CC: NA	Int: Multiple time or repetitive CC: NA	Change in prescribing patterns with respect to use of ICSs	Practice behavior	Unclear	Most study group physicians increased their use of ICSs, all more so did the control group. No overall increase in the study group was given to compare to the control group's overall 24% increase in use (6 months before compared to 6 months after intervention), nor was any indication of statistical significance given (for between or with group differences).	"We report the first PBL-style teleconference series to demonstrate a significant change in physician prescribing habits toward better concordance with current asthma guidelines. This study demonstrated the powerful impact that the PBL format has on physician learning that actually translated into action—a measurable change in beliefs and behavior that led to changes in the number of prescriptions written by the participants. Although standard, traditional, didactic lectures remain the norm for CME and credits are given for attendance, many studies have now shown that PBL is actually more effective at enhancing physicians learning. CME offices should plan more small-group workshops or teleconferences integrating the PBL format, with skilled facilitators trained to develop the cases and moderate the sessions, ultimately to improve the quality of CME."	Int: 6 months CC: 6 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Practice Behavior Objectives With No Control Group, Evaluation Duration Not Reported									
Gold-stein, 2005[146]	Int: Live, Print Int: Live, Print	Int: Discussion group, Readings, packet which had patient-specific information form Int: Discussion group, Readings, packet which had patient-specific information form and advisory about guideline concordance of patient's antihypertensive drug regimen	Int: Not specified Int: Not specified	Guideline concordance of clinician prescribing	Practice behavior	No control group	Concordance with the drug therapy guidelines for hypertension improved in both study groups, with substantially more improvement in the individualized intervention group compared with the general-intervention group. Concordance improved almost 11% with the individualized intervention compared with 4% with the general intervention (t=2.796, P=.008); this absolute increase of 11% represents a 26% relative improvement over baseline nonconcordance in the individualized group versus 7% in the general group. Bootstrap analysis showed that being in the individualized-intervention group increased the odds of concordance 1.5-fold (2-sided P=.03, z=2.23; 95% CI: 0.05, 2.12).	Individualized recommendations about drug therapy for hypertension presented to clinicians at the time of a patient visit are effective in changing prescribing to achieve higher rates of guideline adherence. Providing individualized recommendations to clinicians can be done in healthcare systems with electronic pharmacy and diagnostic data, even in the absence of a complete electronic health record. Generation and distribution of recommendations can be done efficiently if these activities are integrated with existing procedures.	Int: NR Int: NR

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Rosen-thal, 2005[59]	Int: Live, Handheld, Review of data CC: Review of data	Int: Lecture, Readings, Review of practice's data CC: Review of practice's data	Int: Multiple time or repetitive CC: One time	Parent reports of anticipatory guidance	Practice behavior	No con-trol group	The adjusted proportion of families of 1-month-olds who received 4 of the 5 age-appropriate anticipatory guidance items changed from 15.9% (95% CI: 8.9%-26.7%) to 10.0% (95% CI: 5.1%-18.8%) in the control practices and from 7.3% (95% CI: 4.1%-12.9%) to 24.0% (95% CI: 14.6%-36.9%) in the intervention practices (difference between two differences, p=.002). The adjusted proportion of families of 6-month-olds who received all of the age-appropriate anticipatory guidance changed from 8.2% (95% CI, 3.6%-17.8%) to 5.4% (95% CI, 2.8%-10.2%) in the control practices and from 2.2% (95% CI, 0.8%-5.9%) to 18.1% (95% CI, 10.3%-29.9%) in the intervention practices (difference between two differences, P=.001).	An office system intervention improved parent reports of quantity of anticipatory guidance but did not change parent knowledge or parent behavior.	Int: NR CC: NR

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Allison, 2005[147]	CC: Computer-based off-line Int: Computer-based off-line	CC: Readings Int: Feedback (chlamydia screening rates for the physician's entire office), Readings	CC: Multiple time or repetitive Int: Multiple time or repetitive	Screening rates	Practice behavior	No control group	The mean screening rates before, during, and after the intervention for the comparison offices were 18.9%, 13.0%, and 12.4%, respectively, and for the intervention offices were 16.2%, 13.3%, and 15.5%, respectively, (p=0.044 for post-intervention differences after adjusting for baseline performance). The difference in post-intervention screening rates by study group remained significant when adjusting for both pre-intervention and intra-intervention screening rates using repeated-measures analysis (p=0.009).	This randomized trial of a multicomponent, Internet-based CME intervention found an attenuated decrease in screening rates for offices exposed to the intervention. The demonstrated impact on practice patterns coupled with low intervention intensity increases the potential importance of mCME as a learning method that is easy to disseminate. The appropriateness of mCME for other conditions and settings must be assessed.	CC: NR Int: NR

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Practice Behavior Objectives With No Control Group, Evaluation Duration Greater Than 30 Days									
Lockyer, 2002[64]	Int: Live Int: Live	Int: Case-based learning, Discussion group, Lecture, Role play Int: Case-based learning, Discussion group, Lecture	Int: One time Int: One time	Physician practice behaviors: involvement in patient care	Practice behavior	No control group	Both track 1 (introductory course) and track 2 (advanced course) participants improved statistically significantly between pre and post-test scores with a moderate effect size difference (0.7 & 0.4, respectively). Between tracks comparisons showed statistically significant differences between tracks for both precourse and postcourse assessment of involvement.	Track 1 (introductory course) physicians improved moderately, while track 2 (advanced course) physicians showed a small or negligible change in knowledge, comfort, and involvement in patient care for dementia patients. Tracking in CME - assigning physicians to courses based on pre-course ability, interest, or skill - needs further study.	Int: 3 months Int: 3 months
Mazmanian, 1998[24]	CC: Live Int: Live	CC: Lecture Int: Lecture	CC: One time Int: One time	Impact of CME content including barriers to practice change on actual self-reported practice change by physicians	Practice behavior	No control group	There was no difference between the control and intervention group and their self-reported practice change.	Including content on barriers to change in CME lecture material did not make physicians more likely to change their practice. However, physicians who report intent to change are more likely to actually change their practice patterns than those who don't.	CC: 45 days Int: 45 days

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Kutcher, 2002[65]	Int: Live, Print Int: Live, Print	Int: Academic detailing, Discussion group, Lecture, Readings Int: Discussion group, Lecture, Readings	Int: One time Int: One time	Characteristics related to physician action such as use of a screening tool and optimal pharmacotherapy	Practice behavior	No control group	Enhanced intervention group was more likely to utilize depression diagnostic tool, optimize drug therapy, and use a checklist for adverse events (p<0.0001).	"A well-designed, directional, brief, simple, and low-cost educational program can increase family physicians' knowledge of depression, improve their diagnostic skills, and optimize their treatment of depression."	Int: 6 months Int: 6 months
Pimlott, 2003[143]	Int: Print CC: Print	Int: Feedback, Readings CC: Feedback, Readings	Int: Multiple time or repetitive CC: Multiple time or repetitive	Characteristics of physician prescribing (of benzodiazepines to elderly)	Practice behavior	No control group	Though a small reduction in the prescribing of benzodiazepines was observed among the intervention group, and the mean change in percent from baseline to the end was significantly different (p=0.036) for the intervention and control groups, the intervention still had no significant impact on the proportion of seniors who received long-term benzodiazepine therapy (alone or in combination).	"We found that an intervention that had reasonable success in changing antibiotic prescribing patterns was unsuccessful when applied to benzodiazepine prescribing."	Int: 6 months CC: 6 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Mc-Bride, 2000[144]	Int: Live, Print	Int: Academic detailing, Discussion group, Feedback, Lecture, Point of care, Problem-based learning or team-based learning	Int: Multiple time or repetitive	Changes in documentation of screening of cardiovascular risk factors, as measured by medical record audit at baseline, 12 months, and 18 months	Practice behavior	No con-trol group	Tripled in combined intervention group, with significance at 18 months. Prevention coordinator group had significant increase at 12 months and slight decrease at 18 months. Consultation group increases did not reach significance. No changes in conference-only group.	Practices can set goals, make changes in practice organization for prevention services, and increase risk factor screening and management documentation. Consultation practices set more goals, but prevention coordinator practices achieved greater increases in the use of medical record tools and documentation of screening and management.	Int: 6 months
	Int: Live, Print	Int: Lecture, Point of care, Problem-based learning or team-based learning, Patient education	Int: Multiple time or repetitive						Int: 6 months
	Int: Live, Print	Int: Academic detailing, Discussion group, Feedback, Lecture, Problem-based learning or team-based learning, Patient education	Int: Multiple time or repetitive						Int: 6 months
	CC: Live, Print	CC: Lecture, Point of care	CC: One time						CC: 18 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Mc-Bride, 2000[144]	Int: Live, Print	Int: Academic detailing, Discussion group, Feedback, Lecture, Point of care, Problem-based learning or team-based learning	Int: Multiple time or repetitive	Improved use of cardiovas-cular risk assessment tools, as measured by medical record audit at baseline, 12 months, and 18 months	Practice behavior	No con-trol group	Increases in cardiovascular disease risk documentation were greatest in combined intervention group at 12 months (21-35% in different locations in chart) and maintained at 18 months. Prevention coordinator group had largest increases flowsheet (22%) and second-largest in patient questionnaire, problem list, and chart label (10-22%), with most changes maintained at 18 months. Documentation increased to lesser degree in consultation group. Conference-only group demonstrated small increase in questionnaires, flowhseets, but not in chart labels or problem list.	Practices can set goals, make changes in practice organization for prevention services, and increase risk factor screening and management documentation. Consultation practices set more goals, but prevention coordinator practices achieved greater increases in the use of medical record tools and documentation of screening and management.	Int: 6 months
	Int: Live, Print	Int: Lecture, Point of care, Problem-based learning or team-based learning, Patient education	Int: Multiple time or repetitive						Int: 6 months
	Int: Live, Print	Int: Academic detailing, Discussion group, Feedback, Lecture, Problem-based learning or team-based learning, Patient education	Int: Multiple time or repetitive						Int: 6 months
	CC: Live, Print	CC: Lecture, Point of care	CC: One time						CC: 18 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Mc-Bride, 2000[144]	Int: Live, Print	Int: Academic detailing, Discussion group, Feedback, Lecture, Point of care, Problem-based learning or team-based learning	Int: Multiple time or repetitive	Goal setting by practices, as reported by physician and staff questionnaires	Practice behavior	No control group	Combined intervention and consultation groups set average of 7 goals, while coordinator group set 5 and conference-only group set 3. Conference-only group less likely to set screening tool goal (42% vs. 82-100% in other groups, p<0.05).	Practices can set goals, make changes in practice organization for prevention services, and increase risk factor screening and management documentation. Consultation practices set more goals, but prevention coordinator practices achieved greater increases in the use of medical record tools and documentation of screening and management.	Int: 6 months
	Int: Live, Print	Int: Lecture, Point of care, Problem-based learning or team-based learning, Patient education	Int: Multiple time or repetitive						Int: 6 months
	Int: Live, Print	Int: Academic detailing, Discussion group, Feedback, Lecture, Problem-based learning or team-based learning, Patient education	Int: Multiple time or repetitive						Int: 6 months
	CC: Live, Print	CC: Lecture, Point of care	CC: One time						CC: 18 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Mc-Bride, 2000[144]	Int: Live, Print	Int: Academic detailing, Discussion group, Feedback, Lecture, Point of care, Problem-based learning or team-based learning	Int: Multiple time or repetitive	Changes in documentation of management of cardiovascular risk factors, as measured by medical record audit at baseline, 12 months, and 18 months	Practice behavior	No control group	Appropriate management documented for 65% of patients at baseline, with significant increase in combined intervention group (72%) at 12 months compared with conference-only group (64%, p<0.05). At 18 months, all intervention groups (88-95%) had increased documentation compared with control (71%), with significant difference in coordinator and consultation groups.	Practices can set goals, make changes in practice organization for prevention services, and increase risk factor screening and management documentation. Consultation practices set more goals, but prevention coordinator practices achieved greater increases in the use of medical record tools and documentation of screening and management.	Int: 6 months
	Int: Live, Print	Int: Lecture, Point of care, Problem-based learning or team-based learning, Patient education	Int: Multiple time or repetitive						Int: 6 months
	Int: Live, Print	Int: Academic detailing, Discussion group, Feedback, Lecture, Problem-based learning or team-based learning, Patient education	Int: Multiple time or repetitive						Int: 6 months
	CC: Live, Print	CC: Lecture, Point of care	CC: One time						CC: 18 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Cherkin, 1991[83]	Int: Live, Video Int: Live, Video	Int: Demonstration, Discussion group, Lecture Int: Demonstration, Discussion group, Lecture	Int: Multiple time or repetitive Int: One time	Ordering spine radiographs	Practice behavior	No control group	Percentage of providers indicating they would order lumbosacral spine radiographs fell from 67% to 43% (not statistically significant).	Both HMO and private practice achieved the first goal. As a result of the intervention about 50% of the physicians felt more confident in their ability to manage back pain.	Int: 4 months Int: 1-2 months
Heale, 1988[66]	Int: Live Int: Live Int: Live	Int: Lecture Int: Case-based learning, Discussion group Int: Problem-based learning or team-based learning	Int: One time Int: One time Int: One time	Performance by participants with SPs in the office in 7 months	Practice behavior	No control group	There were no differences between groups on physician performance in test cases, but there were differences between cases, with physicians performing significantly lower ($p<.001$) on one case than on the other two cases. The small group problem-based group participants performed better on one item related to one case than other participants ($p<.05$).	Within a one day CME course in family medicine, the learning format had no effect on acquired or retained knowledge or on physician performance in three patient problems. Physicians rated the small group problem based format higher.	Int: 7 months Int: 7 months Int: 7 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Greenberg, 1985[25]	Int: Live Int: Live	Int: Lecture Int: Case-based learning	Int: One time Int: One time	Documentation of appropriate management of common pediatric problems	Practice behavior	No control group	No statistically significant difference in recording diagnoses (case-based 70% vs. lecture-based 38%) or in accuracy of diagnosis (79 vs. 78%). Significantly more case-based learners recorded a plan than lecture-based learners (80 vs. 39%, p<0.02). Plans were appropriate in 63% case-based vs. 44% lecture-based learners, but no significance test was reported.	Case-based learning, compared with lecture-based learning, was associated with some significant advantages in teaching skills and behavior in management of common pediatrics problems.	Int: 6-9 months Int: 6-9 months
Labelle, 2004[67]	Int: Live, Print Int: Live	Int: Case-based learning, Demonstration, Discussion group, Lecture, Problem-based learning or team-based learning, Role play, Standardized patient Int: Case-based learning, Role play, Standardized patient	Int: Multiple time or repetitive Int: Multiple time or repetitive	Impact on prescribing practice, as assessed by OSCE	Practice behavior	No control group	Though the scores increased somewhat for both groups (reflecting increase in WAP use in practice), the change was marginally not significantly different between the intervention groups (p=0.052).	"This study demonstrated a positive impact of the combination of a case-based, interactive asthma workshop featuring a preformatted tool to aid in drafting of WAPs, with a reinforcing OSCE 6 months post-workshop, on GP knowledge and self-reported use of WAPs. These results support the conclusion of reviews of CME programs that interactive and sequential educational activities providing opportunities to practice appear promising in changing physician practice."	Int: 12 months Int: 12 months

Evidence table 11. Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Winick-off, 1984[23]	Int: Print Int: Print	Int: Feedback Int: Feedback	Int: Multiple time or repetitive Int: Multiple time or repetitive	Compliance with colorectal screening, as measured by chart review / health plan records	Practice behavior	No con-trol group	Intervention period 1: both intervention and control groups improved significantly (p<0.001) from rates of 66 and 67.5% to 79.9 and 76.6%, respectively. Intervention period 2: group 1 stabilized at 79.8%, while group 2 continued to improve to 84.1% (p<0.001 for improvement, p<0.025 compared with group 1). Rates sustained at 6 and 12 months post-intervention.	Peer comparison feedback may improve compliance with quality improvement	Int: 12 months Int: 6 months

Evidence table 11. **Effectiveness of continuing medial education on short-term and long-term practice behavior outcomes**

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Howe, 1997[145]	Int: NR	Int: Feedback, Point of care, Readings	Int: NR	Changes in breast cancer management practices before and after the intervention	Practice behavior	No con-trol group	Statistically significant urban-rural discrepancies were eliminated by both interventions for many practices.	The intervention had some impact on individuals measures, but overall it did not have a measurable impact on the rural-urban difference	Int: 2 years
	Int: NR	Int: Feedback, Lecture, Point of care, Readings, (the major difference between groups was the intensity of the intervention with frequent seminars and more intensive outreach but with greater access to experts in breast cancer)	Int: Multiple time or repetitive						Int: 2 years
	Int: NR	Int: Feedback, Point of care, Readings	Int: Multiple time or repetitive						Int: 2 years
	Int: NR	Int: Feedback, Point of care, Readings	Int: NR						Int: 2 years

AAP = American Academy of Pediatrics; ACEI = angiotensin-converting enzyme inhibitor; AMI = acute myocardial infarction; ANCOVA = analysis of covariance; ATP = allergy trial pack; CC = concurrent control; CCBs = calcium channel blocker; CDE = complete diagnostic exam; CHF = congestive heart failure; CI = confidence interval; CME = continuing medical education; COPD = chronic obstructive pulmonary diseases; COX-2 = cyclooxygenase-2; DES = diethylstilbestrol; GIOP = glucocorticoid-induced osteoporosis; HC = historical control; HCQIP = Health Care Quality Improvement Program; IG = intervention group; Int =intervention group; LTC = long-term care; LTRA = leukotriene antagonists; mCME = multicomponent Internet continuing medical education; NA = not applicable; NCEP = National Cholesterol Education Program;NHC = neighborhood health center; NR = not reported; NSAID = non-steroidal anti-inflammatory drugs; OA = osteoarthritis; OR = odds ratio; OSCE = objective structured clinical examination; PBL = problem-based learning; PCP = primary care provider; RCT = randomized controlled trial; RR = relative risk; R-ANOVA = repeated measures analysis of variance; SABA = short acting bronchodilators; SD = standard deviation; SP = standardized patient; URI = upper respiratory infection; WAP = written action plan

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Clinical Outcomes Objectives Met, Evaluation Duration Not Reported									
Kiang*, 2005[33]	Int: NA CC: NA Int: many things were made available but it is not reported as to which groups used what methods, options included live, regional meetings, CD-ROMs, mailings, grandrounds CC: NA	Int: NA CC: NA Int: not clear CC: NA	Int: NA CC: NA Int: not clear CC: not clear	Perception of prescription and prescription rates of antimicrobial drug use for upper respiratory infections among pediatric patients	Clinical outcome	Yes	In both states, a decline was noted in the perceived parental demand for antimicrobial agents to treat pediatric respiratory illness. The temporal change was significant in Wisconsin ($p = 0.004$) and approaching significance in Minnesota ($p = 0.064$). The median reported percentage of parents who requested an antimicrobial agent decreased from 25% in 1999 to 20% in 2002 in both states, but the distribution around the medians differed significantly between the states.	In conclusion, this study suggests that the WARN campaign had at least a modest positive effect on the knowledge and decision-making of primary care clinicians in Wisconsin.	Int: NA CC: NA Int: NR CC: NA

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Kiang*, 2005[33]	Int: NA CC: NA Int: many things were made available but it is not reported as to which groups used what methods, options included live, regional meetings, CD-ROMs, mailings, grandrounds CC: NA	Int: NA CC: NA Int: not clear CC: NA	Int: NA CC: NA Int: not clear CC: not clear	Perception of prescription and prescription rates of antimicrobial drug use for upper respiratory infections among adult patients	Clinical outcome	Yes	In 2002, Wisconsin clinicians perceived less demand for antimicrobial agents among adult patients compared with 1999 (p<0.001). Based on clinician estimates, the median percentage of patients who requested an antimicrobial agent for cough, cold, or flu symptoms decreased from 50% in 1999 to 30% in 2002. Minnesota clinicians also perceived a decrease in the percentage of patients who requested antimicrobial agents, but the difference was not significant (p = 0.152); the median percentage of Minnesota patients requesting antimicrobial agents decreased from 40% in 1999 to 30% in 2002.	In conclusion, this study suggests that the WARN campaign had at least a modest positive effect on the knowledge and decision-making of primary care clinicians in Wisconsin.	Int: NA CC: NA Int: NR CC: NA

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Wells, 2000[151]	Int: Live, Print CC: NA	Int: Academic detailing, Discussion group, Feedback, Lecture, Point of care, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Depression, as measured by patient survey (CES-D)	Clinical outcome	Yes	At 6 months, 39.9% of QI patients and 49.9% of controls still met criteria for probable depressive disorder (P = .001), with a similar pattern at 12 months (41.6% vs. 51.2%; P = .005). Intervention patients were less likely to have probable depression at 6- and 12-month follow-up by 7 to 10 percentage points. QI-therapy and QI-meds patients, each compared with controls, were 8 to 10 percentage points less likely to have probable disorder at 6 and 12 months (P = .03).	When these managed primary care practices implemented QI programs that improve opportunities for depression treatment without mandating it, quality of care, mental health outcomes, and retention of employment of depressed patients improved over a year, while medical visits did not increase overall.	Int: NR CC: NA

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Wells, 2000[151]	Int: Live, Print CC: NA	Int: Academic detailing, Discussion group, Feedback, Lecture, Point of care, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Health care utilization, as measured by patient survey	Clinical outcome	Yes	There were no differences in probability of having any medical visit at any point (each P.21). At 6 months, 47.5% of QI patients and 36.6% of controls had a medical visit for mental health problems (P = .001), and QI patients were more likely to see a mental health specialist at 6 months (39.8% vs. 27.2%; P<.001) and at 12 months (29.1% vs. 22.7%; P = .03). At each follow-up, QI-meds patients had higher rates than controls of any specialty counseling (by 10-12 percentage points, P = .003).	When these managed primary care practices implemented QI programs that improve opportunities for depression treatment without mandating it, quality of care, mental health outcomes, and retention of employment of depressed patients improved over a year, while medical visits did not increase overall.	Int: NR CC: NA

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Wells, 2000[151]	Int: Live, Print CC: NA	Int: Academic detailing, Discussion group, Feedback, Lecture, Point of care, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Appropriate management of depression, as measured by patient survey	Clinical outcome	Yes	At 6 months, 50.9% of QI patients and 39.7% of controls had counseling or used antidepressant medication at an appropriate dosage (P<.001), with a similar pattern at 12 months (59.2% vs. 50.1%; P = .006). At 6 months, rates of appropriate care were greater by 14% for QI-meds than controls (P<.001) and by 8% for QI-therapy patients than controls (P = .002). At 12 months, QI-meds patients had higher rates of appropriate care than did controls (P<.001) or QI-therapy patients (P = .02), who did not differ significantly from controls. At each follow-up, QI-meds patients had higher rates than controls of appropriate medication use (by 10-14 percentage points, P = .001).	When these managed primary care practices implemented QI programs that improve opportunities for depression treatment without mandating it, quality of care, mental health outcomes, and retention of employment of depressed patients improved over a year, while medical visits did not increase overall.	Int: NR CC: NA

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Clinical Outcomes Objectives Met, Evaluation Duration Less Than or Equal to 30 Days									
Zucker-man, 2004[18]	Int: Print Int: Print CC: NA	Int: Readings Int: Readings CC: NA	Int: One time Int: One time CC: NA	Patient factors: compliance of beta-blocker users.	Clinical outcome	Yes	There was an 8.3% (p=0.02) increase in compliance among beta-blocker users from pre to post-intervention.	"The system wide physician education program in Pennsylvania Medicaid program increased beta-blocker prescribing after AMI hospitalization by increasing physicians' awareness of the guidelines for treatment of AMI survivors. The educational intervention also improved patients' compliance with beta-blocker therapy. These effects are likely to apply to AMI patients well beyond the study population. Besides clinical effects, this intervention program also led to cost savings for the Pennsylvania Medicaid program, as well as avoidance of a few deaths."	Int: 30 days Int: 30 days CC: NA
Clinical Outcomes Objectives Met, Evaluation Duration Greater Than 30 Days									
Stein, 2001[95]	Int: Live, Handheld by phone CC: NA	Int: Readings study, physician visit, algorithm CC: NA	Int: Multiple time or repetitive CC: NA	Among patients: scores on measures of pain, functioning, and disability before and after intervention.	Clinical outcome	Yes	Arthritis pain showed a similar profile in both intervention and control homes: for about 1/3 of subjects, pain worsened in both groups (p=0.81).	An educational intervention effectively reduced NSAID use in nursing homes without worsening of arthritis pain.	Int: 3 months CC: NA

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Stewart, 2005[43]	Int: Internet, not real time CC: NA	Int: Case-based learning, Discussion group, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Quality of practice	Clinical outcome	Yes	Participation in the intervention was associated with quality of practice on the prevention topic; the mean quality of practice score at 6 months for the intervention group was significantly greater than for the control group. However, there were no differences on the diabetes topic. In a multiple regression analysis assessing the relationship of the intervention on quality of practice at 2 months and 6 months, taking knowledge into account, we found that after controlling for 2-month knowledge (as well as solo/group and baseline knowledge), the quality of practice on the prevention topic was significantly better in the intervention group than in the control group at both 2 months (b=1.27, p=.028) and 6 months (b=1.25, p=.016).	The case-based on-line discussion demonstrated a mixed effect, with significant differences on only one of two cases and for only two of the three outcomes (family physicians' knowledge and quality of practice). The study identified a promising continuing education format (case-based, on-line learning), as well as questions for future research regarding the content and order of cases presented in on-line education.	Int: 6 months CC: NA

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Rost, 2001[22]	Int: by phone CC: NA	Int: conference calls CC: NA	Int: Multiple time or repetitive CC: NA	Improvement in patient depressive symptoms (for patients starting a new treatment episode) based on increased use of psychotherapy or medication and patient satisfaction with care.	Clinical outcome	Yes	Patients in the intervention practices starting a new treatment episode reported improvements of depressive symptoms, versus patients in the control practices (p=0.04). Patients who claimed that psychopharmacology was acceptable to use showed more improvement overall (p=0.007) and patients in the intervention group practices were more satisfied with their care than those in the control group practices (p=0.02), among those for whom medication was acceptable. However, patients who were already in treatment did not report improvements with the intervention.	Patients starting a new treatment episode for depression in the intervention practices (which were trained to re-determine practice team roles) were significantly more likely to show improvements of symptoms (mental and physical) than were those patients in the control practices. Those who were already in treatment showed no significant improvements, regardless of group.	Int: 6 months CC: NA
Worrall, 1999[152]	Int: Live CC: Print	Int: Case-based learning, Discussion group, Lecture CC: Readings	Int: One time CC: One time	Number and percent of patients taking medication at 6 month follow-up	Clinical outcome	Yes	Significant difference with more patients in intervention group taking medication at 6 months, p<.05	"The educational strategy had a modest beneficial effect on the outcomes of patients with depression, but there are still concerns regarding the low rates of drug treatment and referral to mental health professionals by family physicians."	Int: 6 months CC: 6 months

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Worrall, 1999[152]	Int: Live CC: Print	Int: Case-based learning, Discussion group, Lecture CC: Readings	Int: One time CC: One time	The gain score, defined as the difference in the scores between the initial threshold score of depression on the Center for Epidemiologic Studies Depression Scale (CES-D, a 20-item self-report questionnaire) and the same score obtained 6 months later	Clinical outcome	Yes	Before treatment, the mean CES-D score for patients didn't differ. The mean scores at 6 months were lower overall, but the difference between the intervention and control groups was not statistically significant. However, the mean gain score for patients in the intervention group was significantly higher ($p < 0.05$).	"The educational strategy had a modest beneficial effect on the outcomes of patients with depression, but there are still concerns regarding the low rates of drug treatment and referral to mental health professionals by family physicians."	Int: 6 months CC: 6 months

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Worrall, 1999[152]	Int: Live CC: Print	Int: Case-based learning, Discussion group, Lecture CC: Readings	Int: One time CC: One time	The gain score, which is the difference between the score obtained from the initial subjective diagnosis of depressive symptoms (based on a 4-point ordinal scale where 1 = absence of depressive symptoms and 4= severely depressed) and the same measure taken 6 months later	Clinical outcome	Yes	A statistically significant difference between the intervention and control groups' mean gain scores for physicians' ratings of depression severity was observed (p = 0.02).	"The educational strategy had a modest beneficial effect on the outcomes of patients with depression, but there are still concerns regarding the low rates of drug treatment and referral to mental health professionals by family physicians."	Int: 6 months CC: 6 months

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Roter, 1995[84]	Int: Live Int: Live CC: NA	Int: Discussion group, Lecture, Role play, Standardized patient Int: Discussion group, Lecture, Role play, Standardized patient CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NA	Effect on patients' emotional distress	Clinical outcome	Yes	There was a reduction in emotional distress for all patient groups. However, patients of PD physicians showed significantly greater reduction in distress at 2 weeks, 3 months, and 6 months ($p<0.05$). Although their scores were lower, the patients of EH physicians did not have significantly greater reductions in emotional distress than the patients of control physicians.	Physicians' use of communication skills in their practices changed as a result of an 8-hour CME program. Physicians trained in specific communication skills recognized more psychological problems in their patients than did untrained physicians. Trained physicians showed greater clinical proficiency in the management of a simulated patient compared with control group physicians. The patients of trained physicians compared with untrained physicians showed greater reduction in emotional distress for as long as 6 months after their medical visit.	Int: Participant questionnaire was conducted in between sessions. When the simulated patient occurred was not reported. The last patient assessment was 6 months after their audiotaped visit, which occurred during the CME.
Mai-man, 1988[47]	Int: Live Print Int: Print CC: NA	Int: Discussion group, Lecture, Readings Int: Readings CC: NA	Int: Multiple time or repetitive Int: One time CC: NA	Mothers (patient) compliance with antibiotics	Clinical outcome	Yes	Educational interventions were associated with increased adherence as measured by liquid/pill counts in the home, and mothers' report of missed doses.	CME increased physician knowledge and compliance-enhancing practices and resulted in improvement in mothers' adherence to therapy.	Int: 6 months Int: 6 months CC: NA

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Pinto, 1998[74]	CC: Print Int: Live, Print	CC: Readings Int: Discussion group, Readings, Role play	CC: Given materials to read-exposure up to the physicians Int: One time	Patient satisfaction with care	Clinical outcome	Yes	Patients in the IG were statistically more likely to report an increase in their satisfaction with care than controls (t =4.55, df =255, p<.01).	The program improved physician confidence in counseling and patient satisfaction, but did not increase the physician reports of exercise counseling provided to all patients.	CC: 8 months Int: 8 months
Derebery, 2002[153]	Int: Live, Print CC: Print	Int: Demonstration, Discussion group, Lecture, Problem-based learning or team-based learning, Readings, Simulation (other than standardized patient or role-play) CC: Readings	Int: In addition to workshop, physicians received updated LBP manual to read on their own within 2-3 months for additional CME credit CC: NA	Characteristics related to physician management of lower back pain including restricted duty rate, duration of restricted work, off-duty rate, number of therapy visits, number of doc visits, & case duration.	Clinical outcome	Yes	There was a significant decrease in the outcomes (physician lower back pain management practices) of the study group while the control group experienced no significant changes between pre and post-training period.	"All the outcomes measured decreased significantly in the study group while the control group experienced no significant changes from the pretraining period to the posttraining period, with the exception of a significant increase in case duration."	Int: 1 year CC: 1 year

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Ray, 2001[109]	Int: Live, Print CC: NA	Int: Academic detailing, Readings, chart reminders CC: NA	Int: Multiple time or repetitive CC: NA	Change between baseline and follow-up years in: SF36 measures of general health, physical function, and bodily pain (from 40% random patient sample)	Clinical outcome	Yes	No change over time of pain, health, or functioning scores for either group.	The educational program modestly reduced NSAID exposure in community-dwelling elderly patients without undesirable substitution of other medications or detectable worsening of musculoskeletal symptoms.	Int: 1 year CC: NA
Gon-zales, 1999[111]	Int: Live, Print Int: Print CC: NA	Int: Academic detailing, Demonstration, Lecture, Point of care Int: Academic detailing, Point of care CC: NA	Int: One time Int: NA CC: NA	Incidence of adult office visits (incident visits) for uncompli-cated acute bronchitis and changes in return visit rates	Clinical outcome	Yes	No increase across sites.	Antibiotic treatment of adults diagnosed as having uncomplicated acute bronchitis can be safely reduced using a combination of patient and practitioner interventions.	Int: 1 year Int: 1 year CC: NA
Wilson, 1988[154]	CC: NA CC: NR Int: Live	CC: NA CC: NR Int: NR	CC: NA CC: MDs were told to offer nicotine gum Int: One time	Smoking cessation quit rates	Clinical outcome	Yes	Patients of physicians in intervention group had higher rates of smoking cessation (8.8%) at 3 months than patients of non-intervention physicians (4.4% for usual care and 6.1% for gum only).	Patients of physicians in intervention group had higher rates of smoking cessation (8.8%) at 3 months than patients of non-intervention physicians (4.4% for usual care and 6.1% for gum only).	CC: NA CC: NA Int: 1 year

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Lindsay-McIntyre, 1987[115]	Int: Print Int: Live, Video, Print CC: NA	Int: Point of care Int: Demonstration, Lecture, Point of care, Standardized patient CC: NA	Int: Multiple time or repetitive Int: Training 1 time, cueing with each patient CC: NA	Patient smoking cessation behaviors, as measured by patient question-naire at 2 months and 1 year	Clinical outcome	Yes	17.8% of gum plus training patients reported successful smoking cessation at 2 months, vs. 4% of usual care and 7% of gum only (p=0.05), with preliminary 1-year analysis showing narrower but still statistically significant differences. No significant differences in attempts to quit between gum only group (62.8%) and gum plus training group (76.5%).	Nicotine gum with chart cues helped stimulate patient smoking cessation attempts, but physician training in counseling with a more intensive flow sheet produced more successful short-term cessation.	Int: 1 year Int: 1 year CC: NA
Clark, 1998[120]	CC: NA Int: Live, Video	CC: NA Int: Case-based learning, Clinical experiences, Lecture	CC: NA Int: Multiple time or repetitive	Impact of the intervention independent of the prescription of inhaled anti-inflammatory devices.	Clinical outcome	Yes	This was a subgroup analysis of 72 children (combined intervention and control groups) who were started on anti-inflammatory devices during the study. Intervention group patients were statistically significantly more likely to have fewer symptomatic asthma days in spring, summer, and winter (but not in the fall).	The intervention had a positive impact on both physician and parent reported behaviors, and patient outcomes were also positively impacted by the intervention. In addition, the impact appeared to be more than just that resulting from the increased use of anti-inflammatory medication and the change in practice behavior and the disease management model seems to be important as well	CC: 22 months Int: 22 months

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
McMa-hon, 1988[155]	Int: Live Int: Live CC: Live CC: NA	Int: Discussion group, Feedback, Lecture Int: Discussion group, Lecture CC: Discussion group, Lecture CC: NA	Int: Multiple time or repetitive Int: One time CC: One time CC: NA	Length of stay	Clinical outcome	Yes	LOS for patients discharged from the study unit dropped significantly (p<.001) when compared with pre-intervention. Between group differences were not measured/ only pre and post intervention.	The length of stay decreased significantly in the three targeted specialty services after a 2 pronged Int: 1 individual meeting with medical director, and a CME group meeting.	Int: 16 months Int: 16 months CC: 16 months CC: 16 months
Clark, 2000[78]	Int: Live, Video CC: NA	Int: Case-based learning, Demonstration, Lecture CC: NA	Int: Multiple time or repetitive CC: NA	Patient use of healthcare for asthma	Clinical outcome	Yes	Intervention patients had fewer hospitalizations (p=.03). Intervention patients did not show less utilization of ED use, but high baseline users of the ED did show a decrease in use (p=.03). Number of office visits was not affected.	Participating physicians reported that they communicated and taught patients in a more sophisticated way. Parents of intervention patients reported that physicians used a range of communication and education strategies to enhance patient learning and satisfaction. Intervention patients showed a decrease in hospitalization.	Int: 2 years CC: 2 years

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Kim, 1999[137]	Int: Live, Print CC: Print	Int: Academic detailing, Feedback, Readings CC: Readings	Int: Multiple time or repetitive CC: Multiple time or repetitive	Preventative services used by patients, as reported by patient question-naire	Clinical outcome	Yes	Comprehensive group reported greater use of pneumococcal and tetanus vaccination, (p=.02 and p<.01, respectively) and decline in mammography not seen in comprehensive group but seen in education only group (p<.01)	A physician-targeted approach of education, peer-comparison feedback, and academic detailing has modest effects on patient satisfaction and possibly on the offering of selected preventative care services. The lack of agreement between patient reports and medical records review raises concerns about current methods of ascertaining compliance with guidelines for preventative care.	Int: 2-2.5 years CC: 2-2.5 years

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Clinical Outcomes Objectives Not Met, Evaluation Duration Greater Than 30 Days									
Mehler, 2005[99]	Int: Internet, not real time, Print Int: Live, Print CC: NA	Int: Academic detailing, Readings Int: Academic detailing, Lecture CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NA	Percent change in LDL-cholesterol levels	Clinical outcome	No	They observed a decrease in LDL-cholesterol levels in all groups (electronic 111 to 97 mg/dL, direct 115 to 104 mg/dL, and control 109 to 101 mg/dL), although there were no differences in magnitude between the groups (P =.4).	A simple educational intervention seems to positively influence provider behavior in the area of lipid management in diabetes mellitus. Both electronic and direct detailing seem to be viable approaches. Future studies to determine optimal educational components that facilitate appropriate provider actions to initiate or intensify lipid treatment seem warranted given the burgeoning population of diabetic patients at risk for coronary heart disease morbidity and mortality.	Int: 3 months Int: 3 months CC: 3 months
Norris, 2000[81]	Int: Live, Print F/U phone calls about protocol CC: NA	Int: Lecture, Point of care, Opinion-leader from clinic teaching CC: NA	Int: Multiple time or repetitive CC: NA	Patient self-reported physical activity, as reported on telephone question-naire at 6-month f/u	Clinical outcome	No	No differences in energy expenditure at 6 months (p=0.77) or other measures of physical activity, although intervention patients had higher stages of change scores among subset of patients classified as Contemplators (p=0.03).	"a one-time PACE counseling session with minimal reinforcement, in a setting with high baseline levels of activity, does not further increase activity of Contemplators advanced in stage of behavior change."	Int: 6 months CC: NA

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Brown, 1999[72]	Int: Live CC: NA	Int: Clinical experiences, Discussion group, Lecture, Role play, Clinicians audio taped interaction with patients and listened between workshops CC: NA	Int: Multiple time or repetitive CC: NA	Patient satisfaction scores as measured by change in mean score on Art of Medicine survey during 6-month periods pre- and post-workshop	Clinical outcome	No	The mean score on the Art of Medicine survey improved more in the control group (0.072[0.030 + 0.042,CI, -0.010 to 0.154]) than in the intervention group (0.030[CI, -0.060 to 0.120]). The difference in these changes was 0.042 (CI, -0.080 to 0.164). Exposure to the communication skills program therefore did not affect changes in patient satisfaction scores.	"Thriving in a Busy Practice: Physician-Patient Communication," a typical continuing medical education program geared toward developing clinicians' communication skills, is not effective in improving general patient satisfaction. To improve global visit satisfaction, communication skills training programs may need to be longer and more intensive, teach a broader range of skills, and provide ongoing performance feedback.	Int: >=6 months CC: NA
Lin, 1997[73]	CC: NA Int: Live, Video, Print	CC: NA Int: Academic detailing, Feedback, Lecture, Readings, Role play	CC: NA Int: Multiple time or repetitive	Patient satisfaction	Clinical outcome	No	There was no difference in patient satisfaction with their PCP or in the care they received.	The results do not support the concept that this complex and aggressive intervention effected a sustained change in practice behaviors 6 months after the intervention. In fact, some positive changes were noted immediately after the intervention (i.e. prescribing patterns) but were lost 6 months after the intervention was over.	CC: NA Int: 6 months

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Case-beer, 1999[131]	Int: Audio Telephone conferences CC: NA	Int: Case-based learning, Discussion group, Point of care CC: NA	Int: Multiple time or repetitive CC: NA	Patient health status as measured by SF-12	Clinical outcome	No	No difference in physical health status or mental health status between intervention and control groups.	Combining a series of interactive case audio-conferences with chart reminders shows promise in increasing physicians' adherence-enhancing strategies.	Int: 9 months CC: NA
Gullion, 1988[132]	Int: Print, Telephone conference Int: Print, Telephone conference Int: Print, Telephone conference CC: NA	Int: Discussion group, Feedback, Readings Int: Discussion group, Feedback, Readings Int: Discussion group, Feedback, Readings CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NA	Change in patients' diastolic blood pressure (DBP), from pre- to post-intervention (up to 11 months post-phone call)	Clinical outcome	No	DBP improved for all groups (1.32 mmHg, p<0.0001), with no significant differences between control group and the intervention groups.	An education program combining an individualized feedback report of performance, a peer-reviewed syllabus, and an educational session in the form of a telephone conference call had no significant impact on patients' hypertension.	Int: 11 months Int: 11 months Int: 11 months CC: NA
Harris, 2005[75]	Int: Live, Audio, Print, teleconference CC: NA	Int: Case-based learning, Lecture, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Overall mean fasting plasma glucose values	Clinical outcome	No	The overall mean fasting plasma glucose values were not significantly affected (control, 8.5 mmol/L, versus intervention, 8.4 mmol/L; p = .74).	CME delivered by teleconference was feasible, well attended, well received by participants, and improved some key diabetes management practices and outcomes, although primary goal of improving HbA1C was not achieved.	Int: 12 months CC: NA

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Harris, 2005[75]	Int: Live, Audio, Print, teleconference CC: NA	Int: Case-based learning, Lecture, Readings CC: NA	Int: Multiple time or repetitive CC: NA	HbA1c levels	Clinical outcome	No	The intervention did not significantly affect the primary outcome measure (control, 0.076, versus intervention, 0.073; p = .29). The intervention did, however, significantly (p < .04) alter the distribution of patients (n = 369) by level of glycemic control as defined by 1998 Canadian diabetes guidelines and as taught in the TED CME. In the intervention group, fewer patients had inadequate glycemic control (HbA1c levels > 0.084) than in the control group (15.8% versus 23.9%). Significantly more patients in the intervention group were taking insulin (alone or in combination with oral agents), whereas significantly more patients in the control group were prescribed oral agents only. Significantly more patient records in the intervention group had documentation of BMI, eye exams, communication of a treatment plan, and used a flow sheet.	CME delivered by teleconference was feasible, well attended, well received by participants, and improved some key diabetes management practices and outcomes, although primary goal of improving HbA1C was not achieved.	Int: 12 months CC: NA

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Cum-mings, 1989[112]	Int: Live, Video, Print CC: NA	Int: Demonstration, Discussion group, Lecture, Role play CC: NA	Int: Multiple time or repetitive CC: NA	Long-term smoking cessation rates of patients	Clinical outcome	No	There was no difference between intervention and control groups regarding long-term smoking cessation rates among patients at one year.	Intervention physicians discuss smoking at a greater rate than did control physicians. Intervention physicians spent more time discussing smoking with their patients. More smoking patients of the intervention physicians set quit dates and had more follow-up with their physicians. Rates of smoking cessation among patients at one year were no different between control and intervention physicians.	Int: 1 year CC: 1 year
Cum-mings, 1989[113]	Int: Live, Video, Print CC: NA	Int: Case-based learning, Demonstration, Discussion group, Lecture, Role play CC: NA	Int: Multiple time or repetitive CC: NA	Patient smoking cessation rates at one year	Clinical outcome	No	Although patients in the intervention group received more counseling, their patients did not have a higher rate of smoking cessation at one year.	Intervention physicians discussed smoking cessation at a higher rate than did control physicians. They spent more time discussing smoking overall, and more of their patients set quit dates. Overall, smoking cessation rates of patients at one year did not differ between groups.	Int: 1 year CC: 1 year

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Kottke, 1989[114]	Int: Live, Print Int: Print CC: NA	Int: Demonstration, Discussion group, Lecture, Readings Int: Readings CC: NA	Int: One time Int: determined by participant CC: NA	Smoking cessation rates at one year.	Clinical outcome	No	Smoking cessation rates were not significantly different among the three groups (workshop, materials-only, and control)	A brief training program and/or the distribution of education materials marginally increased smoking cessation behaviors among volunteer physicians but did not result in increased smoking cessation rates at one year.	Int: 1 year Int: 1 year CC: 1 year
Cum-mings, 1989[117]	Int: Live, Video, Patient education materials CC: NA	Int: Case-based learning, Demonstration, Role play, Self-reflection CC: NA	Int: Multiple time or repetitive CC: NA	Smoking cessation by patients, as measured by self-report and biochemical validation	Clinical outcome	No	No statistical differences in attempt to quit (39.7 vs. 36.6%), self-report of abstinence, or biochemically validated long-term (>=9 month) abstinence were similar between groups (3.2 vs. 2.5%, difference -1.7 to +3.1).	3-hour continuing education program combined with supportive materials for offices changed the way physicians in private practice counseled about smoking, but had no statistically significant effects on patient outcomes. Some significant differences physicians and patients in intervention vs. control group related to drop-out, but adjustment for factors did not affect outcomes.	Int: 1 year CC: NA

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Elliott, 1997[55]	CC: NA Int: Live, Print	CC: NA Int: Case-based learning, Clinical experiences, Discussion group, Lecture, Readings	CC: NA Int: Multiple time or repetitive	Attitude score of patients and caregivers	Clinical outcome	No	Attitude score declined in patients and caregivers in the intervention group but not statistically significant.	With the exception of attitudes of patients and caregivers, there was a trend toward improvement in pain ratings as well as provider attitudes and knowledge but the effect was minor and the overall results were not overwhelmingly convincing	CC: NA Int: 15 months
Elliott, 1997[55]	CC: NA Int: Live, Print	CC: NA Int: Case-based learning, Clinical experiences, Discussion group, Lecture, Readings	CC: NA Int: Multiple time or repetitive	Pain scores of patients	Clinical outcome	No	Improved in the intervention group but not statistically significant.	With the exception of attitudes of patients and caregivers, there was a trend toward improvement in pain ratings as well as provider attitudes and knowledge but the effect was minor and the overall results were not overwhelmingly convincing.	CC: NA Int: 15 months
Evans, 1986[56]	Int: Print CC: NA	Int: Readings, Chart cue materials offered, but not necessarily implemented CC: NA	Int: Multiple time or repetitive CC: NA	Average blood pressure change from baseline to post-intervention, as measured by home visit to patient	Clinical outcome	No	Blood pressure improved significantly in both intervention and control groups (SBP 12.2 and 13 mmHg lower, DBP 10.4 and 10.6 mmHg lower), but no difference between study and control groups.	"Our study demonstrates no influence of a mailed continuing medical education program on the practices of physicians or on the control of blood pressure of hypertensive patients referred from a community survey to these physicians after the program was begun.	Int: 21 months CC: 21 months

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Kim, 1999[137]	Int: Live, Print CC: Print	Int: Academic detailing, Feedback, Readings CC: Readings	Int: Multiple time or repetitive CC: Multiple time or repetitive	Patient satisfaction	Clinical outcome	No	Satisfaction high at baseline with no significant changes, but comprehensive intervention patients felt quality of care improved. Patient satisfaction reporting preventative services offered reported higher satisfaction.	A physician-targeted approach of education, peer-comparison feedback, and academic detailing has modest effects on patient satisfaction and possibly on the offering of selected preventative care services. The lack of agreement between patient reports and medical records review raises concerns about current methods of ascertaining compliance with guidelines for preventative care.	Int: 2-2.5 years CC: 2-2.5 years
Clinical Outcomes Objectives With Mixed Results, Evaluation Duration Not Reported									
Wells, 2000[151]	Int: Live, Print CC: NA	Int: Academic detailing, Discussion group, Feedback, Lecture, Point of care, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Patient employment status, as measured by patient survey	Clinical outcome	Mixed	Among patients initially employed, 89.7% of intervention patients and 84.7% of control patients worked at 12 months (P = .05). Among those initially not working, 16.4% of intervention patients and 11.4% of control patients were working at 6 months (P>.10); by 12 months, 17% to 18% of intervention and control patients started working.	When these managed primary care practices implemented QI programs that improve opportunities for depression treatment without mandating it, quality of care, mental health outcomes, and retention of employment of depressed patients improved over a year, while medical visits did not increase overall.	Int: NR CC: NA

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Wells, 2000[151]	Int: Live, Print CC: NA	Int: Academic detailing, Discussion group, Feedback, Lecture, Point of care, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Health-related quality of life, as measured by patient survey (SF-12)	Clinical outcome	Mixed	Intervention patients improved more on mental HRQOL by 1 to 2 points at each time point, but not global physical health or physical limitations.	When these managed primary care practices implemented QI programs that improve opportunities for depression treatment without mandating it, quality of care, mental health outcomes, and retention of employment of depressed patients improved over a year, while medical visits did not increase overall.	Int: NR CC: NA
Gerrity, 1999[32]	Int: Live, Video, Audio, Print CC: NA	Int: Clinical experiences, Discussion group, Feedback, Lecture, Readings, Role play CC: NA	Int: Multiple time or repetitive CC: NA	Patient satisfaction	Clinical outcome	Mixed	Patient satisfaction in the female case was higher for intervention physicians than control (p=.014), and higher in the male patient, but not at a significant level.	The Depression Education Program changed physicians' behavior and may be an important component in the efforts to improve the care of depressed patients.	Int: 2-6 weeks CC: NA

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Clinical Outcomes Objectives With Mixed Results, Evaluation Duration Greater Than 30 Days									
Lin, 1997[73]	CC: NA Int: Live, Video, Print	CC: NA Int: Academic detailing, Feedback, Lecture, Readings, Role play	CC: NA Int: Multiple time or repetitive	Depression outcome measures	Clinical outcome	Mixed	The main depression outcome measure (the IDS score) did not show any change as a result of the intervention (as expected it decreased with treatment but the amount of decrease was not higher as a result of the intervention). Another measure called the SCL-90 did show a significantly greater decrease of scores after the intervention but the overall result was mixed.	The results do not support the concept that this complex and aggressive intervention effected a sustained change in practice behaviors 6 months after the intervention. In fact, some positive changes were noted immediately after the intervention (i.e. prescribing patterns) but were lost 6 months after the intervention was over	CC: NA Int: 6 months
Case-beer, 1999[131]	Int: Audio Telephone conferences CC: NA	Int: Case-based learning, Discussion group, Point of care CC: NA	Int: Multiple time or repetitive CC: NA	Patient knowledge and behavior on hypercholesterolemia, as measured by self-reported patient questionnaire and lipid levels	Clinical outcome	Mixed	Intervention group had significantly higher knowledge score (p=0.008) and self-reported consumption of dietary fats (p=0.002), but no significant difference in 8 other items.	Combining a series of interactive case audio-conferences with chart reminders shows promise in increasing physicians' adherence-enhancing strategies.	Int: 9 months CC: NA
Case-beer, 1999[131]	Int: Audio Telephone conferences CC: NA	Int: Case-based learning, Discussion group, Point of care CC: NA	Int: Multiple time or repetitive CC: NA	Patient lipid levels, as measured by laboratory testing	Clinical outcome	Mixed	Significantly lower serum cholesterol in men in intervention group 9 months after intervention. (p=.02) Specific changes, lipid levels, and data in women NR.	Combining a series of interactive case audio-conferences with chart reminders shows promise in increasing physicians' adherence-enhancing strategies.	Int: 9 months CC: NA

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Clark, 1998[120]	CC: NA Int: Live, Video	CC: NA Int: Case-based learning, Clinical experiences, Lecture	CC: NA Int: Multiple time or repetitive	Impact of intervention on use of health care services by the patient	Clinical outcome	Mixed	IG group patients were stat sig. less likely to have office visits. There was no impact on ED visits and hospitalizations (except in a subgroup analysis of low-income patients where the IG had fewer).	The intervention had a positive impact on both physician and parent reported behaviors, and patient outcomes were also positively impacted by the intervention. In addition, the impact appeared to be more than just that resulting from the increased use of anti-inflammatory medication and the change in practice behavior and the disease management model seems to be important as well.	CC: 22 months Int: 22 months
Mes-sina, 2002[156]	Int: Live, Audio, Print Int: Live, Print CC: Live, Audio CC: NA	Int: Demonstration, Readings, Standardized patient, telephone counseling Int: Demonstration, Readings, Standardized patient CC: Readings, telephone counseling CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive CC: Multiple time or repetitive CC: NA	Patient mammo-graphy use.	Clinical outcome	Mixed	Baseline ever users of mammography showed an increase in use among those who received BSTC compared to control pts (p=0.041). However, among never users, CME, and not BSTC, is more important in achieving regular use of mammography (but not to a statistically significant degree- lack of power)	"...findings suggest that women who have bad prior mammography but do not screen regularly may require different approaches to promote screening than women who have never had a mammogram. BSTC is still potentially useful as a motivator to obtain subsequent mammograms but does not appear to be adequate for initiating screening in our sample of women who never had a mammogram."	Int: 3 years Int: 3 years CC: 3 years CC: 3 years

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Unclear if Clinical Outcomes Objectives Met, Evaluation Duration Greater Than 30 Days									
Rodney, 1986[77]	Int: Live, Video Int: Live, Video CC: NA	Int: Demonstration, Lecture, Simulation (other than standardized patient or role-play) Int: Demonstration, Lecture, Simulation (other than standardized patient or role-play) CC: NA	Int: One time Int: One time CC: NA	Procedure outcomes from flexible sigmoidoscopy, as reported by physicians by phone or written survey	Clinical outcome	Unclear	2 complications were reported among large group learners, and none in the small groups, but no test of significance mentioned.	Physicians who participate in courses in flexible sigmoidoscopy have a higher probability of office utilization of these skills than those who do not take courses. Minimal differences found between large and small group CME formats.	Int: 12-18 months Int: 12-18 months CC: NA

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Clinical Outcomes Objectives With No Control Group, Evaluation Duration Greater Than 30 Days									
Brown, 2004[135]	Int: Live, Video, Print CC: NA	Int: Case-based learning, Demonstration, Lecture, Problem-based learning or team-based learning, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Admission rates, written asthma action plan, and days absent from school	Clinical outcome	No control group	The families of 36 children (13%) had an income of < $20,000, and they were treated by 23 physicians. Low-income children in the treatment group tended to have higher levels of use of controller medications, to receive a written asthma action plan, and to miss fewer days of school, although these differences were not statistically significant compared to low-income children in the control group. However, low-income treatment group children were significantly less likely to be admitted to an emergency department (annual rate, 0.208 vs 1.441, respectively) or to a hospital (annual rate, 0 vs 0.029, respectively) for asthma care compared to children in the control group.	"The physician's interactive seminar has been shown to enhance asthma care and outcomes. The impact of the program is not reserved merely for those patients with more resources. The greatest decline in emergency department use was in children from low-income families."	Int: 22 months CC: 22 months

Evidence table 12. Effectiveness of continuing medical education on short-term and long-term clinical outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Kutcher, 2002[65]	Int: Live, Print Int: Live, Print	Int: Academic detailing, Discussion group, Lecture, Readings, Int: Discussion group, Lecture, Readings	Int: One time Int: One time	Patient satisfaction, compliance, treatment outcome and office visits.	Clinical outcome	No control group	Patients were satisfied in both groups, but no between group comparison was done, no differences were found in compliance or withdrawals. Patients treated by physicians in the enhanced group did make fewer office visits. Both patient groups improved with regard to self reported signs of depression ($p<0.001$) but the between group comparison showed no differences between groups. Patients treated by physicians in the enhanced group were less likely to be sent for adjunctive psychotherapy, ($p <0.0001$).	"A well-designed, directional, brief, simple, and low-cost educational program can increase family physicians' knowledge of depression, improve their diagnostic skills, and optimize their treatment of depression."	Int: 6 months Int: 6 months

*A complex intervention, which involved both physician and patient education, was used.
AMI = acute myocardial infarction; BMI = body mass index; BSTC = barrier-specific telephone counseling; CES-D = Center for Epidemiologic Studies Depression; CME = continuing medical education; CI = confidence interval; DBP = diastolic blood pressure; ED = emergency department; EH = emotion handling; HRQOL = health-related quality of life; IDS = Inventory of Depressive Symptomatology; IG = intervention group; LOS = length of stay; NA = not applicable; NR = not reported; NSAID = non-steroidal anti-inflammatory drug; PCP = primary care provider; PD = problem defining; QI = quality improvement; SBP = systolic blood pressure; SCL-90 = Symptom Checklist-90; SD = standard deviation; SET = standard educational tools; SF-12 = Short Form-12; FQ = fluoroquinolone; TED = teleconferenced educational detailing; WARN = Wisconsin Antibiotic Resistance Network;

Evidence table 13. Characteristics of systematic reviews evaluating the effectiveness of simulation in medical education

Author, year	Simulation methods	Health care professionals	Study designs	Comparisons	End date for search	Articles included, N	Relevant studies, N
Psychomotor Skills							
Haque, 2006[26]	Virtual reality	Medical students; Physicians-in-training (residents or fellows)	Randomized controlled trials; Prospective studies (Note: In order for studies to be included, they should have reported results with statistical data).	Simulation vs other medical education; Experienced operators vs novice operators in a simulated environment	2004	16	7
Aucar, 2005[29]	Partial task simulation; Computer simulation	Medical students; Physicians-in-training (residents or fellows); Fully trained physicians; Non-surgical personnel	Randomized controlled trials; Nonrandomized controlled trials; Prospective studies; review articles	Simulation vs other simulation; Simulation vs other medical education; Simulation vs no education	2004 (not clearly reported, authors wrote that search was conducted until 'present')	37 (16 review articles, 21 original articles)	7
Gerson, 2004[30]	Partial task simulation; Computer simulation; Virtual reality	Physicians-in-training (residents or fellows); Fully trained physicians; novice; clerical staff	Randomized controlled trials; Nonrandomized controlled trials; Prospective studies; Case-control studies	Simulation vs other simulation; Simulation vs other medical education; Simulation vs no education; Expert vs novice	January 2004	12	4
Sutherland, 2006[31]	Full simulation; Partial task simulation; Computer simulation	Medical students; Physicians-in-training (residents or fellows); Fully trained physicians; other groups not specified	Randomized controlled trials	Simulation vs other simulation; Simulation vs other medical education; Simulation vs no education	April 2005	30	30
Gaffan, 2006[158]	Partial task simulation; Computer simulation; Standardized patient	Medical students	Randomized controlled trials; Nonrandomized controlled trials; descriptive; cohort	Simulation vs other medical education; Simulation vs no education	August 2004	48	5

Evidence table 13. Characteristics of systematic reviews evaluating the effectiveness of simulation in medical education

Author, year	Simulation methods	Health care professionals	Study designs	Comparisons	End date for search	Articles included, N	Relevant studies, N
Ravert P, 2002[159]	Full simulation; Partial task simulation; Computer simulation	Medical students; Physicians-in-training (residents or fellows); Nurses; Nursing students	Randomized controlled trials; Nonrandomized controlled trials; Prospective studies	Simulation vs other medical education	NR	9	4
Communication Skills							
Gaffan, 2006[158]	Partial task simulation; Computer simulation; Standardized patient	Medical students	Randomized controlled trials; Nonrandomized controlled trials; descriptive; cohort	Simulation vs other medical education; Simulation vs no education	August 2004	48	5
Spangler, 2002[160]	Standardized patient role play	Medical students	Randomized controlled trials; Prospective studies	Simulation vs other medical education	June 2002	13 studies met eligibility for inclusion; not all included simulation	9
Cognitive Skills							
Hmelo, 1990[28]	Computer simulation, not clear	Medical students; Physicians-in-training (residents or fellows); other health professional students (e.g., dietary, allied health, pharmacy, nursing, occupational health, dental, respiratory health); medical/nursing staff	Not specified, but 78% had controls	Simulation vs other medical education; Simulation vs no education	NR	65, but only 33 had data on effects of simulation	33

Evidence table 13. Characteristics of systematic reviews evaluating the effectiveness of simulation in medical education

Author, year	Simulation methods	Health care professionals	Study designs	Comparisons	End date for search	Articles included, N	Relevant studies, N
Ravert P, 2002[159]	Full simulation; Partial task simulation; Computer simulation	Medical students; Physicians-in-training (residents or fellows); Nurses; Nursing students	Randomized controlled trials; Nonrandomized controlled trials; Prospective studies	Simulation vs other medical education	NR	9	4
Other							
Issenberg, 2005[27]	None, discussed features of high-fidelity simulation	Medical students; Physicians-in-training (residents or fellows); Fully trained physicians	Randomized controlled trials; Nonrandomized controlled trials; Prospective studies	None	June 2003	109	109

NR = not reported

Evidence table 14. Results of systematic reviews evaluating the effectiveness of simulation on medical education

Psychomotor Skills		
Aucar, 2005[29]		
Outcome	Effectiveness of simulation in improving performance of a single cohort of subjects. Comparison was made before and after simulation training.	**Overall Conclusion:** overall improvement after educational intervention **Author's Main Conclusion:** Surgical simulators can serve as an objective measure of technical skill level among surgeons. The presence of limited data and several inconsistencies remain that should temper the acceptance of current simulators as inherently valid for certification of surgeons. Additional studies are needed that correlate the observed clinical performance of capable and experience surgeons, using defined criteria, with their measured performance on simulators.
Objective	Psychomotor skills	
Results	Out of nine studies, eight found that simulation improved performance. Ninth study, which enrolled experienced surgeon only, found marked variability in the measurable skills.	
Outcome	To evaluate the role of simulation in assessing the effectiveness of simulators in differentiating experienced from novice users.	
Objective	Psychomotor skills	
Results	Simulation is effective in differentiating between novice and expert users.	
Outcome	To evaluate the performance on a simulator with performance on live animals or human surgical subjects.	
Objective	Psychomotor skills	
Results	Performance on simulation correlates well with performance on live animals or human subjects. Trainees trained on simulators may perform better on live animals or human subjects as compared to untrained trainees (one study).	
Gaffan, 2006[158]		
Outcome	Student satisfaction with learning.	**Overall Conclusion:** Overall improvement after educational intervention **Author's Main Conclusion:** With respect to simulation: Use of standardized patients to teach breast examination improves students' performance in clinical assessment; the use of silicone models to teach breast examination improves students' sensitivity for detecting breast lumps; computer aided learning modules have a role, but are not superior to other types of learning.
Objective	Attitudes	
Results	Student satisfaction with structured clinical instruction models was positive.	
Outcome	Ability to detect breast lumps using standardized patients.	
Objective	Psychomotor skills	
Results	In two studies, teaching of breast examination with standardized patients had increased detection in intervention groups compared with normal teaching. $p<.05$ and $p<.001$.	
Outcome	Ability to detect breast lumps using models	
Objective	Psychomotor skills	
Results	Lump detection higher for group trained with dynamic model, $p<0.001$. In two more studies, post-test improvement in lump detection, $p<.05$ and $p<.01$, in intervention groups trained with models. Third study showed intervention group had higher sensitivity in detecting breast lumps, $p=.001$, but lower specificity, $p=.001$.	
Outcome	Knowledge of breast cancer detection.	
Objective	Psychomotor skills	
Results	One study showed equivalent knowledge test results in group taught by standardized patients and group taught by normal teaching.	
Outcome	Giving bad news	
Objective	Psychomotor skills	
Results	Four studies looked at giving bad news education, three with SPs, one with role play and SPs, and one with role play alone. All showed improvement in competence in giving bad news.	

Evidence table 14. Results of systematic reviews evaluating the effectiveness of simulation on medical education

Outcome	Student satisfaction with learning detection of testicular lumps.	
Objective	Attitudes	
Results	One study showed positive feedback from students in learning with mannikin Zack	
Sutherland, 2006[31]		
Outcome	Surgical trainees trained with physical or model training vs other forms of training, including no training.	**Overall Conclusion:** Overall improvement after educational intervention. **Author's Main Conclusion:** Computer simulation generally showed better results than no training at all but was not convincingly superior to standard training (such as surgical drills) or video simulation (particularly when assessed by operative performance). Video simulation did not show consistently better results than groups with no training at all, and there were not enough data to determine if video simulation was better than standard training or the use of models. Model simulation may have been better than standard training, and cadaver training may have been better than model training.
Objective	Psychomotor skills	
Results	Four studies found that model training may be better than no training and standard training, but overall there were mixed results.	
Outcome	Surgical trainees trained on computer simulation versus video simulation.	
Objective	Psychomotor skills	
Results	Mixed results in seven studies; may have depended on types of tasks, with computer simulating producing better results for tasks such as incisions, but not for knot tying times.	
Outcome	Surgical trainees trained on computer simulating vs no training.	
Objective	Psychomotor skills	
Results	Those trained on computer simulation performed better than those with no training in eight of nine studies.	
Outcome	Surgical trainees trained on computer simulation vs physical trainer.	
Objective	Psychomotor skills	
Results	One study showed computer simulation training to be superior to live pig (p=.0005)	
Outcome	Surgical trainees with two or more types of computer simulating; MIST-VR outcome.	
Objective	Psychomotor skills	
Results	One study showed more intensive training is more effective than easy level training; 2nd study showed inconsistent results.	
Outcome	Surgical trainees trained with video simulation vs no training or other forms of training.	
Objective	Psychomotor skills	
Results	Six studies comparing video simulation with no training showed inconsistent results; five studies comparing video with other forms of training showed no differences.	
Outcome	Surgical trainees trained on computer simulation vs standard training.	
Objective	Psychomotor skills	
Results	Four out of five studies showed statistical differences with improved results in computer simulation group. Authors concluded that computer simulation comparisons varied, potentially confounded by the different components of standard training, as well as by the different intensities of time allowed on the simulator in computer simulation groups.	
Ravert P, 2002[159]		
Outcome	Effect of simulation on skill or knowledge acquisition.	**Overall Conclusion:** Partial improvement or mixed results
Objective	Knowledge or cognitive skills (Psychomotor skills)	

Evidence table 14. Results of systematic reviews evaluating the effectiveness of simulation on medical education

Results	Five out of nine studies included in this review included medical students or physicians-in-training. Two out of the five studies had a control or comparison group, and one study had a cross-control design. Overall, 75% of the nine studies showed positive effects of simulation on skill or knowledge acquisition as determined by effect size which was measured as d-index. The effect sizes ranged from 0.34 to 5.06.	**Author's Main Conclusion:** It appears that the use of computer-based simulators could play a role in knowledge and skill acquisition. The potential of computer-based simulation as an education strategy is enormous, but more research to fully document its effectiveness is needed.
Gerson, 2004[30]		
Outcome	To evaluate the role of upper GI endoscopy simulator in differentiating between a novice and an expert in performing upper GI endoscopy.(Validation).	**Overall Conclusion:** Overall improvement after educational intervention **Author's Main Conclusion:** 1. Flexible sigmoidoscopy simulators might be applied for clinical training of residents and fellows if improved patient comfort is the primary outcome. However, based upon the current studies, no benefit in clinical training has been demonstrated to date. 2. Use of the colonoscopy training for residents and fellows early in the training process (performance of less than 30 procedures) has been shown to be beneficial, based upon data from a small clinical trial. Further prospective studies are needed to confirm these preliminary findings. 3. Indications for ERCP and EUS simulator training cannot be made until validation and clinical trials are conducted. 4. Because current state-of-the art computer-based simulators have been demonstrated to distinguish expert endoscopists from novices in upper endoscopy, sigmoidoscopy, and colonoscopy, this technology may someday be used as an objective method to judge competence in GI endoscopy.
Objective	Psychomotor skills	
Results	Authors found two studies and they showed that a simulator was able to distinguish a novice from an expert. One study also found that novice trained on the simulator reached the level of the experts after three weeks of simulator training.	
Outcome	To evaluate the role of simulation in training colonoscopy by comparing novice GI fellows trained on simulators with traditionally trained novice GI fellows.	
Objective	Psychomotor skills	
Results	Simulator-trained novice fellows performed better than the novice fellows trained traditionally in all performance aspects except for time of insertion ($p<.05$) and that this advantage continued up to 30 colonoscopies.	
Outcome	To determine optimal time for using simulation in the training of GI fellows.	
Objective	Psychomotor skills	
Results	Authors found one study which concluded that colonoscopy simulators are most effective early in the training of GI fellows.	
Outcome	To evaluate the role of simulation in training ERCP by comparison of live pig model, Erlangen Endo-trainer model, and a computer simulation model. Each model was rated by novices and expert faculty for realism, utility in training, and ease of use.	
Objective	Realism, usefulness in teaching basic and advanced ERCP skills.	
Results	Authors found one study that reported Erlangen Endo-trainer model to be superior to other models.	
Outcome	To evaluate the role of simulation in training flexible sigmoidoscopy by comparing simulator-trained trainees with trainees trained with standard methods or no training.	
Objective	Psychomotor skills	

Results	Authors found three studies. One study reported that simulator training is better than no training in teaching flexible sigmoidoscopy to family medicine residents as measured by insertion time (p=.03), directional errors (p<.01), and examination time (p=.01). Second study reported that bedside teaching was superior to simulator training in teaching flexible sigmoidoscopy to medical residents as measured by insertion time, negotiating rectosigmoid junction, reaching spleenic flexure, and performing reteroflexion. The third study found no procedural skills differences between the groups of 2nd-year residents trained on a simulator and those trained using standard methods.	
Outcome	To evaluate the role of flexible sigmoidoscopy simulator in differentiating between a novice and an expert in performing sigmoidoscopy.	
Objective	Psychomotor skills	
Results	Authors found two studies and they showed that a flexible sigmoidoscopy simulator was able to distinguish a novice from an expert.	
Outcome	To evaluate the role of simulation in assessing the effectiveness of colonoscopy simulators in differentiating novice from experts	
Objective	Psychomotor skills	
Results	Colonoscopy simulators can differentiate a novice from an expert as measured by procedure time, insertion time, and time in and out.	
Haque, 2006[26]		
Outcome	Effectiveness of virtual simulation in differentiating between experienced (those who have performed more than 50 such procedures) and novice (those who have performed less than 10 procedures) trainees based on the "error score" (the number of "wall-strikes" experienced by the trainee or the ratings provided by an external expert of the trainee's performance).	**Overall Conclusion:** No evaluation of improvement after educational intervention **Author's Main Conclusion:** Training on virtual reality simulators can lessen the time taken to complete a given surgical task as well as can help to discriminate between the experienced and the inexperienced trainees.
Objective	Psychomotor skills	
Meta-analysis	Yes	
Significant Results	Yes	
Results	Virtual reality simulators help to differentiate between a novice and an experienced trainee as evidenced by low error scores of the experienced trainees to complete a given surgical task in a virtual reality simulation environment. Standardized effect size = -1.325 (95%CI; -2.125, -0.525)[Random-effects model, p <0.0001 for homogeneity].	
Outcome	Effectiveness of virtual simulation in differentiating between experienced (those who have performed more than 50 such procedures) and novice (those who have performed less than 10 procedures) trainees based on the "task completion time" (amount of time, in seconds or minutes, taken by the trainee to complete task)	
Objective	Psychomotor skills	
Meta-analysis	Yes	
Significant Results	Yes	

Evidence table 14. Results of systematic reviews evaluating the effectiveness of simulation on medical education

Results	Virtual reality simulators help to differentiate between a novice and an experienced trainee as evidenced by the decreased amount of time taken by experienced trainees to complete a given surgical task in a virtual reality simulation environment. Standardized effect size = -1.059 (95% CI; -1.331, -0.786)[fixed-effects model, p = 0.13 for homogeneity; authors report performing a random effects model with quite similar results.]	
Outcome	Effectiveness of transference of skills from the simulation environment to the operating room with experienced surgeons or physicians, trained on simulations, operating on real patients or animal subjects. The control group was experienced surgeons or physicians trained using traditional methods. Both, simulation-trained and traditional method-trained, groups were compared using the "task completion time" (amount of time, in seconds or minutes, taken by the trainee to complete task).	
Objective	Psychomotor skills	
Meta-analysis	Yes	
Significant Results	Yes	
Results	The simulation-trained group took much less time than the traditionally trained group. Using the fixed effect model, a significant standardized effect size of -1.178 (95% CI; -1.706, -0.651) was obtained, but the inadequacy of analysis was indicated by lack of homogeneity (P <0.0001). Reanalysis using the random effects model yielded a statistically significant standardized effect size of -2.175(95% CI; -3.865, -0.485).	
Outcome	Effectiveness of transference of skills from the simulation environment to the operating room with experienced surgeons or physicians, trained on simulations, operating on real patients or animal subjects. The control group was experienced surgeons or physicians trained using traditional methods. Both, simulation-trained and traditional method-trained, groups were compared using the "error score" (the number of "wall-strikes" experienced by the trainee or the ratings provided by an external expert of the trainee's performance).	
Objective	Psychomotor skills	
Meta-analysis	Yes	
Significant Results	No	
Results	The simulation-trained group had a smaller error score than the traditionally trained group. Using the fixed effect model, a significant standardized effect size of -0.974(95% CI; -1.457, -0.491) was obtained, but the inadequacy of analysis was indicated by lack of homogeneity (P <0.0001). Reanalysis using the random effects model yielded a statistically insignificant standardized effect size of -1.565(95% CI; -3.445, 0.314).	

Evidence table 14. Results of systematic reviews evaluating the effectiveness of simulation on medical education

Communication Skills		
Spangler, 2002[160]		
Outcome	Student demonstration of effective tobacco cessation counseling.	**Overall Conclusion:** Overall improvement after educational intervention **Author's Main Conclusion:** Enhanced instructional methods (e.g., the use of patient centered counseling, standardized patient instructors, role playing, or a combination of these) are more effective for teaching tobacco intervention than are traditional didactic methods alone.
Objective	Psychomotor skills	
Results	Nine studies with active (role play or standardized patient) component to education: all but one showed significant improvement at posttest observation of skills; one did not show an improvement when SP group was compared with role playing group in follow-up SP assessment.	
Outcome	Student confidence in tobacco cessation counseling skills	
Objective	Attitudes	
Results	Three studies demonstrated that students working with standardized patients expressed increased confidence in smoking cessation counseling. One RCT showed increased confidence in intervention students compared with controls.	
Gaffan, 2006[158]		
Outcome	Student satisfaction with learning.	**Overall Conclusion:** Overall improvement after educational intervention **Author's Main Conclusion:** With respect to simulation: Use of standardized patients to teach breast examination improves students' performance in clinical assessment; the use of silicone models to teach breast examination improves students' sensitivity for detecting breast lumps; computer aided learning modules have a role, but are not superior to other types of learning.
Objective	Attitudes	
Results	Student satisfaction with structured clinical instruction models was positive.	
Outcome	Ability to detect breast lumps using standardized patients.	
Objective	Psychomotor skills	
Results	In two studies, teaching of breast examination with standardized patients had increased detection in intervention groups compared with normal teaching. p<.05 and p<.001.	
Outcome	Ability to detect breast lumps using models	
Objective	Psychomotor skills	
Results	Lump detection higher for group trained with dynamic model, p<0.001. In two more studies, post-test improvement in lump detection, p<.05 and p<.01, in intervention groups trained with models. Third study showed intervention group had higher sensitivity in detecting breast lumps, p=.001, but lower specificity, p=.001.	
Outcome	Knowledge of breast cancer detection.	
Objective	Psychomotor skills	
Results	One study showed equivalent knowledge test results in group taught by standardized patients and group taught by normal teaching.	
Outcome	Giving bad news	
Objective	Psychomotor skills	
Results	Four studies looked at giving bad news education, three with SPs, one with role play and SPs, and one with role play alone. All showed improvement in competence in giving bad news.	
Outcome	Student satisfaction with learning detection of testicular lumps.	
Objective	Attitudes	
Results	I One study showed positive feedback from students in learning with mannikin Zack	

Evidence table 14. Results of systematic reviews evaluating the effectiveness of simulation on medical education

Cognitive Skills		
Hmelo, 1990[28]		
Outcome **Objective** **Meta-analysis** **Significant Results** **Results**	Achievement Unclear Yes Unclear The average effect size for achievement was 0.63.	**Overall Conclusion:** need for future research **Author's Main Conclusion:** Whether or not computer-assisted instruction (CAI) is a useful modality, how it may best be used and what features promote learning and problem solving in the health care environment require further study. Ultimately, CAI may have a role in preparing a new generation of health practitioners, able to adapt to the changing situations that their professions demand.
Ravert P, 2002[159]		
Outcome **Objective** **Results**	Effect of simulation on skill or knowledge acquisition. Knowledge or cognitive skills (Psychomotor skills) Five out of nine studies included in this review included medical students or physicians-in-training. Two out of the five studies had a control or comparison group, and one study had a cross-control design. Overall, 75% of the nine studies showed positive effects of simulation on skill or knowledge acquisition as determined by effect size which was measured as d-index. The effect sizes ranged from 0.34 to 5.06.	**Overall Conclusion:** Partial improvement or mixed results **Author's Main Conclusion:** It appears that the use of computer-based simulators could play a role in knowledge and skill acquisition. The potential of computer-based simulation as an education strategy is enormous, but more research to fully document its effectiveness is needed.
Other		
Issenberg, 2005[27]		
Outcome **Objective** **Results**	To evaluate the features and uses of high-fidelity simulators that lead to effective learning. Effective learning The important features of high-fidelity simulator that lead to effective learning are following: 1. feedback is provided during learning experience 2. Learners engage in repetitive practice 3. Simulator is integrated in overall curriculum 4. Learners practice with increasing levels of difficulty 5. Adaptable to multiple learning strategies 6. Clinical variation in a simulated environment can increase the number and variety of patients a learner encounters 7. Controlled Environment in which learners make and detect mistakes without consequences 8. Individualized and standardized learning 9. Outcomes are clearly defined 10. Face validity-realism of simulator	**Overall Conclusion:** Unclear **Author's Main Conclusion:** While research in this field needs improvement in terms of rigor and quality, high-fidelity medical simulations are educationally effective and simulation-based education complements medical education in patient care settings.

SP = standardized patient; RCT = randomized controlled trial; MIST-VR = Minimally Invasive Surgical Trainer Virtual Reality; ERCD = endoscopic retrograde pancreatography; EUS = endoscopic ultrasound; CAI = computer assisted instruction

Evidence table 15. Effects of audience characteristics on the effectiveness of continuing medical education

Author, year	Audience characteristic	Educational technique	Outcome	Results	Other characteristics analyzed	Primary goal audience characteristics
Juzych, 2005[92]	Years in practice	Live case studies and printed material	Antibiotic prescribing rates	No effect	None	No
Kiang, 2005[33]	Years in practice	Multiple interventions but specifics for groups not identified	Clinician knowledge and beliefs regarding antibiotic prescribing for upper respiratory infections	Clinicians in practice for >10 years improved in their beliefs about antibiotic prescribing but not in their knowledge compared to physicians with $\leq$ 10 years practice experience	None	No
Leopold, 2005[80]	Years in practice	Printed guide or hands-on instruction or video instruction	Clinician confidence in performing knee joint injection and objective evaluation of joint injection technique	No effect	Age, number of injections performed in last year, gender, physician vs. non-physician	No
Beaulieu, 2002[140]	Years in practice	90-minute workshop using case discussion, role play, and educational handouts	Performance of physicians in including recommended screening items and excluding non-recommended screening items during periodic health exam	Physicians with less than 11 years of experience ordered fewer unnecessary tests order and fewer other tests ordered, but results not stratified by intervention	None	No
Gerstein, 1999[53]	Years in practice	Seven-hour small group workshop for family physicians	Sub-scores on participant questionnaire about diabetes knowledge, attitude, practice behavior	Greater number of years in practice predicted an improvement in self-reported practice behavior but no improvement in attitude or diabetes knowledge	Gender, family practice certification, solo or group practice, full or part-time, practice size	No

Evidence table 15. Effects of audience characteristics on the effectiveness of continuing medical education

Author, year	Audience characteristic	Educational technique	Outcome	Results	Other characteristics analyzed	Primary goal audience characteristics
Grady, 1997[79]	Years in practice	Educational presentation with/without cue enhancement with/without feedback rewards	Cueing had a positive impact on mammography rates above education alone, but feedback and rewards had no added benefit	No effect	Age, gender, practice setting, board certification, specialty, foreign medical graduate vs. US graduate, group size, AMA membership, residency vs no residency	No
Leopold, 2005[80]	Age	Printed guide or hands-on instruction or video instruction	Clinician confidence in performing knee joint injection and objective evaluation of joint injection technique	No effect	Years in practice, number of injections performed in last year, gender, physician vs. non-physician	No
Davis, 2004[101]	Age	Live interactive case-based teleconferences	Change in prescribing patterns of asthma controller medications	Non-significant trend towards older physicians being less likely to prescribe controller medications	Unclear (analysis of factors mentioned but not described)	No
Harris, 2002[39]	Age	Interactive, online, case-based program on domestic violence	Confidence in managing domestic violence patients	No effect, although data not shown	Gender, previous domestic violence training	No
Mazmanian, 2001[161]	Age	Commitment-to-change statement with or without a signature by the CME course participant	Whether or not physicians changed their behaviors, depending on if they had a commitment to change, and also depending on whether or not they signed a commitment to change form	No effect	Gender	No

Evidence table 15. Effects of audience characteristics on the effectiveness of continuing medical education

Author, year	Audience characteristic	Educational technique	Outcome	Results	Other characteristics analyzed	Primary goal audience characteristics
Grady, 1997[79]	Age	Educational presentation with/without cue enhancement with/without feedback rewards	Cueing had a positive impact on mammography rates above education alone, but feedback and rewards had no added benefit	Intervention more effective in older physicians in bivariate but did not hold in multivariate analysis	Age, gender, practice setting, board certification, specialty, foreign medical graduate vs. US graduate, group size, AMA membership, residency vs no residency	No
Soumerai, 1987[105]	Age	Printed educational materials and visits by clinical pharmacists	Intensity of prescribing target drugs.	No effect	Practice setting, specialty, professional boards, intensity of target drug use, Medicaid practice size, nursing home practice size	Yes
Leopold, 2005[80]	Gender	Printed guide or hands-on instruction or video instruction	Clinician confidence in performing knee joint injection and objective evaluation of joint injection technique	Females confidence and objective performance improved more than males	Years in practice, number of injections performed in last year, age, physician vs. non-physician	No
Harris, 2002[39]	Gender	Interactive, online, case-based program on domestic violence	Confidence in managing domestic violence patients	No effect, although data not shown	Age, previous domestic violence training	No
Mazmanian, 2001[161]	Gender	Commitment-to-change statement with or without a signature by the CME course participant	Whether or not physicians changed their behaviors, depending on if they had a commitment to change, and also depending on whether or not they signed a commitment to change form.	No effect	Age	No
Gerstein, 1999[53]	Gender	Seven-hour small group workshop for family physicians	Sub-scores on participant questionnaire about diabetes knowledge, attitude, practice behavior	No effect	Years in practice, family practice certification, solo or group practice, full or part-time, practice size	No

Evidence table 15. Effects of audience characteristics on the effectiveness of continuing medical education

Author, year	Audience characteristic	Educational technique	Outcome	Results	Other characteristics analyzed	Primary goal audience characteristics
Grady, 1997[79]	Gender	Educational presentation with/without cue enhancement with/without feedback rewards	Cueing had a positive impact on mammography rates above education alone, but feedback and rewards had no added benefit	No effect	Age, gender, practice setting, board certification, specialty, foreign medical graduate vs. US graduate, group size, AMA membership, residency vs no residency	No
Gerstein, 1999[53]	Board certification (family practice)	Seven-hour small group workshop for family physicians	Sub-scores on participant questionnaire about diabetes knowledge, attitude, practice behavior	No effect	Years in practice, gender, solo or group practice, full or part-time, practice size	No
Grady, 1997[79]	Board certification (family practice or IM)	Educational presentation with/without cue enhancement with/without feedback rewards	Cueing had a positive impact on mammography rates above education alone, but feedback and rewards had no added benefit	Greater effect on non board certified in bivariate model but not significant in multivariate	Age, gender, practice setting, board certification, specialty, foreign medical graduate vs. US graduate, group size, AMA membership, residency vs no residency	No
Soumerai, 1987[105]	Board certification	Printed educational materials and visits by clinical pharmacists	Intensity of prescribing target drugs	No effect	Age, practice setting, specialty, professional boards, intensity of target drug use, Medicaid practice size, nursing home practice size	Yes
Grady, 1997[79]	Race	Educational presentation with/without cue enhancement with/without feedback rewards	Cueing had a positive impact on mammography rates above education alone, but feedback and rewards had no added benefit	Intervention more effective in nonwhites in multivariate analysis	Age, gender, practice setting, board certification, specialty, foreign medical graduate vs. US graduate, group size, AMA membership, residency vs no residency	No

Evidence table 15. Effects of audience characteristics on the effectiveness of continuing medical education

Author, year	Audience characteristic	Educational technique	Outcome	Results	Other characteristics analyzed	Primary goal audience characteristics
Grady, 1997[79]	Practice setting: solo vs. other	Educational presentation with/without cue enhancement with/without feedback rewards	Cueing had a positive impact on mammography rates above education alone, but feedback and rewards had no added benefit	Intervention more effective in solo practitioners in multivariate analysis	Age, gender, practice setting, board certification, specialty, foreign medical graduate vs. US graduate, group size, AMA membership, residency vs no residency	No
Soumerai, 1987[105]	Practice setting: rural vs. non-rural	Printed educational materials and visits by clinical pharmacists	Intensity of prescribing target drugs.	No effect	Age, practice setting, board certification, professional boards, intensity of target drug use, Medicaid practice size, nursing home practice size	Yes
Grady, 1997[79]	Specialty (FP vs. IM)	Educational presentation with/without cue enhancement with/without feedback rewards	Cueing had a positive impact on mammography rates above education alone, but feedback and rewards had no added benefit	No effect	Age, gender, practice setting, board certification, specialty, foreign medical graduate vs. US graduate, group size, AMA membership, residency vs no residency	No
Lewis, 1993[70]	Specialty	Day-long program on HIV using videotape, group discussion, small group workshops, and lecture	Increased frequency of sexual history questions asked	Internists, but not FPs or Ob/Gyns, were affected by the intervention.	None	No
Lane, 1991[69]	Specialty	Multiple CME interventions AND low-cost mammography	Compliance with mammography screening guidelines	Ob/Gyns had the highest base-line screening levels, but still showed an increase in screening recommendations after the intervention. FP's improved significantly more than OB/Gyns.	Not specified	No

Evidence table 15. Effects of audience characteristics on the effectiveness of continuing medical education

Author, year	Audience characteristic	Educational technique	Outcome	Results	Other characteristics analyzed	Primary goal audience characteristics
Des Marchais, 1990[61]	Specialty	2 training sessions on interpersonal skills	Pre- and post- average deviation score: participant's scoring of interpersonal interactions in videotape, compared with median group score	Psychiatrists had less deviation from median of group both pre- and post-, compared with family physicians	None	No
Soumerai, 1987[105]	Specialty (IM vs. FP)	Printed educational materials and visits by clinical pharmacists	Intensity of prescribing target drugs.	No effect	Age, practice setting, board certification, professional boards, intensity of target drug use, Medicaid practice size, nursing home practice size	Yes
Grady, 1997[79]	U.S. vs. foreign medical graduation	Educational presentation with/without cue enhancement with/without feedback rewards	Cueing had a positive impact on mammography rates above education alone, but feedback and rewards had no added benefit	No effect	Age, gender, practice setting, board certification, specialty, foreign medical graduate vs. US graduate, group size, AMA membership, residency vs no residency	No
Grady, 1997[79]	Residency trained vs. no residency	Educational presentation with/without cue enhancement with/without feedback rewards	Cueing had a positive impact on mammography rates above education alone, but feedback and rewards had no added benefit	Intervention more effective in non residency trained in bivariate analysis but not in multivariate	Age, gender, practice setting, board certification, specialty, foreign medical graduate vs. US graduate, group size, AMA membership, residency vs no residency	No

AMA = American Medical Association; FP = family practitioner; Ob/Gyn = obstetrician/gynecologist; IM = internal medicine; US = United States; CME = continuing medical education

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cogni-tive testing	Method previ-ously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic mea-sured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic mea-sured for current or previous study
Knowledge / Cognitive Skills									
Fordis, 2005[42]	Knowledge test about cholesterol / CAD risk and management, using multiple-choice questions and case vignettes with fixed-choice responses.	Yes	No	Face / content (Not reported)	NA	Current study	Internal consistency (inter-item) reliability	Cronbach's alpha: 0.79 averaged across pre- and post-testing	Current study
Macrae, 2004[85]	Locally developed test of critical appraisal skills pilot tested on group of residents with internal consistency (in pilot and current study) and inter-rater reliability (pilot) as described below. Small modification of evaluation- decreasing number of articles used from 3 (in pilot) to 2 (in current), but claimed that this change has "minimal impact" on alpha reliability (dropped to 0.74) or "the evidence of validity" which wasn't otherwise quantified.	Yes	Yes (questions changed)	Face, content, and construct validity (experts and comparisons not reported)			Internal consistency (inter-item) reliability	Cronbach's alpha: 0.74	Current study

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cognitive testing	Method previously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic measured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic measured for current or previous study
Andersen, 1990[36]	Diagnostic Knowledge Inventory, a measure of psychiatric knowledge based on DSM-III / DSM-IIIR criteria using 18 paragraph-length case vignettes about affective and anxiety disorders (discussed in intervention) and other disorders not discussed. Item-pool of 72 vignettes reviewed by team of experts and reduced through item-analysis in trained and untrained sample. Response options yes/no, 24-choice diagnoses, 7-point Likert for treatment options. Pre- and post-test versions with randomized vignette order.	No	Yes (no changes)	Face / content (Team of experts not specified)	KR 20 = 0.89	Prior study	Internal consistency	Split-half and item-to-total KR20: 0.82-0.90	Prior study
				External construct (known group)	55% difference in score between experts & non-experts; p<0.0001 for "diagnosis" cases	Prior study	Equivalence reliability	R=0.92, p<0.0001	Prior study
Doucet, 1998[40]	The Key Features Problem (KFP) was a 28-item mailed exam developed from guidelines by investigators to test on topics related to headache. 38-item pilot test was given to intervention and control groups for item-analysis.	Yes	No	Face / content (Experts/ sources: Two neurologists with interest in headache treatment)	NA	Current study	Internal consistency (inter-item) reliability	Kuder-Richardson method: 0.71 (pilot sample only)	Current study

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cognitive testing	Method previously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic measured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic measured for current or previous study
White, 1985[48]	Knowledge test for in-hospital treatment of acute myocardial infarction, combining multiple-choice action items and true/false concept items corresponding to course objectives. Pilot tested on 15 physicians. Different versions used same items with change in order.	Yes	No	Face / content (Experts/ sources: 4 cardiovascular faculty and 2 family practice faculty)	NA	Current study	Internal consistency (inter-item) reliability	Cronbach's alpha: 0.57-0.82	Current study
Chung, 2004[54]	34-item multiple-choice questionnaire to assess bioterrorism diagnosis and management, using case scenarios. After review by expert panel, test was given to pilot group of 3 physicians in one exam period. Final test delivered by web.	Yes	No	Face / content (Experts/ sources: Physicians in EM, Ped EM, Peds, ID, medical toxicology, and medical informatics	NA		Equivalence reliability	Average absolute difference of 8%	Current study

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cognitive testing	Method previously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic measured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic measured for current or previous study
Gifford, 1999[142]	Questionnaire / test using three clinical scenarios about dementia diagnosis and management, with open-ended responses about diagnosis, closed-ended choice of 12 diagnostic tests, additional write-in diagnostic tests, and additional write-in options. Test was developed by study neurologists, reviewed by advisory panel, and piloted in 8 neurologists. Mailed 8-page test was scored by 3 physician investigators	Yes	No	Face / content (Experts/ sources: AAN advisory panel)	NA	Current study			
				Concurrent Criterion (Chart review on subset of 22 physicians' charts)	Percent agreement: 95-99% for EEG, Apo E test, and referral to Safe Return Program; 47-77% for referral to Alzheimer's Association and diagnosis of and prescription for depression; 27-49% for neuro-imaging use	Current study			
Chan, 1999[21]	Multiple choice test assessing physician knowledge of geriatric psychiatry, administered by e-mail.	No	Yes (no changes)	Face / content (Experts/ sources: geriatrician, psychiatrist, and family physician)	NA	Current study			

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cognitive testing	Method previously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic measured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic measured for current or previous study
Gerrity, 1999[32]	54-item knowledge test about depression diagnosis and management. Pilot testing by facilitators and investigators, with retention of items if all 7 agreed on answer.	Yes	Yes (changed, but unclear how; test based on objecttives and derived from other test)	Face / content (Experts/ sources: literature review and workshop contents)	NA	Current study			
Maxwell, 1984[57]	30-item multiple-choice test for evaluating knowledge gains at medical evaluation committee meetings. Senior resident and experts in relevant fields reviewed test, then pretested in resident physicians.	Yes	No	Face / content (Experts/ sources: NR)	NA	Current study			

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cogni-tive testing	Method previ-ously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic mea-sured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic mea-sured for current or previous study
Premi, 1993[38]	Knowledge test about the diagnosis and management of chest pain. 94 questions covering 5 specified domains. Reviewed by 8 residents for interpretability, reading level, ambiguity, double-barreled questions, jargon, value-laden terms, positive-negative wording, and length. Two versions created with software for randomized sampling and balancing.	Yes	No	Face / content (Experts/ sources: Consultants and practicing physicians)	NA	Current study			

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cogni-tive testing	Method previ-ously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic mea-sured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic mea-sured for current or previous study
Gifford, 1996[46]	Survey instrument to assess subjects' decision making and adherence to 16 practice recommendations on disease detection, diagnostic test use, and treatments for neurology topics. Developed by 2 investigators from guidelines and course content, using 7 clinical scenarios. Response options included write-in diagnoses, 12-choice test options, write-in management, and other open-ended questions. Pilot tested in 27 neurologists.	Yes	No	Face / content (Experts/ sources: seven experts designed course & reviewed content of the scenarios)	NA	Current study			
				External (known group) validity (Comparison: Readers within the intervention group were more likely to report adherence to practice recommendations)	Readers were 1.7-6.3 x more likely to report adherence	Current study			
Stewart, 2005[43]	Physician knowledge test, measured by questionnaire, of preventive / screening practices related to perimenopausal patient (21 items) and type 2 diabetes (22 items).	No	Yes (unclear if changed)	External construct (known group)	Statistic not reported	Current study			

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cognitive testing	Method previously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic measured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic measured for current or previous study
Slotnick, 1993[17]	24-item knowledge test about drug prescribing information for two drugs, Bumex (older drug) and Mazicon (newer drug). Response options included multiple-choice and true/false.	No	No				Equivalence reliability	Split-half correlations and Spearman Brown prophecy calculations conducted but not reported	Current study
Hergen roeder, 2002[60]	Knowledge test about ankle and knee examination	No	Yes (unclear if changes)				Reliability: not specified	Statistic not reported	Prior study
Attitudes (and/or Knowledge)									
Mere-dith, 2000[51]	Self-administered, mailed physician questionnaire on depression treatment. Questionnaires included batteries of questions that have been previously evaluated for reliability & validity & batteries that were specifically developed for their study. Included items of depression knowledge (12-item scale) measuring endorsement of AHRQ guidelines. Response options: 5-point Likert scale from very false to very true, 3 reversed items.	No	Yes (No changes made)	Face / content (Experts/ sources: Panel of clinicians determined "nonambiguous" indicators of knowledge)	NA	Current study			

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cognitive testing	Method previously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic measured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic measured for current or previous study
Mann, 1997[52]	60-item physician questionnaire about knowledge and attitudes towards cholesterol-lowering practices. Response options included true/false and Likert. Experts agreed on >90% of questions and rest deleted. Piloted by FPs for internal consistency.	No	No	Face / content (3 experts not specified)	NA	Current study	Test-retest reliability	Correlation coefficient: knowledge r= 0.54-0.75; attitude/ practice component r=0.54-0.69	Current study
							Internal consistency	KR=0.60	Previous study
Mann, 1997[52]	Physicians' perceptions of self-efficacy in counseling on cholesterol-lowering, hypertension, and smoking management practices, using 14-items and Likert scale.	No	No				Test-retest reliability	Correlation coefficient: pre & posttest 1 r=0.79, pre & posttest 2 r=0.78, posttest 1&2 r=0.68	Current study
Chodosh, 2006[62]	Short scale for providers' perceptions of quality of care for dementia patients, comprising Likert scales and administered through mailed survey 9 months after intervention initiated.	Yes	No				Internal consistency (inter-item) reliability	Cronbach's alpha: 0.75	Current study

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cogni-tive testing	Method previ-ously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic mea-sured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic mea-sured for current or previous study
Lock-yer, 2002[64]	Written survey for knowledge and comfort in dementia management. 5-point scale for involvement-level in patient management; true/false and multiple-choice knowledge items for total score of 14; 3-point comfort score from 13 items.	No	No				Internal consistency (inter-item) reliability	Cronbach's alpha: 0.56 for cognitive (pre- and post-), 0.88 & 0.93 (pre- and post-) for comfort	Current study
Elliott, 1997[55]	Survey of physician and nurse knowledge and attitudes towards cancer pain management: 15 knowledge items on 5-point scale and 9 attitude items on 11-point scale	No	Yes (modified: unclear how)				Internal consistency (inter-item) reliability	Cronbach's alpha: knowledge 0.68 for physicians and 0.67 for nurses; attitude 0.78 for physicians and 0.77 for nurses (with 2 items omitted)	Current study

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cogni-tive testing	Method previ-ously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic mea-sured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic mea-sured for current or previous study
White, 2004[63]	Case-based 25 item, multiple-choice questionnaire of scenarios faced by community physicians treating asthma patients, to measure knowledge, skills, attitudes (confidence) towards asthma management. Visual analog scale used to assess confidence about answers.	Unclear	Yes (unclear if changed)				Internal consistency (inter-item) reliability	Cronbach's alpha: 0.71 - 0.95, increasing with each administration	Current study
Skills (communication, psychomotor, or procedural)									
Hergenroeder, 2002[60]	Clinical Skills Assessment Examination (CSAE) using standardized patient to evaluate performance of ankle / knee exam by checklist: Interrater reliability of baseline rater evaluated in previous study of residents' performance using the same CSAE as that used in current study. SP (certified athletic trainer) used published checklist to rate as observer.	No	Yes (unclear if changes)				Inter-rater reliability	Ankle and knee Cronbach alpha = 0.99 and 0.90, ankle and knee respectively	Prior study

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cogni-tive testing	Method previ-ously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic mea-sured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic mea-sured for current or previous study
Skills (communication, psychomotor, or procedural) Assessed in the Practice Setting (Practice Behaviors)									
Green-berg, 1985[25]	Standardized patients' assessment of the appropriateness of medical plan given by the learner for managing common pediatric problems. 6 sets of SP mothers/children with case histories on 4 topics; SP mother completed checklist after visit; senior author rated records after visits for validation.	No	No	Concurrent Criterion (Senior author's evaluation of medical records)	Correlation coefficient: 0.60 $p<0.001$	Current study			
Gerrity, 1999[32]	Kaplan's 3-item Participatory Decision-Making scale, as completed by standardized patient after visit.	No	Yes (adapted, unclear how)				Internal consistency (inter-item) reliability	Cronbach''s alpha: 0.91	Current study
Roter, 1995[84]	Simulated patient visits about globus hystericus associated with unresolved grief were audiotaped and then scored by blinded coders for clinical proficiency. 97 clinical and psychologic items; 3 male physicians at Hopkins trained as blinded SPs; 10 categories and overall summed score as well as subscales.	No	No				Internal consistency (inter-item) reliability	Cronbach alpha: Range of 0.76 to 0.81 for scales with four or more items; Range of 0.20 to 0.62 for scales with 2 or 3 items; Reliability for the overall score was 0.62.	Current study

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cogni-tive testing	Method previ-ously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic mea-sured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic mea-sured for current or previous study
Roter, 1995[84]	Proficiency in the management of emotional distress by physicians audiotaped in a few real patient visits. The audiotapes were analyzed to determine how often the physicians used each skill that was mentioned in the CME activities. This evaluates the reliability of blinded coders based on 20 tapes.	No	No				Inter-rater reliability	Correlation coefficient: 0.69 for emotion-handling skills; 0.80 for problem-defining skills	Current study
Beau-lieu, 2002[140]	Standardized patient visits for the periodic health exam (male and female scenario), 2 scenarios (man / woman).	No	Yes (questions, response options changed)				Inter-rater reliability for coding	Kappa: K=0.66 female (90.5%); K=0.68 male scenario (90.1%)	Current study
							Degree of conformity of SP with scenario	93.5% female; 84.8% male	Current study

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cognitive testing	Method previously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic measured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic measured for current or previous study
Carney, 1995[88]	Physicians' cancer-control clinical skills as measured through standardized patients after encounters.. Reliability was tested for standardized-patient accuracy in case replication and in recall of study variables - monitored by audiotaping of encounters through hidden recorders. Pilot tested in 3 practice sessions, videotaped; only SPs with >90% recall accuracy and maintenance of scenarios retained; 9 SPs used	No	No				Inter-rater reliability	Kappa: 0.93 indexed (range 0.87-1.0)	Current study
Levinson, 1993[138]	RIAS content analysis of audiotaped patient encounters (measurement of communication skills behaviors); also 6-point scale for Global Affect Ratings for physicians and patients. Interrater reliability tested for 34 tapes, with random 2nd coder to check for coder decay and drift; interrater reliability for 17 components (others not frequent enough to do analysis).	Unclear	Yes (no changes)				Inter-rater reliability	Pearson Correlation coefficient: averaged 0.80, range 0.55-0.94; Percent Agreement 0.33-1.00 for global affect ratings scales	Current study

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cognitive testing	Method previously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic measured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic measured for current or previous study
Gerrity, 1999[32]	Standardized patients to assess physician communication on depression, completed form after visit.	No	Yes (no changes)				Inter-rater reliability	Statistic not reported	Current study
Gerrity, 1999[32]	ABIM Patient Satisfaction Scale, 9-item, 5-point Likert scales, completed by standardized patients after visit	No	Yes (shorter version compared with citation)	Validity: not specified		Previous study	Reliability: not specified		Previous study
Stewart, 2005[43]	Physician behavior in prevention and diabetes management, as assessed by standardized patient and checklists	No	Yes (unclear if changes made)	Validity: not specified					
Self-reported Practice Behaviors with Knowledge and/or Attitudes									
Gerstein, 1999[53]	Survey about diabetes care knowledge, attitudes, and practice behaviors, as self-reported by primary care clinicians. 120 true/false items drafted / modified by endocrinologists, administered in two 58-question halves. 18 FPs tested in crossover design to test for test-retest and equivalence. Translated to and from French translation. Attitude scales used a 5-point Likert scale.	No	Yes (unclear if changes made)	Face / content (Experts/ sources: literature review and workshop contents)	NA	Current study	Test-retest reliability	Correlation coefficient: Intraclass correlation coefficients 0.8-0.87	Prior study
							Equivalence reliability	Not given	Prior study
				External construct (known group) (Comparison: Administration to medical students, residents, family physicians, and diabetes specialists (endocrinologists))	ANOVA p=0.02 for attitude, p=0.0001 knowledge, p=0.012 practice	Prior study	Internal consistency (inter-item) reliability	Cronbach's alpha: 0.64 attitude, 0.13 knowledge, 0.63 practice	Prior study

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cogni-tive testing	Method previ-ously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic mea-sured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic mea-sured for current or previous study
Mc-Bride, 2000[144]	Physician and staff questionnaires about use of prevention care documentation tools and services	No	No	Concurrent Criterion (Comparison: physician and staff phone interviews for 22%)	Statistic not reported	Current study			
Schroy, 1999[82]	Pre- and post-provider survey (mail or phone) to assess provider attitudes / practices in colorectal cancer screening. Based on ACS 1989 survey: Piloted to full-time providers within site. Yes/no and Likert responses. Actual utilization through appt logs / referrals.	Yes	Yes (unclear)	Concurrent validity	Kappa: 0.67 between self-report and utilization (referrals) for sigmoidoscopy	Current study			
Clark, 2000[78]	Physician self-report of clinical behaviors related to asthma management	No	Yes (no changes)	Predictive Criterion (Comparison: parent description of physician behavior)	Statistic not reported	Prior study			

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cogni-tive testing	Method previ-ously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic mea-sured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic mea-sured for current or previous study
Terry, 1981[49]	Self-assessment questionnaires about knowledge, attitudes, and clinical practice behaviors related to COPD. 44-multiple-choice questions constructed using "standard test development procedures"; 25 items on subsequent tests, chosen based on reliability coefficients	No	No				Internal consistency (inter-item) reliability	Cronbach's alpha: 0.80 on baseline test	Current study
Lane, 2001[45]	Physician barriers to screening for breast cancer (CME need) based on skills, knowledge, and resources on a pre-intervention survey, with physicians categorized as high or low need for CME. Cronbach's alphas were calculated to determine inter-item reliability of the subscales of the test of CME intervention need.	No	Yes (no changes)				Internal consistency (inter-item) reliability	Cronbach's alpha: 0.65 (overall), 0.77 for non-adherence, individual subscales ranged 0.44 for breast exam to 0.78 for counseling need	Current study
Brown, 1999[72]	Learner (clinician) questionnaire about dealing with patients and routine communication style (skills, attitudes, and behaviors in communication)	No	Yes (unclear if changes made)	Validity: not specified		Previous study			

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cogni-tive testing	Method previ-ously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic mea-sured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic mea-sured for current or previous study
Practice Behaviors									
Sibley, 1982[136]	Abstraction of medical chart data to assess quality of documentation of clinical care processes for common medical conditions. Nurse abstractors trained and blinded; outcome was proportion of episodes of care classified as superior or adequate.	No	No	Face / content (Experts/ sources: Peer group of experienced clinicians and consultants)	NA	Current study	Intra-rater reliability	Kappa: >0.8	Current study
							Inter-rater reliability	Kappa: >0.8	
Brown, 1999[72]	Art of Medicine Survey, a patient questionnaire about clinician's communication behavior and patient's reaction to it. Being administered by contractor to HMO, but no published reference to development or use of questionnaire. Mailed survey, 8 items; survey shown to be correlated with observed and experimentally manipulated differences in communication performance	No	Yes (no changes)	Concurrent Criterion (Comparison: Satisfaction)	Spearman Correlation coefficient: 0.92	Current study	Internal consistency (inter-item) reliability	Cronbach''s alpha: 0.97	Current study
								Correlation coefficient: 0.69-0.84 for 7 communications questions	

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Ozer, 2005[104]	Adolescent Report of the Visit: an independent survey of provider screening behavior involving interviews by staff with patients / families after well visits. Distributed by research/clinic staff after MD visit, completed anonymously, yes/no responses. Included 45 items physician behavior; described as "valid indicator of delivery of services" with "construct validity."	Unclear	Yes (length changed)	Construct validity	Statistic not reported	Prior study			
Schectman, 1996[16]	Claims based prescribing data as a measure of practice behavior	No	No	Concurrent Criterion (Comparison: Chart audit data)	100% reliability for prescribing drug info, 92% for prescribing MD - % agreement?	Current study			

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Socolar, 1998[134]	Chart audit of quality of physician documentation in evaluation for sexual abuse: rater scores of individual history and physical exam items documented. Up to 5 records from each MD assessed by two blinded reviewers; 3 reviewers total; 16 items assesed in each; if disagreed on 2 items or more by >=2 Likert scale, 3rd reviewer	No	Unclear				Inter-rater reliability	Kappa: 0.75 (subsample of 30 charts once and all charts during second period)	Current study
							Test-retest reliability	Kappa: 0.96 (subsample of 60 charts done at two time periods)	Current study
Margo-lis, 2004[118]	Blinded chart review data abstraction to assess preventive services for children - interrater reliability assessed on random 20% of charts	No	Yes (unclear if changes made)				Inter-rater reliability	Kappa: above 0.85 for each preventive service	Current study
Fordis, 2005[42]	Chart review to assess appropriate lipid screening and treatment in high-risk patients. Generalized Kappa averaged across dichotomously scored outcomes of primary interest (lipid screening and drug treatment); other outcomes for percent agreement.	No	Unclear				Inter-rater reliability	Percentage agreement: 94.7% Kappa: 0.83 <0.4% error rate on 10% sample	Current study

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

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Schectman, 2003[108]	Chart audit assessment of guideline-consistent behavior for low back pain management: independent patient record review (100 records, oversampled for utilization events) by clinician investigators blinded to prior audit findings	No	No				Inter-rater reliability	Kappa: 0.55; Disagreements almost all due to 1 criterion; without item, residual misclassification <2% of events, mostly due to chart abstraction or data entry	Current study
Jennett, 1988[76]	Chart abstraction for practice behaviors related to 3 cardiovascular and 3 cancer topics. 2 part-time data abstractors reviewed records selected by appointment / billing records; intraconsistency checks for both abstractors 1 year following training period with still high level of consistency	Yes	Unclear				Inter-rater reliability	Statistic unclear: >0.95	Current study

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Mc-Bride, 2000[144]	Chart review for use of cardiovascular risk tools and documentation of cardiovascular risk factor assessment and management; blinded abstracters at baseline, but not at 12 or 18 months; 100% of charts reviewed at baseline; at 12 / 18 months, random 2nd reviews on 10%	No	No				Inter-rater reliability	Half of second reviews showed no data differences, and error rate on others was 1.3%	Current study
White, 1985[48]	Medical record audit for appropriate in hospital management of acute myocardial infarction. 1 trained abstractor on project staff; not aware of desired medical practices for most objectives; Iowa Foundation for Medical Care helped develop audit; 1 audit per objective; exclusion criteria specified for cases; rated on 3-point scale; field tested; re-audit time not specified	Yes	No				Intra-rater reliability	Percentage agreement: 84%	Current study

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Rost, 2001[22]	Services Assessment of Children and Adolescents: Patient self-report telephone interview about pharmacotherapy; concordance of physician depression treatment behavior with AHCPR guidelines was measured.	No	Yes (added questions)				Test-retest reliability	Statistic not reported	Prior study
Moran, 1996[121]	College of Family Physicians of Canada Practice Assessment Program (PASS). Clinical patient care, charting, prevention, and drug use as measured by PASS scores in database; physician questionnaire, patient questionnaire, chart review based on consensus criteria.	Yes	Yes (unclear if changes made)	Validity: not specified		Prior study	Reliability: not specified		Prior study

Evidence table 16. Validity and/or reliability of tools to measure the effectiveness of continuing medical education

Author, year	Evaluation method	Pilot or cogni-tive testing	Method previ-ously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic mea-sured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic mea-sured for current or previous study
Clinical Outcomes									
Maiman, 1988[47]	Assessment of medication compliance by mothers' self-reports, as compared with home visit liquid/pill assessment: number of missed doses, measured during home visit 8 days after visit with MD. 20-minute structured interview with mothers	No	Unclear	Concurrent Criterion: (Comparison: mother self-report of missed doses in home interview vs. liquid / pill check vs. physician report	Correlation coefficient: Liquid/pill vs. self-report of missed doses 0.241; liquid/pill vs. self-report 0.367; compared with pediatricians report p<=0.05	Current study			
Kim, 1999[137]	Patient survey about physician provision of preventive services, validated by medical record review. Surveyed by mail or f/u telephone; Usually medical records did not support pt recall of offered services	No	No	Concurrent Criterion: (Comparison: medical record review)	Percentage agreement: Disagreements 20-40% of time	Current study			
Roter, 1995[84]	General Health Questionnaire, 28-item, to detect psychiatric distress in patients. "Self-administered screening test to detect psychiatric distress in community and nonpsychiatric medical settings." Cut-off for scores not specified.	No	Yes (unclear if changes made)				Internal consistency (inter-item) reliability	Cronbach's alpha: 0.92	Current study

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Author, year	Evaluation method	Pilot or cognitive testing	Method previously used (If "yes," did method change)	Type of validity measured (comparison method)	Statistic for validity measure	Statistic measured for current or previous study	Type of reliability measured	Statistic for reliability measure	Statistic measured for current or previous study
Elliott, 1997[55]	Brief Pain Inventory: measure of cancer patients pain over last 7 days using 4-items and 11-point Likert scale	No	Yes (unclear)				Internal consistency (inter-item) reliability	Cronbach's alpha: 0.83	Current study
Elliott, 1997[55]	Survey of patient and family knowledge (5-point scale) and attitudes (11-point scale) towards cancer pain management, modified from provider questionnaires - items for knowledge did not have adequate internal consistency (statistic not reported).	Yes	Yes (modified: unclear how)				Internal consistency (inter-item) reliability	Cronbach 0.80 for pt attitude, 0.83 for family (total scale only - lower on subscales); knowledge scores without adequate internal consistency.	Current study
Gullion, 1988[132]	Medical record abstraction to assess provider behavior and clinical outcomes regarding appropriate medication and behavioral management of hypertension	Yes	No				Inter-rater reliability	Percentage agreement: 89-92% among 4 abstractors, baseline and re-assessment respectively	Current study
Kim, 1999[137]	Chart review for preventive care services provided	No	No				Inter-rater reliability	Percentage agreement: 100	

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Norris, 2000[81]	Patient questionnaires regarding physical activity and health status: SF-36, Washburn's Physical Activity Scale for the Elderly (PASE), Paffenbarger's physical activity index; administered in-person at baseline and 6 months.	No	Yes (modified PASE subscales, unclear how)	Validity: not specified		Previous study	Reliability: not specified		Previous study

NA = not applicable; NR = not reported; EM = emergency medicine; Ped = pediatrics; ID = infectious disease; AAN = American Academy of Neurology; MCQ = multiple choice questionnaire; AHRQ = Agency for Healthcare Research and Policy; AHCPR = Agency for Health Care Policy and Research (now AHRQ); SP = standardized patient; CME = continuing medical education; RIAS = Roter Interactional Analysis System; KR = Kuder-Richardson; ANOVA = analysis of variance; COPD = chronic obstructive pulmonary diseases; HMO = health maintenance organization; ABIM = American Board of Internal Medicine; EEG = electroencephalography

Evidence Table 2. Characteristics of study population and study setting in studies assessing the effectiveness of continuing medical education

Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
Adams, 1998[125]	Overall: 21	Physicians-in-training (residents or fellows), nurse practitioners	M overall: 12 F overall: 17	Overall: 37.8	Internal medicine	Learners' graduation from medical school, overall: 9.3	Equivalent	Univer-sity/ medical school faculty	NR	NR	Govern-ment
Allison, 2005[147]	NR	None	F study group range: (35.4-41.1)	Study group range: 44.5-44.5	Family medicine, general practice (NOS), internal medicine, pediatrics	NR	Equivalent	Private practice, health plan	NR	NR	Govern-ment
Ander-sen, 1990[36]	Overall: 41 (100)	None	NR	NR	Family medicine, general practice (NOS), internal medicine	NR	NR	Private practice, health plan, county public health system	NR	Recrea-tional/ resort, short seminar during dinner	Govern-ment
Ander-son, 1996[103]	Study group range: 15-17 (100%)	None	M study group range: 15-17 (100%)	Study group range: 50-52	General practice (NOS)	Learners' graduation from medical school, study group range: 24-26	Equivalent	NR	External audits, participa-tion was voluntary, but those invited were high prescrib-ers of regulated drugs	School/ institu-tion	NR

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Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
Beaulieu, 2002[140]	Overall: 108 (100)	None	M study group range: 19-38 (61-68) F study group range: 12-18 (32-39)	Study group range: 41.6	Family medicine	Years of experience, study group range: (<11->20)	Minor differences	Private practice, commu-nity health center	NR	Practice setting	Pharma-ceutical industry, govern-ment
Beaulieu, 2004[44]	Overall: 52	Pharmacists	NR	NR	General practice (NOS)	NR	NR	NR	Educat-ional credit	NR	Pharma-ceutical industry, profess-sional society, insur-ance industry/ health plan
Bjornson, 1990[14]	Overall: 576 (100%)	None	NR	NR	Family medicine, general practice (NOS), internal medicine	NR	Equivalent	NR	NR	Not linked to a physical setting	NR
Block, 1988[37]	Overall: 64 (100)	None	NR	NR	Family medicine, internal medicine	NR	NR	Private practice	NR	School/ institu-tion, practice setting	NHLBI Demonst ration Project, govern-ment
Bloom-field, 2005[68]	Overall: 92 (100)	None	NR	NR	Primary care physician (NOS)	NR	NR	Hospital staff, military/ govern-ment	NR	Practice setting	Govern-ment

Evidence Table 2. Characteristics of study population and study setting in studies assessing the effectiveness of continuing medical education

Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
Brown, 1999[72]	Study group range: 19-25 (66-78)	Physician assistants, nurse practitioners, optometrists	M study group range: 19-20 (62-65) F study group range: 10-12 (35-38)	Overall: (30 - 60)	Obstetrics and gynecology, pediatrics, primary care physician (NOS), surgery, medical specialists	NR	Equivalent	Health plan	NR	Practice setting	Pharma-ceutical industry, profes-sional society, insur-ance industry/ health plan
Brown, 2004[135]	Overall: 23 (100)	None	NR	NR	Pediatrics	NR	NR	Private practice	NR	NR	NR
Browner, 1994[122]	Overall: (100)	None	M overall: (92) F overall: (8)	NR	Family medicine, general practice (NOS), internal medicine	NR	NR	Private practice	NR	Practice setting	Govern-ment
Bunting, 2004[123]	Overall: 200 (100)	None	M study group range: 65-66 (69-72) F study group range: 26-29 (28-31)	NR	Family medicine, general practice (NOS), internal medicine, obstetrics and gynecology, pediatrics, surgery, rheumatology, urology, nephrology, medical biochemistry	Learners' graduation from medical school, study group range: (less than 7 years before intervention- >37 years before intervention)	Equivalent	NR	NR	Practice setting	NR

Evidence Table 2. Characteristics of study population and study setting in studies assessing the effectiveness of continuing medical education

Author, year	N (%) of fully trained physicians	Other health care professionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Comparable groups	Type of practice	Motivating factors	Physical setting of CME activity	External sponsors of CME activity
Carney, 1995[88]	98 (100%)	None	M overall: (92-97) F overall: (3-8)	Study group range: 43.7-44.5	Family medicine, internal medicine	NR	Minor differences	Private practice	NR	Not linked to a physical setting	Government
Casebeer, 1999[131]	Overall: 28 (100)	None	NR	NR	Family medicine, general practice (NOS), internal medicine	NR	Equivalent	Private practice	NR	Practice setting	Pharmaceutical industry, Alliance for Continuing Medical Education
Chan, 1999[21]	Overall: 23 (100) Study group range: 11-12	None	M overall: (72) M study group range: (66.7-76.9)	Overall: 42.2 Study group range: 40.4-43.8	Family medicine	Mean years in practice, overall: 13.5 study group range: 11.6-15.3	Minor differences	NR	NR	Not linked to a physical setting	NR
Chassin, 1986[106]	Overall: 1483 physicians (120 hospitals) (100)	None	NR	NR	Obstetrics and gynecology, all physicians with delivery privileges	NR	Large differences	University/ medical school faculty, hospital staff	Quality improvement	Practice setting	Government
Cherkin, 1991[83]	NR	Physician assistants	M overall: 22 F overall: 7	NR	Family medicine, internal medicine	Median years of practice, study group range: 8-12	NA	Private practice, health plan	Personal improvement, CME credit	Practice setting	NR

Evidence Table 2. Characteristics of study population and study setting in studies assessing the effectiveness of continuing medical education

Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
Chod-osh, 2006[62]	Study group range: 63-85 (88.5-90)	Physician assistants, nurse practitioners	M study group range: 40-55 (57.1-57.3) F study group range: 30-41 (42.7-42.9)	NR	Family medicine, internal medicine	NR	Equivalent	Health plan	NR	Practice setting, not linked to a physical setting	Govern-ment
Chung, 2004[54]	Study group range: 15-21 (48-66)	Physicians-in-training (residents or fellows)	F overall: 29	NR	Emergency medicine	NR	NR	Hospital staff	NR	Not linked to a physical setting	Govern-ment
Clark, 1998[120]	NR	NR	M overall: 60 F overall: 40	Study group range: (30-39: 22%, 40-49: 37%, 50-59: 27%, over 60: 14%)	Pediatrics	NR	NR	NR	NR	NR	Govern-ment
Clark, 2000[78]	Overall: (100)	NR	M overall: (60) F overall: (40)	Overall: (30-39: 22%, 40-49: 37%, 50-59: 27% over 60: 14%)	Pediatrics	NR	Equivalent	NR	Personal improve-ment	NR	Lung division of the NHLBI and Arnold P. Gold Found-ation

Evidence Table 2. Characteristics of study population and study setting in studies assessing the effectiveness of continuing medical education

Author, year	N (%) of fully trained physicians	Other health care professionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Comparable groups	Type of practice	Motivating factors	Physical setting of CME activity	External sponsors of CME activity
Cohn, 2002[19]	Overall: 13-21 (77-86)	NR	M study group range: (48-54) F study group range: (46-52)	NR	Obstetrics and gynecology	NR	Minor differences	NR	NR	Practice setting	Government
Costanza, 1992[35]	Overall: 116 (100)	Support staff, radiologists, community women	M overall: (80.4-82.8) F overall: (19.6-17.2)	NR	Family medicine, general practice (NOS), internal medicine, obstetrics and gynecology	Learners' graduation from medical school, study group: 34.9-36% up to 1965, 30-33.3% in 1966-76, 34-31.8% in 1977 or later	Large differences	Private practice, health plan	NR	NR	Government
Cummings, 1989[112]	Overall: 44 (100)	NR	M study group range: 16-22 (80-92) F study group range: 2-4 (8-20)	NR	Family medicine, internal medicine	NR	Minor differences	Private practice	San Francisco Medical Society endorsement, personal improvement, CME credit	School/ institution	NR

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Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
Cum-mings, 1989[113]	Overall: 81 (100)	None	M overall: 58 (100) F overall: 23 (100)	NR	Internal medicine	NR	Equivalent	Health plan	San Francis-co Medical Society endorse-ment, personal improve ment, CME credit	School/ institu-tion	NR
Cum-mings, 1989[117]	Overall: 59 (100)	None	M study group range: 16-22 (80-92) F study group range: 2-4 (8-20)	NR	Family medicine, internal medicine	NR	Minor differences	Private practice	NR	Not linked to a physical setting	Govern-ment
Curran, 2000[34]	Overall: 52 (100)	None	M overall: 42 (81) F overall: 10 (19)	NR	Dermatology	Learners' completion of residency overall: (74.5% had 11+ years)	Equivalent	Private practice, health plan	NR	Not linked to a physical setting	NR
Davis, 2004[101]	Overall: 54 (100)	None	NR	NR	Pediatrics	NR	NR	Health plan	Quality improve ment, CME credit, mone-tary gain to charity of choice	Not linked to a physical setting	Pharma-ceutical industry, insur-ance industry/ health plan

Evidence Table 2. Characteristics of study population and study setting in studies assessing the effectiveness of continuing medical education

Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
Dere-bery, 2002[153]	Overall: 258 (100)	None	NR	NR	Occupational medicine physician	NR	NR	Large occupat-ional health group	CME credit	Confere nce	
Des March-ais, 1990[61]	Overall: 25 (100)	None	NR	NR	Family medicine, psychiatry	NR	NA	Univer-sity/ medical school faculty	NR	NR	Le Fonds d'educat-ion medicale, Unite de Recherch e et de Develop-ment en Education Medicale
Dietrich, 2000[110]	NR	Nurse practitioners	M study group range: (50-75) F study group range: (25-50)	Overall: 44	Family medicine, internal medicine, pediatrics	Overall: 10 years in current practice	Minor differences	NR	NR	Practice setting, local hospital and clinic practice	Pharma-ceutical industry, sun-screen industry, govern-ment
Dormuth, 2004[15]	Study group range: 241-258 (100)	None	M study group range: (83-89)	Study group range: 45.6-46.2	General practice (NOS)	NR	Equivalent	Health plan	NR	Not linked to a physical setting	Govern-ment

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Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
Doucet, 1998[40]	Overall: 87 (100)	None	M overall: 35 M study group range: (26 - 51) F overall: 52 F study group range: (49 - 74)	NR	Primary care physician (NOS)	NR	Large differences	NR	NR	NR	NR
Elliott, 1997[55]	NR	Nurses	M overall: (90) F overall: (10)	NR	Family medicine, general practice (NOS), internal medicine, surgery	Years in practice, overall: 15.3	NR	NR	NR	NR	Govern-ment
Evans CE, 1986[56]	Overall: 76 (100)	None	NR	NR	Internal medicine, primary care physician (NOS)	NR	Equivalent	Private practice	NR	Not linked to a physical setting	Govern-ment
Fordis, 2005[42]	Study group range: 44-49 (100)	None	M study group range: 22-29 (50-59) F study group range: 20-22 (41-50)	NR	Family medicine, internal medicine, obstetrics and gynecology	Learners' graduation from medical school, median by study group: 17 years (1985), 13 years (1989)	Equivalent	Hospital staff	Monetary/ financial gain	NR	Pharma-ceutical industry

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Author, year	N (%) of fully trained physicians	Other health care professionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Comparable groups	Type of practice	Motivating factors	Physical setting of CME activity	External sponsors of CME activity
Frush, 2006[87]	Overall: (70.5-74.4)	Nurses, paramedics	NR	NR	Emergency medicine, pediatrics	Learners' completion of residency, study group range: (5.7-5.8)	Equivalent	University/ medical school faculty, hospital staff	NR	Unclear for video-taped portion, not linked to a physical setting	Government
Gerbert, 2002[86]	Overall: 71 (100)	None	M overall: (56%) F overall: (44%)	Overall: 40	General practice (NOS), internal medicine, general internists	NR	Minor differences	University/ medical school faculty, private practice, hospital staff, military/ government	NR	Not linked to a physical setting	NR
Gerrity, 1999[32]	Overall: 49 (100)		M study group range: 14-15 (58-61) F study group range: 9-11 (39-42)	Study group range: 45.4-47.7	Family medicine, internal medicine, primary care physician (NOS)	Learners' graduation from medical school, study group range: 16.8-20	Equivalent	Private practice, solo, specialty group, hospital-affiliated clinic	NR	NR	MacArthur Foundation

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Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
Gerstein, 1999[53]	Overall: 290 (100) Study group range: 113-177 (100)	None	M study group range: 82 - 107 (60.5 - 72.6) F study group range: 31 - 70 (27.4 - 39.5)	NR	Family medicine	Learners' graduation from medical school, overall: 16-21	Large differences	Private practice	NR	NR	Pharma-ceutical industry, govern-ment
Gifford, 1996[46]	Overall: 492 (100)	None	M study group range: (85-89) F study group range: (11-15)	Study group range: 45.5-46.2	Neurology	Number of years in practice, overall: 13	Equivalent	Univer-sity/ medical school faculty, private practice	NR	Not linked to a physical setting	Center for Study of Health-care Provider Behavior
Gifford, 1999[142]	Overall: 417 (100)	None	M study group range: (78-85) F study group range: (15-22)	Study group range: 46-47	Neurology	Years in practice, study group range: 11 - 14	Equivalent	Univer-sity/ medical school faculty, private practice, hospital staff, health plan	NR	NR	Profess-ional society, govern-ment
Gold-berg, 2001[93]	NR	Administra-tive personnel	NR	NR	Neurology, surgery, orthopedic surgeons	NR	Equivalent	Private practice	Quality improve-ment	Not linked to a physical setting	NR
Goldstein, 2005[146]	Overall: 36	Nurse practitioners	NR	NR	NR	NR	Equivalent	Military/ govern-ment	NR	Practice setting	Govern-ment

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Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
Goldwater, 2001[157]	NR	Nurses, pharmacists, hospital personnel	NR	NR	NR	NR	NR	Hospital staff	NR	Practice setting	NR
Gonzales, 1999[111]	NR	Physician assistants, nurse practitioners, nurses	NR	NR	Family medicine, internal medicine	NR	Equivalent	Health plan	NR	Home/ personal, practice setting	RWJ, insur-ance industry/ health plan
Grady, 1997[79]	NR	NR	M overall: (88.4) F overall: (11.6)	Overall: 46.76	Family medicine, general practice (NOS), internal medicine	Learners' completion of residency overall: 15.22 (1-45)	Large differences	Private practice	NR	Practice setting	Govern-ment
Green-berg, 1985[25]	Overall: 23 (100)	None	NR	NR	Pediatrics	NR	NR	Private practice	NR	Practice setting	NR
Gullion, 1988[132]	Overall: 111 (100)	None	M overall: (96) F overall: (4)	Overall: 46.3	Family medicine, general practice (NOS), internal medicine	NR	NR	NR	NR	Not linked to a physical setting	Govern-ment
Hagen, 2005[126]	Overall: 33	Nurses, pharmacists, family members	NR	NR	NR	NR	NR	Long term care facility	NR	Practice setting	Found-ation

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Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
Harris, 2002[39]	Overall: 65 (100)	None	M overall: (70) M study group range: (64.3-73) F overall: (30) F study group range: (27-35.4)	Study group range: 42.6-43.7	Emergency medicine, family medicine, internal medicine, pediatrics, orthopedics	Learners' graduation from medical school, study group range: 16.7-17.7	Equivalent	NR	NR	Not linked to a physical setting	Govern-ment
Harris, 2005[75]	Study group range: 43-47	None	M study group range: 27-30 (93.1-93.8)	NR	Family medicine	NR	Equivalent	NR	NR	Initial session at a dinner, but subse-quent ones by phone confer-ence	Pharma-ceutical industry
Heale, 1988[66]	Overall: 53 (100)	None	NR	NR	Family medicine	Years in practice, overall: 10.2	NR	NR	NR	NR	NR
Herbert, 2004[102]	Overall: 200 (100)	None	NR	NR	Family medicine	NR	Equivalent	Private practice	Already be-longed to PBSG learning program, personal improve-ment	School/ institu-tion	Profes-sional society, insur-ance industry/ health plan

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Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
Hergen-roeder, 2002[60]	Overall: 75 (100)	None	M study group range: 20-23 (55-61) F study group range: 13-22 (39-45)	NR	Pediatrics	Years after residency, study group range: 15.5-18 (1-48)	Equivalent	Health plan	NR	Practice setting	Medical device industry
Howe, 1997[145]	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Govern-ment
Jennett, 1988[76]	Overall: 31 (100)	None	M overall: 25 F overall: 6	Overall: (35-60)	Family medicine	Learners' graduation from medical school, number in each decade: 5 -1950s, 6-1960s, 19- 1970s; all at least 2 years in active practice	Equivalent	Private practice	NR	Home/ personal, school/ institu-tion	NR
Juzych, 2005[92]	Study group range: 9-19	Nurses, Pharma-cists	NR	NR	Internal medicine, pediatrics	NR	NR	Health plan	NR	Practice setting	Pharma-ceutical industry, General Motors Founda-tion, insur-ance industry/ health plan

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Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
Kemper, 2006[58]	Overall: 374 (29.5)	Physician assistants, nurses, medical students, pharmacists, nutritionists, dietitians	M overall: (25.3)	Overall: 40.3 (27.4-53.2)	NR	NR	Equivalent	Univer-sity/ medical school faculty	NR	Not linked to a physical setting	Govern-ment
Kiang, 2005[33]	Study group range: 400-600	Physician assistants, nurse practitioners	M study group range: (51-61)	Mean years in practice, study group range: 12.6-13.8	Emergency medicine, family medicine, general practice (NOS), internal medicine, pediatrics	NR	Equivalent	All types of practices	Public demand/ patient expect-ations	NR	Profes-sional society, govern-ment
Kim, 1999[137]	Overall: 48 (100)	None	M study group range: (85-86%)	Study group range: 42-45	Family medicine, internal medicine, subspecialists with large proportion of primary care	Overall: 10 years employed in health plan (mean) study group: range 4-32 years employed in health plan	Equivalent	Health plan	NR	Practice setting	Insur-ance industry/ health plan
Kottke, 1989[114]	Overall: NR	None	M overall: 66 (86) F overall: 10 (14)	Study group range: 37.9 - 44.3	Family medicine	NR	Equivalent	NR	NR	NR	NR

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Kronick, 2003[71]	Overall: 81 (100)	None	M study group range: 30-31 (75-75.6) F study group range: 10 (24.4-25)	NR	Family medicine	Year starting first practice, study group range: 1980 - 1984	Minor differences	Private practice	NR	Practice setting	NR
Kutcher, 2002[65]	Overall: 68	None	M study group range: 16-19 (46-63) F study group range: 11-19 (37-54)	Overall: (31 and up)	Family medicine	Duration of practice, study group range: (20-25)	Minor differences	Private practice	Personal improve-ment, voluntary	NR	Govern-ment
Labelle, 2004[67]	Overall: 40 (100)	None	NR	NR	General practice (NOS)	NR	NR	NR	NR	NR	Pharma-ceutical industry, profes-sional society
Lane, 1991[69]	NR	Medical students, other health professional students	NR	NR	Family medicine, general practice (NOS), obstetrics and gynecology	NR	Equivalent	Private practice, 14% not in private practice, but practice descrip-tion not provided	NR	NR	Govern-ment

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Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
Lane, 2001[45]	Overall: 282 (100)	None	M study group range: 106-135 (82.8-88.3) F study group range: 19-22 (11.7-17.2)	Study group range by age category: </=44: 44-49 (33.3-36.7), >=65: 9-18 (7.5-12.2)	Family medicine, internal medicine, obstetrics and gynecology	Learners' graduation from medical school, study group range: (21-30)	Minor differences	Private practice, hospital staff, public health center	Quality improve-ment	Home/ personal, practice setting	NR
Leopold, 2005[80]	Overall: 48	Physician assistants, nurse practitioners, osteopathic physicians	NR	NR	NR	NR	NR	NR	NR	Not linked to a physical setting	NR
Levinson, 1993[138]	Overall: (100)	NR	M overall: 44 F overall: 9	NR	Family medicine, internal medicine	Learners' graduation from medical school, overall: 15 (3-47)	NR	NR	Reduced mal-practice premium	NR	Miles Program for Physician-Patient Commun-ication, profes-sional society, insurance industry/ health plan

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Lewis, 1993[70]	Overall: 253 (100)	None	F overall: (37.1)	Study group range: 37-47	Family medicine, internal medicine, obstetrics and gynecology	NR	Large differences	Health plan	HMO mandate	NR	NR
Lin, 1997[73]	NR	NR	NR	NR	Family medicine, internal medicine	NR	NR	Health plan	NR	Some activities clearly took place in the clinic, but others were not specified	Govern-ment
Lin, 2001[133]	Overall: 109 (100)	None	M study group range: 40-44 (75.5-78.6) F study group range: 12-13 (21.4-24.5)	NR	Primary care physician (NOS)	NR	Minor differences	Health plan	NR	Practice setting	Pharma-ceutical industry
Lindsay-McIntyre, 1987[115]	Overall: 82 (100)	None	NR	NR	Family medicine	Learners' graduation from medical school, overall: (15-20)	NR	Private practice	NR	NR	NR
Lockyer, 2002[64]	Overall: 637 (100)	None	NR	NR	Family medicine	NR	NR	Private practice	NR	NR	NR

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Maclure, 1998[96]	Overall: (100)	NR	M overall: (76) F overall: (24)	NR	General practice (NOS)	NR	NR	NR	NR	NR	Govern-ment
Macrae, 2004[85]	Overall: 86 (100)	None	NR	NR	Surgery	Learners' graduation from medical school, overall: 23	Equivalent	Univer-sity/ medical school faculty, private practice, hospital staff	NR	Not linked to a physical setting	Medical device industry
Maiman, 1988[47]	Overall: 83 (100)	None	M overall: (80) F overall: (20)	Overall: 46	Pediatrics	Learners' completion of residency, overall: 14 years	NR	Private practice	NR	NR	NR
Mann, 1997[52]	Overall: 59 (100)	None	M overall: 49 F overall: 10	Study group range: 42.4-45	Family medicine	NR	Minor differences	NR	NR	NR	NR

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Margolis, 2004[118]	The mean (range) number of clinicians in the 22 inter-vention practices was 5.6 (1-12) and in the 22 control practices 4.4 (1-12)	Nurses, clerical	NR	NR	Family medicine, pediatrics	NR	Minor differences	Private practice, hospital staff	NR	Practice setting	Govern-ment
Maxwell, 1984[57]	NR	NR	NR	NR	NR	NR	NR	Hospital staff	NR	Practice setting	NR
Mazmani an, 1998[24]	Overall: (100)	NR	NR	NR	Primary care	NR	NR	NR	NR	School/ institu-tion, commun -ity hospital	Pharma-ceutical industry, profes-sional society, govern-ment
Mazmani an, 2001[161]	Overall: 88 (100)	None	M overall: 76 (100) F overall: 16 (100)	Overall: 42	NR	NR	NR	NR	Personal improve ment	School/ institu-tion	NR

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McBride, 2000[144]	Overall: 160 (100)	Physician assistants, nurse practitioners, nurses, pharmacists, medical technicians, nursing assistants	M study group range: (81) F study group range: (19)	NR	Family medicine, general practice (NOS), internal medicine, geriatrician	Years in practice, study group range: 12-14	Equivalent	Private practice, health plan	NR	Practice setting	Govern-ment
McClellan, 2003[119]	Overall: 477 (100)	None	NR	NR	Family medicine, general practice (NOS), internal medicine, obstetrics and gynecology, endocrinology	NR	NR	NR	NR	Practice setting, mailings	Govern-ment
McMahon, 1988[155]	Overall: 34 (100)	None	NR	NR	Internal medicine	NR	NR	Univer-sity/ medical school faculty, private practice	Hospital creden-tialing	Recrea-tional/ resort, school/ institu-tion	NR
Mehler, 2005[99]	NR	NR	NR	NR	Family medicine, internal medicine, academic	NR	NR	Hospital staff	Quality improve ment	Practice setting, electron-ic detailing	Grant making founda-tion, insur-ance industry/ health plan

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Meredith, 2000[51]	Overall: (86.2) study group range: (81.0-93.9)	Physician assistants, nurse practitioners	F overall: (35.6) F study group range: (30.6-41.4)	Overall: 43.7 study group range: 43.1-44.0	Family medicine, general practice (NOS), internal medicine	Mean years from training, overall: 11.7 study group range: 11.1-12.0	Equivalent	Health plan	NR	Practice setting	NR
Messina, 2002[156]	Overall: (100)	None	NR	NR	Primary care physician (NOS)	NR	NR	NR	NR	Practice setting	NCI
Moran, 1996[121]	Overall: 15 (100) study group range: 5-10 (100)	None	M study group range: 5-6 (60-100) F study group range: 0-4 (0-40)	NR	Family medicine, general practice (NOS), the specialty of the experimental group was not specified although none were residency trained suggesting that they were GPs	Learners' graduation from medical school, all five of the experimental groups graduated between 1950-1960. Six of the ten control physicians graduated in the 1980s.	Large differences	Private practice	Participation was voluntary, but intervention physicians were invited because they were identified as having serious deficiencies in their practices	NR	Professional society
Mukohara, 2005[13]	Overall: 107	None	F study group range: (38.9-47.2)	Study group range: 40.8-41.7	General practice (NOS), internal medicine	NR	Equivalent	University/ medical school faculty	NR	School/ institution practice setting	NR

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Myers, 2004[148]	Overall: 838	NR	NR	NR	Primary care physician (NOS)	NR	Not applicable	Private practice	NR	Practice setting	Insur-ance industry/ health plan
Norris, 2000[81]	Overall: 32 (100)	None	NR	NR	Primary care physician (NOS)	NR	Equivalent	Health plan	NR	Practice setting	Govern-ment
Ockene, 1996[124]	Overall: 45 (100)	None	M overall: 30 (66.7) M study group range: 9-11 (59-79) F overall: 15 (33.3) F study group range: 3-7 (21-41)	Overall: 38.1 study group range: 36.8-39.3	Internal medicine	Learners' graduation from medical school, overall: 11.1 study group range: 9.9-12.9	Minor differences	Health plan	NR	Practice setting, unclear where group sessions took place	Govern-ment
Ozer, 2005[104]	Overall: 86	Nurse practitioners	F study group range: (62.2-64.1)	Study group range: 41.4-44.1	Pediatrics	Learners' graduation from medical school, study group range: 14-15	Minor differences	Hospital staff, health plan	NR	NR	NR
Pazirand eh, 2002[128]	Overall: 134 (100)	None	NR	NR	Family medicine, internal medicine, obstetrics and gynecology	NR	NR	NR	NR	NR	Pharma-ceutical industry
Pereles, 1996[163]	NR	None	NR	NR	NR	NR	NR	NR	NR	School/ institu-tion	NR

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Perera, 1983[107]	Overall: 26 (100)	None	NR	Overall: (37.2-40.5)	Primary care physician (NOS)	NR	Minor differences	Health plan	NR	NR	NR
Pimlott, 2003[143]	Overall: 274 (100)	None	M study group range: 145-170 (82.5-86.3) F study group range: 23-36 (13.7-17.5)	Study group range: 50.6-50.7 (32-81)	Primary care physician (NOS)	Learners' graduation from medical school, study group range: 24.5	Minor differences	NR	NR	Not linked to a physical setting	NR
Pinto, 1998[74]	Overall: (100)	None	M overall: 26 F overall: 13	Overall: 44.1 study group range: 43.7-44.6	Family medicine, general practice (NOS), internal medicine	Learners' completion of residency, overall: 9.2	Equivalent	Private practice	Monetary/ financial gain	Practice setting	Government
Premi J, 1993[38]	Overall: 40 (100)	None	NR	NR	Military physicians (specialty not reported)	Years in clinical practice, overall: 4.8	NR	Military/ government	NR	Not linked to a physical setting	Government
Premi, 1994[41]	Overall: 152 (100)	None	NR	NR	Family medicine, general practice (NOS)	NR	NR	NR	NR	Local communities	Professional society

Evidence Table 2. Characteristics of study population and study setting in studies assessing the effectiveness of continuing medical education

Author, year	N (%) of fully trained physicians	Other health care professionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Comparable groups	Type of practice	Motivating factors	Physical setting of CME activity	External sponsors of CME activity
Rabin, 1998[97]	NR	NR	NR	NR	General practice (NOS), internal medicine, obstetrics and gynecology, primary care physician (NOS)	NR	NR	NR	NR	Practice setting	Government
Rahme, 2005[100]	Study group range: 29-84	None	NR	NR	General practice (NOS)	NR	NR	Health plan	Educational credit	Practice setting	Pharmaceutical industry
Ray, 1985[20]	Overall: 372 (100)	None	NR	NR	NR	NR	NR	Private practice	Tennessee Medicaid program prescription behavior	Practice setting	Professional society
Ray, 2001[109]	Overall: 209 (100)	None	NR	NR	Primary care physician (NOS)	NR	Equivalent	NR	NR	Practice setting	NR
Rodney, 1986[77]	Overall: 196 (100)	None	NR	NR	Family medicine, internal medicine, other sigmoidoscopists	NR	NR	Private practice	NR	Recreational/ resort, practice setting, state/ medical meeting	NR

Evidence Table 2. Characteristics of study population and study setting in studies assessing the effectiveness of continuing medical education

Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
Rosenthal, 2005[59]	Study group range: 1-12	Nurses, clerical	NR	NR	Family medicine, pediatrics	NR	Minor differences	Private practice, hospital staff	CME credit	Practice setting	Profes-sional society, govern-ment
Rost, 2001[22]	Overall: (66.6)	Nurses	NR	NR	Primary care physician (NOS)	NR	Equivalent	Private practice	NR	Practice setting, via telephone	NR
Roter, 1995[84]	Overall: 63	Physicians-in-training (residents or fellows)	M overall: 63 M study group range: 18-23 (82-96) F overall: 6 F study group range: 1-4 (4-18)	Overall: 40.3 (27-67) study group range: 38.5-42.7	Family medicine, internal medicine	Years in practice, overall: 10.8 (1-39 years) study group range: 9.3 – 12.5	Equivalent	Private practice, hospital staff, health plan	NR	NR	NR
Schectman, 1991[139]	NR	Physician assistants, nurse practitioners	NR	NR	Internal medicine	Experience, study group range: (7 -13)	NR	Health plan	HMO mandate	Not linked to a physical setting	NR
Schectman, 1995[130]	NR	NR	NR	NR	Family medicine, internal medicine	NR	Equivalent	Univer-sity/ medical school faculty, private practice, HMO practi-tioners	NR	NR	NR

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Schectman, 1996[16]	Study group range: 13-190	Physician assistants, nurse practitioners	NR	NR	Family medicine, internal medicine	Learners' completion of residency, study group range: (7 -10 years)	Large differences	Health plan	Quality improve-ment	Practice setting	NR
Schectman, 2003[108]	Overall: 120	Physician assistants, nurse practitioners	M study group range: 7-14 (36-58) F study group range: 9-13 (42-64)	NR	Family medicine, internal medicine	Years of practice, study group range: 8.7-11.0	Minor differences	Health plan, group practices affiliated with not-for-profit group model HMOs	NR	NR	Govern-ment
Schroy, 1999[82]	NR	Physician assistants, nurse practitioners	M study group range: 48 F study group range: 52	Study group range: 36 - 38	Primary care physician (NOS)	NR	Equivalent	Primary care physi-cians at neighbor-hood health centers	NR	NR	NR
Schwartzberg, 1997[98]	NR	NR	M overall: (78) F overall: (22)	NR	Family medicine, internal medicine, geriatrics	NR	NR	NR	NR	Medical specialty annual meetings	Profes-sional society
Sharif, 2002[94]	Study group range: 6-9 (100)	None	NR	NR	Pediatrics	NR	NR	Univer-sity/ medical school faculty	NR	NR	Profes-sional society

Evidence Table 2. Characteristics of study population and study setting in studies assessing the effectiveness of continuing medical education

Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
Short, 2006[50]	Study group range: 23-29	None	M study group range: (52-56)	Overall: 47	Family medicine, internal medicine, obstetrics and gynecology, pediatrics, psychiatry	Learners' completion of residency, overall: 17 years	Equivalent	Private practice	CME credit, mone-tary/ financial gain	Not linked to a physical setting	Govern-ment
Sibley, 1982[136]	Overall: 16 (100)	None	NR	NR	Family medicine	NR	Equivalent	NR	NR	Not linked to a physical setting	Govern-ment
Slotnick, 1993[17]	Overall: 33 (100)	None	M study group range: (66-100) F study group range: (0-34)	Study group range: 43-47	Family medicine, general practice (NOS), internal medicine	NR	NR	NR	NR	NR	Pharma-ceutical industry
Socolar, 1998[134]	NR	None	M study group range: (64-67) F study group range: (33-36)	Overall: (<35: 12%, 35-50: 57%, >50: 31%)	Family medicine, pediatrics, 5% specialty not specified	NR	Equivalent	NR	NR	Home/ personal, practice setting	Govern-ment
Solomon, 2004[127]	Overall: 32 (100)	None	F study group range: (30-45)	NR	Rheumatology	Learners' completion of fellowship, overall: 13	Minor differences	Private practice	NR	NR	Pharma-ceutical industry

Evidence Table 2. Characteristics of study population and study setting in studies assessing the effectiveness of continuing medical education

Author, year	N (%) of fully trained physicians	Other health care professionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Comparable groups	Type of practice	Motivating factors	Physical setting of CME activity	External sponsors of CME activity
Soumerai, 1987[105]	Overall: 435 (100)	None	NR	Overall: 51	Family medicine, general practice (NOS), internal medicine, 18% not specified	NR	Equivalent	NR	External audits	Practice setting	NR
Stein, 2001[95]	Overall: 63	Nurses, nursing home staff	NR	NR	Primary care physician (NOS)	NR	NR	NR	Quality improvement	Practice setting, by phone	NR
Stewart, 2005[43]	Overall: 58	None	M study group range: (63-71)	NR	Family medicine	Learners' graduation from medical school, study group range: 17.9-18.6	Minor differences	Private practice military/ government	NR	Not linked to a physical setting	Government
Stross, 1985[116]	Overall: (100)	None	NR	NR	Primary care physician (NOS)	NR	NR	Private practice, hospital staff	NR	NR	Government
Terry, 1981[49]	Overall: 44 (100)	None	NR	NR	Family medicine, general practice (NOS), internal medicine	NR	NR	Rural western Pennsylvania	NR	Home/ personal, group meeting location not described	Government, insurance industry/ health plan

Evidence Table 2. Characteristics of study population and study setting in studies assessing the effectiveness of continuing medical education

Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
Thom, 2000[129]	Overall: (100)		F study group range: 1-2 (10-20)	Overall: 47	Family medicine	Years in practice, overall: (15-17)	Equivalent	NR	NR	NR	Picker/ Common-wealth Fund and Bayer Institute for Health Care Commun-ication
Tziraki, 2000[141]	Overall: 616 (100)	None	M overall: 510 (83) F overall: 106 (17)	NR	Family medicine, general practice, (NOS), internal medicine	NR	Minor differences	Private practice	NR	NR	Govern-ment
Wells, 2000[151]	Overall: 114 (87)	Nurse practitioners	NR	NR	Family medicine, internal medicine	NR	NR	Private practice, health plan, public health clinics	NR	Practice setting	Govern-ment
White, 1985[48]	Overall: 103 (100) study group range: 40-63 (100)	None	NR	NR	Family medicine, internal medicine	NR	NR	Hospital staff	NR	NR	NR

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Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
White, 2004[63]	Overall: 52	NR	NR	NR	Family medicine	NR	NR	Private practice, hospital staff, health plan, military/ govern-ment	NR	Practice setting	NR
Wilson, 1988[154]	Overall: 83	None	M overall: 74 M study group range: (81.5-93.1) F overall: 9	Study group range: 40.5-41.77	Family medicine	% Graduated from medical school in past 15 years: 45-83	Minor differences	Private practice	NR	NR	NR
Winickoff, 1984[23]	Overall: 16 (100)	None	NR	NR	Internal medicine	NR	NR	Health plan	Quality improve-ment	Practice setting	Insur-ance industry/ health plan
Worrall, 1999[152]	Overall: 42	None	NR	NR	Family medicine	NR	NR	Fee-for-service physic-cians	NR	NR	Pharma-ceutical industry, govern-ment

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Author, year	N (%) of fully trained physi-cians	Other health care profes-sionals attending CME	Gender, n (%) Males (M) Females (F)	Mean age (age range)	Specialty of learners	Years from training, mean (range)	Compar-able groups	Type of practice	Motiva-ting factors	Physical setting of CME activity	External spon-sors of CME activity
Zucker-man, 2004[18]	Overall: (100)	None	NR	NR	Family medicine, general practice (NOS), internal medicine, primary care physician (NOS)	NR	NR	NR	NR	Not linked to a physical setting	Profes-sional society, govern-ment

CME = continuing medical education; GP = general practitioner; HMO = health maintenance organization; NCI = National Cancer Institute; NHLBI = National Heart, Lung, and Blood Institute; NOS = not otherwise specified; NR = not reported; PBSG = practice-based small-group; RWJ = Robert Wood Johnson Foundation

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Adams, 1998[125]	Interven-tion	Received formal intensive training sessions on counseling techniques and the approach to alcohol counseling as well as practice supports to promote screening and counseling, n assigned: 17	Live	Lecture, mentor/ preceptor, office cuing system	Individu-als	T: 2.5 W: NR D: NR	Multiple time or repetitive	32 months	NR	No	Will primary care providers who have received training in a brief alcohol counseling intervention of 5 to 10 minutes use these skills with high-risk drinkers in a clinical setting that provides a facilitative office support system?
	Concur-rent control	Received usual alcohol counseling intervention with weekly conferences at which alcohol counseling was encouraged in one session over two years, n assigned: 12	Live	Lecture	Individu-als	T: NR W: Once only D: NR	NR	32 months	NR	No	
Allison, 2005[147]	Interven-tion	Intervention group that received multicomponent Internet CME modules, n assigned: NR	Computer-based off-line	Feedback, (chlamydia screening rates for the physician's entire office), readings	Practice settings/ teams	T: 0.2 per module W: NR D: 1 year	Multiple time or repetitive	NR	NR	Yes	The overall goal of the educational intervention was to increase chlamydia screening for at-risk women in the managed care setting.
	Concur-rent control	Comparison group that received flat-text, Internet-based CME modules on women's health, n assigned: NR	Computer-based off-line	Readings	Practice setting/ teams	T: NR W: NR D: 1 year	Multiple time or repetitive	NR	NR	Yes	

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Andersen, 1990[36]	Concur-rent control	Primary care physicians receiving no training on affective and anxiety disorders in primary care, n assigned: NR	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NR	No	To improve primary care physicians' diagnosis, treatment, and referral of selected DSM-III / DSM-IIIR affective and anxiety disorders in primary care.
	Interven-tion	Primary care physicians receiving 3.5 hour seminar on diagnosis, treatment, and referral of affective and anxiety disorders in primary care, n assigned: NR	Live, video	Case-based learning, lecture	Individu-als	T: 3.5 W: Once only D: 3.5 hours	One time	1-8 weeks	Yes	No	
Anderson, 1996[103]	Concur-rent control	Control, n assigned: 18, n analysis: 15	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	No	This study was intended to measure and compare the effects of group education and feedback concerning prescribing patterns on physicians' prescribing of drugs to treat chronic pain. To modify the prescribing patterns of physicians who prescribe excessive amounts of drugs covered by the Triplicate Prescription Program.
	Interven-tion	Education and notification, n assigned: 18, n analysis: 17	Live, video	Case-based learning, discussion group, lecture	Individu-als	T: NR W: Once only D: 1 day	One time	6 months	NR	Yes	
	Concur-rent control	Notification only, n assigned: 18, n analysis: 17	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	Yes	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Beaulieu, 2002[140]	Interven-tion	"Exposed" physicians attended workshop incorporating features of effective educational interventions, n assigned: 59, n analysis: 31	Live	Case-based learning, problem-based learning or team-based learning, readings, role play	Individu-als, practice setting/ teams	T: 1.5 W: Once only D: NR	One time	4-6 months	Yes	No	Increase compliance with the recommendations of the Canadian Task Force on Preventive Health Care and decrease the ordering of tests not the subject of specific recommendations.
	Concur-rent control	"Unexposed" physicians attended no such workshops until after the SP visit, n assigned: 49, n analysis: 56	NA	NA	NA	T: NA W: NA D: NA	NA	4-6 months	NA	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Beaulieu, 2004[44]	Interven-tion	Workshop only, n assigned: NR	Live	Case-based learning, discussion group, problem-based learning or team-based learning, readings	Individu-als, practice settings/ teams	T: NR W: Once only D: NR	One time	6 months	Yes	Yes	"The primary objectives of the CURATA program were to (1) improve the GP's ability to identify OA patients through appropriate questioning and musculoskeletal examination and (2) to enhance the GP's ability to select appropriate pharmacologic and nonpharmacologic therapy according to a defined decision tree."
	Concur-rent control	Control group, n assigned: NR	NA	NA	NA	W: NA D: NA	NA	6 months	NA	NA	
	Interven-tion	Workshop and a decision tree, n assigned: NR	Live, print	Case-based learning, discussion group, problem-based learning or team-based learning, pro-grammed learning, readings	Individu-als, practice setting/ teams	T: NR W: Once only D: NR	One time	6 months	Yes	Yes	
	Interven-tion	Decision tree only, n assigned: NR	Print	Discussion group, pro-grammed learning, readings	Individu-als	T: NR W: Once only D: NR	One time	6 months	Yes	Yes	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Bjornson, 1990[14]	Interven-tion	Received information packet including letter, copy of study, and questionnaire, n assigned: 288, n analysis: 141	Print	Readings	Individu-als	T: NR W: NA D: NA	One time	4 months	NR	No	1. To investigate the impact of the Minnesota Department of Human Services drug-use review program which seeks to promote rational drug therapy among Medicaid users. 2. To assess physician awareness and acceptance of the clinical trial results and to identify underlying factors associated with the intent to adopt a change in drug therapy.
	Concur-rent control	Control, n assigned: 288, n analysis: 288	NA	NA	NA	T: NA W: NA D: NA	NA	4 months	NR	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Block, 1988[37]	Concur-rent control	Control hospital in comparison city (no provider or public education), n assigned: 38, n analysis: 23	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	To test whether a public health approach to CHD risk factors can be effective in reducing both risk and disease events in a demonstration population. "To improve cholesterol awareness and diet change in the general population" and "to lower thresholds at which physicians recommend dietary and drug therapy to better approximate the guidelines established by the consensus conference."
	Interven-tion	Demonstration hospital (targeted with provider and public education), n assigned: 50, n analysis: 41	Live, print	Lecture, point of care	Individu-als	T: NR W: NR D: NR	Multiple time or repetitive	NR	NR	Yes	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Bloom-field, 2005[68]	Interven-tion	Multicomponent intervention plus patient letters, n assigned: NR	Live, print, patient letter prompting patient to discuss with provider about letter contents (treatment)	Discussion group, lecture, patient informs provider	Individu-als, practice setting/ teams	T: 1 W: Once only D: 1 year	One time	NR	Yes	Yes	Our primary objective was to evaluate the effectiveness of this multicomponent intervention for improving evidence based lipid management for IHD patients with low high density lipoprotein cholesterol. A second objective was to evaluate the relative effectiveness of the three different prompts on provider prescribing behavior.
	Concur-rent control	Control, n assigned: NR	NA	NA	NA	T: NA W: NA	NA	NA	NA	NA	
	Interven-tion	Multicomponent intervention plus progress notes, n assigned: NR	Live, print, progress notes reminding PCP about appropri-ate approach	Discussion group, lecture, point of care	Individu-als, practice settings/ teams	T: 1 W: Once only D: 1 year	One time	NR	Yes	Yes	
	Interven-tion	Multicomponent intervention plus computer chart reminders, n assigned: NR	Live, print, chart reminders appearing on cover page of patient's computer-ized medical record	Discussion group, lecture, point of care	Individu-als, practice settings/ teams	T: 1 W: Once only D: 1 year	One time	NR	Yes	Yes	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Brown, 1999[72]	Interven-tion	Clinicians who attended training program in communication skills immediately, n assigned: 37, n analysis: 30	Live	Clinical experiences, discussion group, lecture, role play, clinicians audio taped interaction with patients and listened between workshops	Individu-als	T: 4 W: NR D: 10 hours	Multiple time or repetitive	>=6 months	NR	No	The overall goal of the intervention was to achieve higher quality of care and higher levels of patient satisfaction by improving clinicians' communication skills.
	Concur-rent control	Clinicians who would receive training program on communication skills at a later time, n assigned: 32, n analysis: 29	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
Brown, 2004[135]	Concur-rent control	Control, n analysis: 11	NA	NA	Individu-als	T: NA W: 1 day/week D: NA	NA	22 months	NA	NA	"The interactive seminar was based on the theory of the self-regulation of guiding physicians to enhance their therapeutic skills in treating childhood asthma, and to develop their ability to educate and counsel families about asthma self-management."
	Interven-tion	Interactive seminar, n analysis: 12	Live, video, print	Case-based learning, demonstra-tion, lecture, problem-based learning or team-based learning, readings	Individu-als	T: 4-6 W: 1 day/week D: 2-3 weeks	Multiple time or repetitive	22 months	NR	Uncle ar	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Browner, 1994[122]	Interven-tion	Physician practices randomized to receive a standard 3 hour CME seminar and syllabus on cholesterol management, n assigned: 55, n analysis: 45	Live, print	Lecture, readings	Individu-als	T: 3 hours W: Once only D: NR	One time	18 months	Yes	No	Compliance with the recommendations of the NCEP on high serum cholesterol levels in adults.
	Interven-tion	Physician practices randomized to receive intensive CME on cholesterol management, n assigned: 57, n analysis: 47	Live, print	Academic detailing, case-based learning, lecture, point of care, readings	Individu-als, practice settings/ teams	T: NR W: NR D: 3 months	Multiple time or repetitive	18 months	Yes	No	
	Concur-rent control	Physician practices who received no CME, n assigned: 62, n analysis: 48	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
Bunting, 2004[123]	Concur-rent control	Control group, n assigned: 100, n analysis: 98	NA	NA	Individu-als	T: NA W: NA D: 2 years	NA	2 years	No	Uncle ar	To reduce test-ordering behaviors of physicians in the community setting
	Interven-tion	Multifaceted education group (meeting + feedback), n assigned: 100, n analysis: 95	Live, print	Feedback, readings	Individu-als	T: NR W: NA D: 2 years	Multiple time or repetitive	2 years	No	Uncle ar	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Carney, 1995[88]	Concur-rent control	Did not receive training, n assigned: 32, n analysis: 32	NA	NA	Individu-als	T: NA W: NA D: NA	NA	NA	NA	Unclear	To assess the effects of CME on cancer prevention practices on new patients requesting a PHE
	Interven-tion	Received CME on cancer detection, n assigned: 25, n analysis: 25	Live, video	Demonstra-tion, discussion group, feedback, lecture, pro-grammed learning, role play	Individu-als	T: 8 W: Once only D: NR	One time	1 year	NR	Unclear	
Casebeer, 1999[131]	Concur-rent control	No training on hypercholesterolemic management, n assigned: 14, n analysis: 12	NA	NA	NA	T: NA W: NA D: NA	NA		NA	NA	Improving physicians' performances in helping their hypercholesterol-emic patients adhere to therapeutic regimens and in improving the health of those patients
	Interven-tion	Three interactive audio conferences plus chart reminders on managing hypercholesterolemic patients, n assigned: 14, n analysis: 14	Audio, telephone conferen-ces	Case-based learning, discussion group, point of care	Individu-als	T: NR W: NR D: NR	Multiple time or repetitive	9 month	NR	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Chan, 1999[21]	Concur-rent control	No small group learning, but was provided with similar resources, n assigned: 12, n analysis: 11	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	Present the patient problem, elaborate the patient problem (laboratory results and past medical history, etc) and redirect the group. Using the Internet to recreate successful PBL CME learning for rural physicians.
	Interven-tion	Internet based problem-based small group learning, n assigned: 11, n analysis: 8	Internet, not real time	Problem-based learning or team-based learning	Individu-als	T: NR W: NR D: 2 months	Multiple time or repetitive	2 months	NR	No	
Chassin, 1986[106]	Interven-tion	Educational interventions to reduce pelvimetry rates, n assigned: 64 hospitals, n analysis: 64 hospitals	Live, print	Feedback, lecture, 16 of 64 hospitals received only print mailings to physicians with privileges, without lecture	Practice setting/ teams	T: NR W: NR	One time	10 months	Yes	Yes	To reduce the inappropriate use of x-ray pelvimetry
	Concur-rent control	No interventions regarding pelvimetry rates, n assigned: 56 hospitals, n analysis: 56 hospitals	NA	NA	NA	T: NA W: NA	NA	NA	NA	NA	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Cherkin, 1991[83]	Interven-tion	University physicians: received 2 lectures and 1 video, n assigned: 23, n analysis: 15	Live, video	Demonstra-tion, discussion group, lecture	Individu-als	T: NR W: NR D: NR	Multiple time or repetitive	4 months	Yes	Unclear	Primary goal was to increase physician comfort and confidence in the management of back pain and to provide patients with additional information and assurance. A secondary goal was to reduce unnecessary spine radiography and lengthy bed rest prescriptions.
	Interven-tion	Community physicians--received 1 workshop, n assigned: 17, n analysis: 14	Live, video	Demonstra-tion, discussion group, lecture	Individu-als	T: 1.5 W: Once only D: NR	One time	1-2 months	Yes	Un-clear	
Chodosh, 2006[62]	Interven-tion	Primary care providers at clinics randomized to a comprehensive management program for patients with dementia (ACCESS) and a provider education program, n analysis: 96	Live, internet, not real time, print	Discussion group, lecture	Practice setting/ teams	T: NR W: NR D: NR	Multiple time or repetitive	9 months	No	Yes	To improve the quality of care for dementia patients by educating providers about dementia management program, role of care managers and care protocols, recognition and treatment of dementia and depression, and assessment of capacity for medical decision-making
	Concur-rent control	Primary care providers at clinics randomized to no management program or educational program, n analysis: 70	NA	NA	Individu-als, NA	T: NA W: NA D: NA	NA	NA	NA	NA	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Chung, 2004[54]	Interven-tion	Web intervention group, n analysis: 31	Live, internet, not real time	Case-based learning, lecture, readings	Individu-als	T: 1 lecture + website access W: NA D: 1 month	Multiple time or repetitive	6 months	No	No	"...determine if a web-based educational intervention improved physician knowledge about the recognition and medical management of diseases caused by biological agents. ...evaluate physicians' general knowledge of bioterrorism, identify their sources of information, and self-assess comfort level with the diagnosis of specific biological agents."
	Concur-rent control	Control group, n analysis: 32	Live	Lecture	Individu-als	T: 1 W: Once only D: 1 month	One time	6 months	NA	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Clark, 1998[120]	Concur-rent control	No educational intervention provided, n assigned: NR	NA	NA	Individu-als	T: NA W: NA D: NA	NA	22 months	NA	No	To determine if an educational intervention targeting both physician knowledge and practice behaviors would have an impact on physician management of asthma, parents self-reported decision-making ability regarding managing asthma, as well as patient outcomes
	Interven-tion	Attended seminars on asthma management, n assigned: NR	Live, video	Case-based learning, clinical experiences, lecture	Individu-als	T: 5 W: NR D: 2-3 weeks	Multiple time or repetitive	22 months	NR	No	
Clark, 2000[78]	Concur-rent control	Pediatricians NOT receiving CME intervention, n assigned: 36, n analysis: 33	NA	NA	Individu-als	T: NA W: NA D: NA	NA	2 years	NR	No	To evaluate the long-term impact of an interactive seminar for physicians based on principles of self-regulation on clinician behavior, children's use of health services for asthma, and parents' views of physician performance.
	Interven-tion	Pediatricians receiving CME intervention, n assigned: 38, n analysis: 34	Live, video	Case-based learning, demonstra-tion, lecture	Individu-als	T: 5 W: NR D: 2-3 weeks	Multiple time or repetitive	2 years	NR	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Cohn, 2002[19]	Interven-tion	Single intervention community, n assigned: 30, n analysis: 13	Live, print	Academic detailing	Individu-als	T: NR W: NA D: NR	Multiple time or repetitive	3-6 months	NR	No	Increase health care providers' awareness of preventive care for women exposed to DES before birth
	Interven-tion	Double intervention community, n assigned: 29, n analysis: 21	Live, print	Academic detailing	Individu-als	T: NR W: NA D: NR	Multiple time or repetitive	3-6 months	NR	No	
	Concur-rent control	Control community, n assigned: 24, n analysis: 22	NA	NA	NA	T: NA W: NA D: NR	NA	3-6 months	NR	No	
Costanza, 1992[35]	Concur-rent control	Comparison, no intervention done, n assigned: 64, n analysis: 64 (pre) and 55 (post)	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	To improve compliance with the National Cancer Institute's breast cancer screening guidelines.
	Interven-tion	Intervention: received CME on breast cancer screening via both direct lectures, CBE practice sessions, and office reminder systems, n assigned: 52, n analysis: 52 (pre) and 45 (post)	Live, print	Discussion group, lecture, point of care, simulation (other than standardized patient or role-play)	Individu-als	T: NR W: NR D: NR	Multiple time or repetitive	NR	Yes	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Cum-mings, 1989[112]	Interven-tion	Physicians participating in a 3-part seminar, n assigned: 31, n analysis: 24	Live, video, print	Demonstra-tion, discussion group, lecture, role play	Individu-als	T: W: NR D: 5-14 weeks	Multiple time or repetitive	1 year	Yes	No	To test the hypothesis that physicians in private practice who receive a continuing education program about how to counsel smokers to quit would counsel smokers more effectively and have higher rates of long-term smoking cessation among their patients.
	Concur-rent control	Did not participate in seminar--control group, n assigned: 28, n analysis: 20	NA	NA	Individu-als, NA	T: NA W: NR D: NA	NA	1 year	Yes	No	
Cum-mings, 1989[113]	Concur-rent control	Control group did not participate in the seminar, n assigned: 41, n analysis: 41	NA	NA	Individu-als, NA	T: NA W: NR D: NA	NA	1 year	Yes	Uncle ar	To test whether physicians who receive a continuing education program about how to counsel smokers to quit would counsel smokers more effectively and have higher rates of long-term smoking cessation among their patients who smoke.
	Interven-tion	Intervention group participated in a 3-part seminar, n assigned: 40, n analysis: 40	Live, video, print	Case-based learning, demonstra-tion, discussion group, lecture, role play	Individu-als	T: 3 W: NR D: 5-14 weeks	Multiple time or repetitive	1 Year	Yes	Un-clear	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Cum-mings, 1989[117]	Interven-tion	Physicians participating in seminars about smoking cessation counseling, n assigned: 31, n analysis: 24	Live, video, patient education materials	Case-based learning, demonstra-tion, role play, self-reflection	Individu-als	T: 3 W: 1 day/week D: 5-14 weeks	Multiple time or repetitive	1 year	NR	No	To teach physicians to use a systematic approach to counseling smokers in cessation
	Concur-rent control	Physicians receiving no training, n assigned: 28, n analysis: 20	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
Curran, 2000[34]	Concur-rent control	No CME instruction/course, n assigned: 22	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	This evaluation study assessed the instructional effectiveness of a hybrid computer-mediated courseware delivery system on dermatologic office procedures.
	Interven-tion	Computer and web-based instructional course on dermatological office practices, n assigned: 16	Computer-based off-line, Internet, not real time	Case-based learning, pro-grammed learning, computer-based courseware	Individu-als	T: NR W: NR D: NR	Multiple time or repetitive	NR	Yes	Un-clear	
	Interven-tion	Computer and web-based instructional course on dermatological office practices, n assigned: 14	Computer-based off-line, internet, not real time	Case-based learning, pro-grammed learning, computer-based courseware	Individu-als	T: NR W: NR D: NR	One time	NR	Yes	Un-clear	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Davis, 2004[101]	Interven-tion	Primary care physicians who were part of the Dean Health System (Madison, WI), n assigned: 30, n analysis: 20	Live, video, audio, audio teleconfer-encing	Case-based learning, discussion group, problem-based learning or team-based learning	Individu-als	T: 2.25-3.00 W: 1 day/week D: 3 weeks	Multiple time or repetitive	6 months	Yes	Un-clear	"A group of pediatricians was recruited to participate in several PBL teleconferences in an effort to evaluate whether this mode of CME could improve their compliance with updated asthma guidelines, particularly with respect to controller use.
	Concur-rent control	Those primary care physicians who chose not to participate in the study- from the same clinics (Dean Health System) as the intervention group, n assigned: 34	NA	NA	NA	T: NA W: NA D: NA	NA	6 months		Uncle ar	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Derebery, 2002[153]	Concur-rent control	Physicians who did not participate in educational workshop and were given a copy of the low back pain manual with no specific instructions, n analysis: 151	Print	Readings	Individu-als	T: NA W: NA D: NR	NA	1 year	No	No	"The purpose of this study then is to evaluate whether the educational strategy was effective in changing physicians' management behaviors of lower back pain."
	Interven-tion	Physicians who participated in education intervention during CMC Professional Development Conference, n analysis: 107	Live, print	Demonstra-tion, discussion group, lecture, problem-based learning or team-based learning, readings, simulation (other than standardized patient or role-play)	Individu-als	T: 10 (2 workshop+8 reading) W: NA D:	In addition to workshop, physicians received updated low back pain manual to read on their own within 2-3 months for additional CME credit	1 year	No	No	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Des Marchais, 1990[61]	Interven-tion	Practical training in assessing interpersonal skills of their learners, followed by theory-based training, n assigned: 12	Live, video	Case-based learning, demonstra-tion, discussion group, reflection about personal experiences	Individu-als	T: NR W: NR D: NR	NR	NR	NR	No	To train faculty in the appropriate and reliable assessment of interpersonal skills in their learners
	Interven-tion	Theory-based training in assessing interpersonal skills, followed by practical training, n assigned: 13	Live, video	Case-based learning, demonstra-tion, discussion group, reflection about personal experiences	Individu-als	T: NR W: NR D: NR	NR	NR	NR	Un-clear	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Dietrich, 2000[110]	Concur-rent control	Completed statewide survey about sun protection counseling and did not practice in intervention communities, n analysis: 12	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	To enhance sun protection advocacy/ counseling by primary care clinicians for children in New Hampshire communities
	Interven-tion	Community-based and practice-based interventions to increase sun protection counseling, n analysis: 29	Live, print, telephone call	Academic detailing, lecture, problem-based learning or team-based learning, readings	Practice setting/ teams	T: 30-45 minutes for first office meeting, otherwise NR W: NR D: NR	Multiple time or repetitive	about 1 year	NR	Yes	
Dormuth, 2004[15]	Concur-rent control	Control group that received intervention 3-8 months later after the intervention group, n assigned: 241	Print	Readings	Individu-als, practice settings/ teams	T: NR W: NR D: NR	Multiple time or repetitive	NR	NR	Yes	The overall goal of the intervention is to increase the probability of prescribing a drug recommended in the Therapeutic Letter rather than other drugs in the same class.
	Interven-tion	Intervention group that received evidence-based drug therapy letters, n assigned: 258	Print	Readings	Individu-als, practice setting/ teams	T: NR W: NR D: 3.17 years	Multiple time or repetitive	NR	NR	Yes	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Doucet, 1998[40]	Concur-rent control	Lecture group, n assigned: 49, n analysis: 29 for the pre- and post-tests; 26 for the KFP assessments; and 26 for the CME evaluation	Live	Discussion group, lecture	Individu-als	T: 2 W: Once only D: NA	One time	3 months	Yes	Unclear	1. Educate primary care physicians about headache, especially migraine, CDH and MIH. 2. Increase awareness of how attitudes toward headache affect the diagnosis and ongoing management of patients. 3. Understand the importance of the doctor-patient relationship in the therapeutic intervention and management of these headache types. 4. Educate primary care physicians in the comprehensive management of migraine, CDH and MIH.
	Interven-tion	PBL group, n assigned: 38, n analysis: 34 for the pre and post-tests; 21 for the KFP test; and 29 for the CME evaluation	Live	Problem-based learning or team-based learning	Individu-als	T: 6 W: 1 day/week D: 3 weeks	Multiple time or repetitive	3 months	Yes	Unclear	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Elliott, 1997[55]	Interven-tion	Extensive intervention including training opinion leaders on cancer pain management and then dissemination of information to their communities, n assigned: 3 communities	Live, print	Case-based learning, clinical experiences, discussion group, lecture, readings	Practice settings/ teams	T: NR W: NR D: 1 year	Multiple time or repetitive	15 months	NR	No	To improve the knowledge, attitudes, and clinical behaviors of physicians and nurses, improve the knowledge and attitudes about CPM of cancer patients and their families members, and to reduce cancer related pain experienced in cancer patients
	Concur-rent control	No intervention, n assigned: 3 communities	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	No	
Evans CE, 1986[56]	Concur-rent control	No education or office materials about hypertension, n assigned: 35 physicians (29 practices)	NA	NA	NA	T: NA W: NA D: NA	NA	21 months	NA	NA	To improve physician's management of patients with hypertension and to lower patients' blood pressures
	Interven-tion	14 weekly information packets about hypertension diagnosis and management, as well as office materials, n assigned: 41 physicians (33 practices)	Print	Readings, chart cue materials offered, but not necessarily implemented	Individu-als, practice setting/ teams	T: NR W: 1 day/week D: NR	Multiple time or repetitive	21 months	NR	Unclear	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Fordis, 2005[42]	Interven-tion	Online CME about cholesterol management; 20 randomly selected for chart review in phase II, n assigned: 52, n analysis: 44 test (17 chart review)	Internet, real time (e.g. streaming) internet, not real time, print, risk calculator	Case-based learning, lecture, pro-grammed learning, readings	Individu-als	T: 3.8 W: NR D: 2 weeks	Multiple time or repetitive	5 months	Yes	Yes	The overall goal of the educational intervention was to improve knowledge in cholesterol management guidelines and improve appropriate treatment for cholesterol.
	Interven-tion	Live CME about cholesterol management (exists in phase I and phase II); 20 randomly selected for chart review in phase II, n assigned: 51, n analysis: 49 test (19 chart review)	Live, print, risk calculator	Case-based learning, lecture, pro-grammed learning, readings	Individu-als	T: 1.75 W: Once only D: 10 days	One time	5 months	Yes	Yes	
	Concur-rent control	No training on cholesterol management, n assigned: 20, n analysis: 18 chart review	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
Frush, 2006[87]	Interven-tion	Web-based education program, n analysis: 43	Internet, not real time, video	Lecture, simulated scenario	Individu-als	T: NR W: NR D: NR	education was available for 3 months	NR	No	Yes	The goal was to improve the proper use of the Broselow Pediatric Resuscitation Tape to reduce dosing errors and time to determine dose.
	Concur-rent control	Control, n analysis: 44	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Gerbert, 2002[86]	Concur-rent control	Control group, n analysis: 32	NA	NA	Individu-als	T: NA W: NA D: NA	NA	8 weeks	No	No	To improve physician skin cancer diagnosis and evaluation planning test performance
	Interven-tion	Intervention group, n analysis: 39	Internet, not real time	Case-based learning, feedback, programmed learning, readings	Individu-als	T: NR W: NA D: NR	Multiple time or repetitive	8 weeks	No	No	
Gerrity, 1999[32]	Interven-tion	Depression Education Program, two 4-hour sessions about recognition and management of depression and syllabus, n assigned: 27, n analysis: 23	Live, video, audio, print	Clinical experiences, discussion group, feedback, lecture, readings, role play	Individu-als	T: 8 W: 1 day/week D: 2 weeks	Multiple time or repetitive	2-6 weeks	NR	No	To improve primary care physicians' knowledge of depression (diagnosis and treatment) and the communication skills they use with patients with the disease
	Concur-rent control	No training on depression recognition and management, n assigned: 29, n analysis: 26	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
Gerstein, 1999[53]	Interven-tion	Workshop on diabetes-specific clinical practice guidelines, n assigned: 1807, n analysis: 177	Live	Case-based learning, discussion group	Individu-als	T: 7 W: Once only D: 1 day	One time	24 months	NR	No	The overall goal of the intervention is to improve participants' attitude, knowledge, and practice behavior regarding diabetes.
	Concur-rent control	Control group that did not attend workshop, n analysis: 113	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Gifford, 1996[46]	Interven-tion	Neurologists subscribing to AAN CME course, who received movement disorders module, n assigned: 248, n analysis: 176	Video, print	Programmed learning, readings	Individu-als	T: 6.0 hours median W: NR D: NR	Multiple time or repetitive	4-5 months	Yes	No	To improve neurologists' adherence to practice recommendations on disease detection, diagnostic test use, and treatments for movement disorders.
	Concur-rent control	Neurologists subscribing to AAN CME course, who did not receive the movement disorders module, n assigned: 244, n analysis: 183	NA	NA	NA	T: NA W: NA D: NA	NA	4-5 months	NA	No	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Gifford, 1999[142]	Interven-tion	Neurologists who received mailed CONTINUUM Dementia Care Course, resource manual, seminar, and mailings: post-intervention evaluation, n assigned: 139, n analysis: 95	Live, print	Case-based learning, discussion group, lecture, readings, mailings	Individu-als, practice settings/ teams	T: 3 for seminar, otherwise NR W: Once only D: 4 months	One time	6 months	NR	No	The overall goal of the intervention is to improve adherence to guideline recommendations for the care of patients with dementia endorsed by the American Academy of Neurology and local opinion leaders.
	Historical control	Baseline neurologists who do not receive teaching about dementia care: pre-intervention evaluation, n assigned: 139, n analysis: 108	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
	Concur-rent control	Control neurologists who received no training about dementia care: post-intervention evaluation, n assigned: 139, n analysis: 102	NA	NA	NA	T: NA W: NA D: NA	NA		NA	NA	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Goldberg, 2001[93]	Interven-tion	5 communities in W. Washington State with higher than average annual number of spine surgeries performed, n assigned: 5	Live, video, print	Academic detailing, discussion group, lecture	Practice setting/ teams	T: NR W: NR D: 30 months	Multiple time or repetitive	NA	NR	Yes	"To implement the conservative, evidence-based approach to low-back pain recommended in national guidelines, with the anticipated effect of reducing population-based rates of surgery."
	Concur-rent control	5 communities in W. Washington State with higher than average annual number of spine surgeries performed, n assigned: 5	NA	NA	NA	T: NA W: NA D: 30 months	NA	NA	NR	NA	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Goldstein, 2005[146]	Interven-tion	Individualized-intervention group, n analysis: 20	Live, print	Discussion group, readings, packet which had patient-specific information form and advisory about guideline concordance of patient's antihyperten-sive drug regimen	Individu-als	T: NR W: NA D: NR	Received multiple items for	NR	NR	Yes	The overall goal of the educational intervention would increase clinician adherence to drug-therapy guidelines in primary care clinics of a large healthcare system.
	Interven-tion	General-intervention group, n analysis: 16	Live, print	Discussion group, readings, packet which had patient-specific information form	Individu-als	T: NR W: NA D: NR	Received multiple items for	NR	NR	Yes	
Goldwa-ter, 2001[157]	Interven-tion	Standard educational tools, n assigned: NR	Print	Academic detailing, point of care, readings	Practice settings/ teams	T: NA W: NR D: 14 months	Multiple time or repetitive	NR	No	No	To achieve health care cost reductions without compromising the quality of patient care
	Interven-tion	Therapeutic interchange, n assigned: NR	Print	Academic detailing, point of care	Practice setting/ teams	T: NA W: NR D: 14 months	Multiple time or repetitive	NR	No	No	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Gonzales, 1999[111]	Interven-tion	Limited intervention, received household and office-based materials only, n assigned: 31	Print	Academic detailing, point of care	Individu-als, practice settings/ teams	T: NA W: Once only D: NR	NA	1 year	NR	Uncle ar	To decrease total antibiotic use for uncomplicated acute bronchitis
	Interven-tion	Full intervention, received household and office-based materials and an educational intervention, n assigned: 28	Live, print	Academic detailing, demonstra-tion, lecture, point of care	Individu-als, Practice setting/ teams	T: 0.5 W: Once only D: 30 minutes	One time	1 year	NR	Uncle ar	
	Concur-rent control	Control, n assigned: 34	NA	NA	Individu-als, practice settings/ teams	T: NA W: NA D: NA	NA	NA	NR	Uncle ar	
Grady, 1997[79]	Interven-tion	Cue enhancement, education, and peer comparison feedback and rewards (money), n analysis: 20	Live, print	Feedback, lecture, point of care, readings, financial reward for compliance	Individu-als, practice settings/ teams	T: NR W: NR D: 1 year	Multiple time or repetitive	NR	NR	No	To determine if cuing will result in significantly more referrals, completions, and compliance than physician education alone; that peer performance feedback and reward will result in more referrals.
	Concur-rent control	Education only, n analysis: 23	Live, print	Lecture, readings	Individu-als, practice setting teams	T: NR W: Once only D: NR	One time	NR	NR	No	
	Interven-tion	Cue enhancement (posters, chart stickers) plus education, n analysis: 18	Live, print	Lecture, point of care, readings	Individu-als, practice settings/ teams	T: NR W: NR D: 1 year	Multiple time or repetitive	NR	NR	No	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Green-berg, 1985[25]	Interven-tion	Lecture-based education on headaches or behavior problems, n assigned: 26	Live	Lecture	Individu-als	T: 1 W: Once only D: 1 hour	One time	6-9 months	NR	No	To improve physician knowledge, skills, and behavior regarding common pediatric medical problems and to investigate differences in lecture or case-based learning
	Interven-tion	Case-based presentations on enuresis or sleep disorders, n assigned: 22	Live	Case-based learning	Individu-als	T: 1 W: Once only D: 1 hour	One time	6-9 months	NR	No	
Gullion, 1988[132]	Concur-rent control	No education about hypertension management, n assigned: 27, n analysis: 26	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	"The intervention attempted to improve physicians' management of hypertension through both medication and behavioral approaches."
	Interven-tion	Education about behavioral management for hypertension, n assigned: 28, n analysis: 27	Print, telephone conference	Discussion group, feedback, readings	Individu-als	T: 1 hour call + reading time W: NR D: NR	Multiple time or repetitive	11 months	NR	No	
	Interven-tion	Education about medication and behavioral management for hypertension, n assigned: 30, n analysis: 29	Print, telephone conference	Discussion group, feedback, readings	Individu-als	T: 2 hours on call + reading time W: NR D: NR	Multiple time or repetitive	11 months	NR	No	
	Interven-tion	Education about medication management for hypertension, n assigned: 27, n analysis: 25	Print, telephone conference	Discussion group, feedback, readings	Individu-als	T: 1 hour call + reading time W: NR D: NR	Multiple time or repetitive	11 months	NR	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Hagen, 2005[126]	Interven-tion	Education for physicians, nursing staff, pharmacists, and family members, n assigned: NR	Live, print, laminated copies to be posted at stations and in charts	Lecture, readings	Practice setting/ teams	T: 1.75 W: NR D: NR	Multiple time or repetitive	6 months	NR	Yes	The overall goal of the educational intervention is to decrease the use of psychotropics and dosage of psychotropics.
	Concur-rent control	No education, n assigned: NR	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NR	NA	
Harris, 2002[39]	Interven-tion	Intervention group participating in the online domestic violence education program, n assigned: 50, n analysis: 28	Internet, not real time	Case-based learning, feedback, readings	Individu-als	T: NR W: NR D: 2 weeks	Multiple time or repetitive	3 weeks	Yes	No	"Improve the confidence of practicing physicians managing domestic violence patients."
	Concur-rent control	Control group not receiving education intervention about domestic violence. n assigned: 49, n analysis: 37	NA	NA	NA	T: NA W: NA D: NA	NA	3 weeks	NA	NA	
Harris, 2005[75]	Interven-tion	Intervention group that received TED (teleconferenced education detailing), n assigned: 43, n analysis: 32	Live, audio, print, teleconfer-ence	Case-based learning, lecture, readings	Individu-als, practice setting/ teams	T: 8 W: NR D: 8, one hour sessions	Multiple time or repetitive	12 months	Yes	Yes	The overall goal of the educational intervention was to evaluate if methods improved regarding diabetes treatment.
	Concur-rent control	Control group, n assigned: 47, n analysis: 29	NA	NA	Individu-als, practice settings/ teams	T: NA W: NA D: NA	NA	NA	NA	NA	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Heale, 1988[66]	Interven-tion	Small group, problem based sessions for a one day CME, n analysis: 22	Live	Problem-based learning or team-based learning	Individu-als	T: NR W: Once only D: 1 day	One time	7 months	NR	No	To test the effectiveness of different learning formats. Six topic areas were selected: transient ischemic attack, hypertension, premenstrual syndrome, chlamydial infections, dementia, common prescribing mistakes. Several specific learning objectives were carefully identified in each of these areas.
	Interven-tion	Large group, case problem discussion educational method for one day CME, n analysis: 12	Live	Case-based learning, discussion group	Individu-als	T: NR W: Once only D: 1 day	One time	7 months	NR	No	
	Interven-tion	Traditional lecture educational method for 1 day CME, n analysis: 27	Live	Lecture	Individu-als	T: NR W: Once only D: 1 day	One time	7 months	NR	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Herbert, 2004[102]	Concur-rent control	Control module and no portrait, n assigned: 56	Live	NA	Individu-als	T: <2 W: Once only D: NR	One time	6 months	NA	NA	This intervention was designed to affect prescribing for hypertension.
	Interven-tion	Control module and portrait, n assigned: 48	Live	Clinical experiences, feedback, readings	Individu-als	T: <2 W: Once only D: NR	One time	6 months	NR	Uncle ar	
	Interven-tion	Experimental module and portrait, n assigned: 49	Live	Case-based learning, clinical experiences, demonstra-tion, discussion group, problem- or team-based learning, readings	Individu-als	T: <2 W: Once only D: NR	One time	6 months	NR	Uncle ar	
	Interven-tion	Experimental module and no portrait, n assigned: 47	Live	Case-based learning, clinical experiences, demonstra-tion, discussion group, problem- or team-based learning	Individu-als	T: <2 W: Once only D: NR	One time	6 months	NR	Uncle ar	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Hergen-roeder, 2002[60]	Interven-tion	Video + skills instruction intervention group, n assigned: 52, n analysis: 42	Live, video, print	Demonstra-tion, feedback, simulation (other than standardized patient or role-play)	Individu-als	T: NR W: Once only D: NR	One time	NR	No	No	Teach physical examination of the ankle and knee to improve the knowledge and skills of pediatricians.
	Interven-tion	Video only intervention group, n assigned: 49, n analysis: 33	Video, Print	Demonstra-tion	Individu-als	T: NR W: Once only D: NR	One time	NR	No	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Howe, 1997[145]	Interven-tion	Patients diagnosed at 5 rural hospitals with intensive intervention: visits by urban oncologists, audit with feedback, physician reminder systems, n assigned: 201 patients (pre and post combined)/5 facilities	NR	Feedback, lecture, point of care, readings (the major difference between the groups was the intensity of the intervention)	NR	T: NR W: NR D: 2 years	Multiple time or repetitive	2 years	NR	No	To determine if a more intensive outreach educational program had a greater impact on breast cancer management than audit and feedback program alone in eliminating the urban-rural difference in breast cancer management
	Interven-tion	Urban patients, received less intensive interventions, n assigned: 947 patients/4 facilities	NR	Feedback, point of care, readings	NR	T: NR W: NR D: 2 years	NR	2 years	NR	No	
	Interven-tion	Patients from rural areas but received care at urban centers which received only audit and feedback (less intensive) intervention, n assigned: 265 patients/4 facilities	NR	Feedback, point of care, readings	NR	T: NR W: NR D: 2 years	NR	2 years	NR	No	
	Interven-tion	Patients diagnosed and treated in hospitals receiving only audit and feedback (less intensive) intervention, n assigned: 114 patients/4 facilities	NR	Feedback, point of care, readings	NR	T: NR W: NR D: 2 years	Multiple time or repetitive	2 years	NR	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Jennett, 1988[76]	Interven-tion	Cancer medicine CME, n assigned: 9, n analysis: 9	Live, print, teleconfer-ence	Discussion group, feedback, mentor/ preceptor, readings	Individu-als	T: 6.8 W: NR D: 6-8 weeks	Multiple time or repetitive	12 months	NR	Unclear	To change doctor office behavior in the fields of cancer and cardiovascular medicine. Critical learning objectives listed in Table 3.
	Concur-rent control	No CME, n assigned: 11, n analysis: 11	NA	NA	NA	T: NA W: NA D: NA	NA	12 months	NA	NA	
	Interven-tion	Cardiovascular CME, n assigned: 11, n analysis: 10	Live, print, teleconfer-ence	Discussion group, feedback, mentor/ preceptor, readings	Individu-als	T: 7.7 hours W: NR D: 6-8 weeks	Multiple time or repetitive	12 months	NR	Unclear	
Juzych, 2005[92]	Concur-rent control	Control group, n assigned: 9, n analysis: 9	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	The overall goal of the educational intervention was to reduce the amount of unnecessary antibiotic treatment for respiratory infections.
	Interven-tion	Educational intervention group, n assigned: 21, n analysis: 14	Live, print	Case-based learning, lecture, readings	Individu-als, practice setting/ teams	T: NR W: NR D: NR	Not perfectly clear, but seems to be a single half day session	NR	NR	Yes	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Kemper, 2006[58]	Interven-tion	Pull + drip, n assigned: 318, n analysis: 202	Internet, not real time	Discussion group, problem-based learning or team-based learning	Individu-als	T: NR W: NR D: NR	Online discus-sions; case-based, self-instruction-al modules	NR	Yes	Unclear	The goal of the educational intervention is to provide training on complementary or alternative medicine. The goal of the study was to examine the difference between "drip" (small amounts of information over a period of time) versus "bolus" methods (large amounts of information over a short period of time) and the difference between "push" and "pull" methods of delivery (email delivery or availability on a web site).
	Interven-tion	Push + drip, n assigned: 318, n analysis: 206	Internet, not real time	Discussion group, problem-based learning or team-based learning	Individu-als	T: NR W: NR D: NR	Online discus-sions; case-based, self-instruction-al modules	NR	Yes	Unclear	
	Interven-tion	Pull + bolus, n assigned: 313, n analysis: 177	Internet, not real time	Discussion group, problem-based learning or team-based learning	Individu-als	T: NR W: NR D: NR	Online discus-sions; case-based, self-instruction-al modules	NR	Yes	Unclear	
	Interven-tion	Push + bolus, n assigned: 318, n analysis: 195	Internet, not real time	Discussion group, problem-based learning or team-based learning	Individu-als	T: NR W: NR D: NR	Online discus-sions; case-based, self-instruction-al modules	NR	Yes	Unclear	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Kiang, 2005[33]	Concur-rent control	Minnesota group, 2002, n assigned: 400	NA	NA	NA	T: NA W: NA D: NA	not clear	NA	NA	NA	The overall goal of the educational intervention was to see if the WARN campaign would improve the "desired" responses of the primary care physicians regarding knowledge, beliefs, and decision-making of appropriate antimicrobial drug use for upper respiratory infections.
	Concur-rent control	Minnesota group, 1999, n assigned: 400	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
	Interven-tion	Wisconsin group, 1999, n assigned: 400	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
	Interven-tion	Wisconsin group, 2002, n assigned: 600	Many things were made available but it is not reported as to which groups used what methods. Options included live, regional meetings, CD-ROMs, mailings, grand rounds	Not clear	NR	T: NR W: NR D: NR	not clear	NR	NR	Yes	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Kim, 1999[137]	Concur-rent control	Educational materials about preventative care practices only, n assigned: 24 MDs, 905 patients, n analysis: 20 MDs	Print	Readings	NA	T: NA W: NR D: 1 year	Multiple time or repetitive	2-2.5 years	NR	NA	To improve the quality of care, as measured by the provision of preventative care services recommended by U.S. Preventative Services Task Force, as well as lead to better patient satisfaction
	Interven-tion	Educational materials about preventative care practices, peer-comparison feedback, and academic detailing from a pharmacist three times over a year, n assigned: 24 MDs, 905 patients, n analysis: 21 MDs	Live, print	Academic detailing feedback, readings	Individu-als	T: NR W: NR D: 1 year	Multiple time or repetitive	2-2.5 years	NR	No	
Kottke, 1989[114]	Interven-tion	Only educational materials for patient distribution, n assigned: 22	Print	Readings	Individu-als	T: NA W: NA D: NA	NR	1 year	NR	Un-clear	To develop a program to help physicians incorporate smoking cessation into their practice routine.
	Interven-tion	Workshop training and educational materials for patient distribution, n assigned: 27	Live, print	Demonstra-tion, discussion group, lecture, readings	Individu-als	T: 6 W: Once only D: 6 hours	One time	1 year	NR	Un-clear	
	Concur-rent control	Control, n assigned: 17	NA	NA	NA	T: NA W: NA D: NA	NA	1 year	NR	Un-clear	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Kronick, 2003[71]	Concur-rent control	Control physicians receiving no training, n assigned: 40, n analysis: 40	NA	NA	NA	T: NA W: NA D: NR	NA	3 months	NA	NA	"...assess changes in the frequency and methods with which a group of rural physicians consulted on-line medical resources before and after the educational intervention. The intervention taught them how to search for and retrieve reliable, peer-reviewed, evidence-based information from bibliographic databases, such as PubMed and the Cochrane Library, and how to find additional resources in the University of Western Ontario (UWO) libraries' on-line collections."
	Interven-tion	Individualized training sessions on evidence-based information retrieval by trained hospital librarians, n assigned: 41, n analysis: 30	Live	Case-based learning, demonstra-tion	Individu-als	T: 3 W: Once only D: NR	One time	3 months	NA	No	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Kutcher, 2002[65]	Interven-tion	General educational intervention program (small group info format), n analysis: 30	Live, print	Discussion group, lecture, readings	Individu-als	T: 1 W: Once only D: NR	One time	6 months	No	No	"...the aim of this study was to evaluate the impact of a low-cost and brief educational program on family physicians' diagnosis and treatment of depression."
	Interven-tion	Enhanced educational intervention program (small group info format), n analysis: 35	Live, print	Academic detailing, discussion group, lecture, readings	Individu-als	T: 1.25 W: Once only D: NR	One time	6 months	No	No	
Labelle, 2004[67]	Interven-tion	GPs attending first OSCE and workshop and participating in OSCE 12 months later, n assigned: 24, n analysis: 12	Live, print	Case-based learning, demonstra-tion, discussion group, lecture, problem-based learning or team-based learning, role play, standardized patient	Individu-als, practice setting/ teams	T: NR W: Once only D: 12 months	Multiple time or repetitive	12 months	NR	No	"Improve the ability of participants to do the following: distinguish between asthma and chronic obstructive pulmonary disease, determine the severity of the asthma, list the different asthma control criteria, interpret respiratory function test results (spirometry), establish a treatment plan, prescribe a WAP for the patient; identify criteria for referral to a specialist."
	Interven-tion	GPs attending a 6 and 12 month OSCE, n assigned: 16, n analysis: 13	Live	Case-based learning, role play, standardized patient	Individu-als	T: NR W: Once only D: 12 months	Multiple time or repetitive	12 months	NR	No	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Lane, 1991[69]	Interven-tion	Multiple CME interventions and low-cost mammography, n analysis: NR	Live, print	ARS, clinical experiences, demonstra-tion, discussion group, feedback, lecture, mentor/ preceptor, readings	NR	T: NR W: NR D: NR	Multiple time or repetitive	NR	Yes	No	To determine if a community-wide multi-method approach to CME can increase physicians' compliance with national guidelines for breast cancer screening.
	Concur-rent control	No CME intervention and no mammography cost intervention, n analysis: NR	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
	Interven-tion	Multiple CME interventions AND no cost intervention with mammography, n analysis: NR	Live, print	ARS, clinical experiences, demonstra-tion, discussion group, feedback, lecture, mentor/ preceptor, readings	NR	T: NR W: NR D: NR	Multiple time or repetitive	NR	Yes	No	
	Interven-tion	No CME intervention but free mammography, n analysis: NR	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Lane, 2001[45]	Interven-tion	High-need physicians, as judged by their responses to a questionnaire on the need for breast cancer screening, received either an in-office or a self-learning intervention, n assigned: 201, n analysis: 128	Live	Lecture, standardized patient	Individu-als	T: 1-3 W: Once only D: 1 day	One time	6 months	Yes	Yes	Broad educational goals were to improve physicians' knowledge of the necessity of regular breast exams and mammograms (breast cancer screening practices) for women over age 50.
	Concur-rent control	Control physicians were also designated as high-need and low-need, but neither group received any CME intervention materials, n assigned: 223, n analysis: 154	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
Leopold, 2005[80]	Interven-tion	CD-ROM video demonstrating technique, n assigned: NR	Computer-based off-line	Demonstra-tion, readings	Individu-als	T: NR W: NA D: NR	NA	NR	NR	Unclear	The overall goal of the educational intervention is to see if the CME could change the relationship between an individual's confidence and competence in his or her ability to perform a task.
	Interven-tion	Hands-on instruction by a trained tutor, n assigned: NR	Live	Demonstra-tion, feedback mentor/ preceptor, simulation (other than SP or role-play)	Individu-als	T: 0.08-0.17 W: Once only D: NR	One time	NR	NR	Unclear	
	Interven-tion	Printed guide, n assigned: NR	Print	Readings	Individu-als	T: NR W: NA D: NR	NA	NR	NR	Unclear	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Levinson, 1993[138]	Concur-rent control	Control physicians not receiving CME, n assigned: 15, n analysis: 15	NA	NA	NA	T: NA W: NA D: NA	NA	1 month	NA	No	To improve physician patient communication skills, including 1) more open-ended questions, 2) more psychosocial discussion, 3) more information-giving, and 4) less talking and more listening.
	Interven-tion	Physicians attending a one time short CME program on communication skills, n assigned: 16, n analysis: 15	Live	Case-based learning, lecture	Individu-als	T: 4.5 hours W: Once only D: NR	One time	1 month	Yes	No	
Lewis, 1993[70]	Interven-tion	Comparison, received only written information, n assigned: 106	Print	Readings	NR	T: NR W: NR D: NR	One time	3 months	NR	No	Improve physician comfort with treating AIDS patients and with obtaining sexual histories. Improve knowledge about nosocomial HIV transmission.
	Concur-rent control	Control, n assigned: 93	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
	Interven-tion	Experimental, received live CME program on HIV and taking a sexual history, n assigned: 54	Live, video	Discussion group, lecture	NR	T: NR W: Once only D: 1 day	One time	3 months	NR	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Lin, 1997[73]	Interven-tion	Multifaceted educational intervention and collaborative treatment model, n assigned: 134 pre-intervention/109 post-intervention, n analysis: 83 pre-intervention/65 post-intervention	Live, video, print	Academic detailing, feedback, lecture, readings, role play	Practice settings/ teams	T: NR W: NR D: 1 year	Multiple time or repetitive	6 months	NR	Unclear	To determine if an extensive physician educational intervention that improved the primary care treatment of patients with major depression would have an enduring effect after its discontinuation.
	Concur-rent control	Control practices (usual care), n assigned: NR, n analysis: NR	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
Lin, 2001[133]	Interven-tion	Intervention group, n analysis: 56	Live	Academic detailing, case-based learning, demonstra-tion, discussion group, role play	Individu-als, practice setting/ teams	T: NR W: NR D: 3 months	Multiple time or repetitive	1 year	NR	Unclear	To assess the effect of physician training on management of depression. Use education on optimal management of depression to improve PCP diagnosis and pharmacotherapy practices of depression.
	Concur-rent control	Usual care group, n analysis: 53	Live, NA	NA	NA	T: NR W: NA D: NR	Multiple time or repetitive	1 year	NR	Unclear	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Lindsay-McIntyre, 1987[115]	Concur-rent control	Family physicians providing usual care, n assigned: NR	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	No	Motivating physicians a) to understand their role in assisting with the cessation process and b) to provide this service on a regular basis, c) providing the knowledge and skills needed to increase physicians' effectiveness in helping patients stop smoking
	Interven-tion	Family physicians with counseling training, nicotine gum, chart cue, intervention flowsheet, and patient self-help materials, n assigned: NR	Live, video, print	Demonstra-tion, lecture, point of care, standardized patient	Individu-als	T: 3-4 hour training session W: NR D: 2 months	Training 1 time, cueing with each patient	1 year	NR	No	
	Interven-tion	Family physicians with nicotine gum and chart cue, n assigned: NR	Print	Point of care	Individu-als	T: NR W: NR D: 2 months	Multiple time or repetitive	1 year	NR	No	
Lockyer, 2002[64]	Interven-tion	Introductory course (track 1) on Alzheimer's disease, n analysis: NR	Live	Case-based learning, discussion group, lecture, role play	Individu-als	T: 6.5 W: Once only D: 1 day	One time	3 months	Yes	No	To improve physicians' diagnosis and management of Alzheimer's disease and other dementias.
	Interven-tion	Advanced course (track 2) on Alzheimer's disease, n analysis: NR	Live	Case-based learning, discussion group, lecture	Individu-als	T: 6.5 W: Once only D: 1 day	One time	3 months	Yes	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Maclure, 1998[96]	Interven-tion	1 hour teleconference participants, n assigned: 94	Live, video	Lecture, teleconfer-ence	Individu-als	T: NR W: NR D: NR	One time	3 months	NR	No	To determine if a variety of educational interventions have an impact on prescribing patterns of calcium channel blockers and ACE inhibitor as first line antihypertensive therapy.
	Concur-rent control	Matched control for the teleconference group, n assigned: 188	NA	NA	NA	T: NA W: NA D: NA	NA	3 months	NA	No	
	Interven-tion	Small group workshops, n assigned: 70	Live	Discussion group, lecture	Individu-als	T: NR W: NR D: NR	NR	3 months	NR	No	
	Concur-rent control	Matched control for the small group workshop group, n assigned: 140	NA	NA	NA	T: NA W: NA D: NA	NA	3 months	NA	No	
	Interven-tion	Physicians receiving 2 newsletters, n assigned: 258	Print	Readings	Individu-als	T: NR W: NR D: NR	Multiple time or repetitive	3 months	NR	No	
	Concur-rent control	Control group for newsletter, n assigned: 241	NA	NA	NA	T: NA W: NA D: NA	NA	3 months	NA	No	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Macrae, 2004[85]	Interven-tion	Intervention group participating in electronic "journal club" & receiving 8 packages, each consisting of 1 clinical and 1 methodological article along with questions designed to guide critical appraisal, n assigned: 44, n analysis: 26	Print	Readings, listserv discussion group with moderator	Individu-als	T: NR W: NR D: 8 months	Multiple time or repetitive	6 weeks	Yes	No	"The objective of this randomized controlled trial was to assess the effectiveness of an Internet-based journal club, which is based on adult learning theory and findings from the continuing education literature, in developing critical appraisal skills of surgeons in practice."
	Concur-rent control	Control group received only the 8 clinical articles, n assigned: 37, n analysis: 29	Print	Readings	Individu-als	T: NR W: NR D: 8 months	Multiple time or repetitive	6 weeks	NR	No	
Maiman, 1988[47]	Interven-tion	2 session didactics and printed materials, n assigned: 33, n analysis: 32	Live, print	Discussion group, lecture, readings	Individu-als	T: 5 hours W: NR D: NR	Multiple time or repetitive	6 months	NR	No	Teaching pediatricians compliance-enhancing strategies.
	Concur-rent control	No additional education, n assigned: 27, n analysis: 24	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
	Interven-tion	Mailed printed materials, n assigned: 30, n analysis: 27	Print	Readings	Individu-als	T: NR W: NR D: NR	One time	6 months	NR	No	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Mann, 1997[52]	Interven-tion	Training workshop on cholesterol-lowering practices with FP, dietician, educational specialist, and internist, n analysis: 17	Live, video, print	Case-based learning, demonstra-tion, discussion group, readings, simulation (other than standardized patient or role-play)	Individu-als	T: NR W: NR D: NR	Multiple time or repetitive	15 months	NR	No	"The primary care physician will demonstrate skill in the detection, management (including counseling and educational activities), referral and follow-up of his/her patients who are at increased risk of cardiovascular disease due to their level of serum cholesterol."
	Concur-rent control	No workshop or chart cues, n analysis: 15	NA	NA	NA	T: NA W: NA D: NA	NR	15 months	NR	NA	
	Interven-tion	Training workshop plus chart cues cholesterol-lowering interventions for patients in their clinical practice, n analysis: 19	Live, video, print, cue stickers on medical chart	Case-based learning, demonstra-tion, discussion group, point of care, readings, simulation (other than standardized patient or role-play)	Individu-als	T: NR W: NR D: NR	Multiple time or repetitive	15 months	NR	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Margolis, 2004[118]	Concur-rent control	Control, n analysis: 22	NA	NA	NA	T: NA W: NA D: NA	NA	NA	No	NA	To improve the delivery of preventive care to children.
	Interven-tion	Plan-do-study-act process improvement, n analysis: 22	Live, organized set of tools otherwise unspecified	Academic detailing, feedback, lecture, unspecified organized set of tools	Practice setting/ teams	T: NR W: NR D: 12 months	Multiple time or repetitive	18 months	Yes	Yes	
Maxwell, 1984[57]	Concur-rent control	Physicians matched by department chairman to be similar in type and length of practice to committee members, n assigned: NR	NA	NA	NA	T: NA W: NR D: NA	NA	NR	NA	NA	To improve the knowledge and clinical performance of physicians in medical care evaluation committees
	Interven-tion	Physician members of three evaluation committees at a hospital, n assigned: NR	Live	Case-based learning, discussion group	Practice setting/ teams	T: NR W: NR D: 1 year	Multiple time or repetitive	NR	NR	Yes	

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Mazmanian, 1998[24]	Concur-rent control	Received lecture only, n assigned: 13 medical schools (340 physicians), n analysis: 13 schools (153 physicians)	Live	Lecture	Individu-als	T: 1 W: Once only D: 1 hour	One time	45 days	NR	No	To see if receiving information about barriers to clinical change during CME activities results in a higher rate of actual change
	Interven-tion	Received lecture as well as information regarding barriers to changing practice, n assigned: 12 medical schools (398 physicians), n analysis: 12 schools (146 physicians)	Live	Lecture	Individu-als	T: 1 W: Once only D: 1 hour	One time	45 days	NR	No	
Mazmanian, 2001[161]	Concur-rent control	This group's questionnaires included a line on which they could sign indicating their commitment to change practice behaviors, n assigned: 55, n analysis: 43	Live	Discussion group, lecture	Individu-als	T: NR W: Once only D: 1 day	One time	3 months	Yes	No	To determine the effect of signing a commitment to change practice form on actual practice change
	Interven-tion	This group's questionnaires did not include a signature line, n assigned: 55, n analysis: 45	Live	Discussion group, lecture	Individu-als	T: NR W: Once only D: 1 day	One time	3 months	Yes	No	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
McBride, 2000[144]	Interven-tion	Consultation group: primary care practices receiving 1-day conference and HEART Kits to improve prevention care systems PLUS 3 consultation meetings and 2 reinforcement visits during 1 year, n assigned: 11 practices	Live, print	Academic detailing, discussion group, feedback, lecture, point of care, problem-based learning or team-based learning	Practice setting/ teams	T: NR W: NR D: 1 year	Multiple time or repetitive	6 months	NR	Yes	To improve primary care practice systems for heart disease prevention services
	Interven-tion	Prevention coordinator group: primary care practices receiving 1-day conference and HEART Kits PLUS prevention coordinator working 4.5 hours per week to promote practice systems improvements for prevention care, n assigned: 11 practices	Live, print	Lecture, point of care, problem-based learning or team-based learning, patient education	Practice settings/ teams	T: NR W: NR D: 1 year	Multiple time or repetitive	6 months	NR	Yes	
	Concur-rent control	Conference-only group: primary care practices receiving 1-day conference and HEART Kits to improve prevention care systems, n assigned: 12 practices	Live, print	Lecture, point of care	Practice settings/ teams	T: NR W: NR D: 1 day	One time	18 months	NR	Yes	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
	Interven-tion	Combined intervention: primary care practices receiving 1-day conference, HEART Kits, 3 consultation meetings, 2 reinforcement visits, and a prevention coordinator, n assigned: 11 practices	Live, print	Academic detailing, discussion group, feedback, lecture, problem-based learning or team-based learning, patient education	Practice settings/ teams	T: NR W: NR D: 1 year	Multiple time or repetitive	6 months	NR	Yes	
McClellan, 2003[119]	Interven-tion	Intervention physicians received material at baseline, 2, 4 and 6 months, n assigned: 247, n analysis: 236	Video, print	Feedback, readings	Individu-als	T: NR W: NR D: 6 months	Multiple time or repetitive	1.5-2 years	NR	Yes	Determine if an intervention that includes claims-based feedback about patterns of HbA1c measurement results in more frequent monitoring of HbA1c in diabetic Medicare beneficiaries improve healthcare of Medicare beneficiaries regarding management and monitoring of diabetes mellitus
	Concur-rent control	Comparison physicians received no materials. n assigned: 230, n analysis: 223	NA	NA	Individu-als	T: NA W: NA D: NA	NA	1.5-2yrs	NR	Yes	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
McMahon, 1988[155]	Concur-rent control	Internists on another IM service in the hospital with a high LOS, n assigned: NR	Live	Discussion group, lecture	Individu-als	T: NR W: Once only D: NR	One time	16 months	NR	Yes	To reduce length of stay on services identified with high length of stay in one hospital. Educate admitting physicians about LOS performance; educate physicians about prison follow-up care and continuity of care.
	Interven-tion	Internists admitting to 3 hospital services with high LOS, n assigned: NR	Live	Discussion group, feedback, lecture	Individu-als	T: 1 hour W: Once only D: NA	Multiple time or repetitive	16 months	NA	Yes	
	Concur-rent control	Physicians on other units; received no intervention, n assigned: NR	NA	NA	NA	T: NA W: NA D: NA	NA	16 months	NA	NA	
	Interven-tion	Internists admitting to 4 services with high LOS, n assigned: NR	Live	Discussion group, lecture	Individu-als	T: NR W: Once only D: NR	One time	16 months	NR	Yes	
Mehler, 2005[99]	Interven-tion	Electronic detailing intervention (using facsimiles and emails), n assigned: 415, n analysis: 415	Internet, not real time, print	Academic detailing, readings	Practice setting/ teams	T: NR W: NR D: NR	Multiple time or repetitive	3 months	NR	Yes	The goal of the educational interventions was to better facilitate the integration of, and adherence to, diabetic lipid-lowering guidelines in clinical practice.
	Interven-tion	Direct detailing intervention (using face-to-face education sessions), n assigned: 146	Live, print	Academic detailing, lecture	Practice settings/ teams	T: NR W: NR D: NR	Multiple time or repetitive	3 months	NR	Yes	
	Concur-rent control	Control, n assigned: 323	NA	NA	NA	T: NA W: NA D: NA	NA	3 months	NA	NA	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Meredith, 2000[51]	Interven-tion	Physician education & QI therapy intervention (reduced copayments for use of practice psychotherapists), n assigned: 58	Live, print	Lecture, readings	Practice settings/ teams	T: NR W: NA D: 6 months	NA	12 months (18 months after implement-ation)	NR	Yes	To improve long-term clinician knowledge of depression treatment.
	Interven-tion	Physician education & QI meds intervention (improved resources for antidepressant medication management), n assigned: 49	Live, print	Lecture, readings	Practice setting/ teams	T: NR W: NA D: 6 months	Multiple time or repetitive	12 months (18 months after implementa-tion)	NR	Yes	
	Concur-rent control	Usual care, n assigned: 53	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Messina, 2002[156]	Interven-tion	Physician CME & no patient training, n assigned: 342, n analysis: 154	Live, print	Demonstra-tion, readings, standardized patient	Individu-als	T: NR W: NA D: NR	Multiple time or repetitive	3 years	NR	Unclear	Evaluate an intervention including both patients and physicians in attempts to increase the use of mammography.
	Concur-rent control	No training: control physicians, control patients, n assigned: 489, n analysis: 115	NA	NA	NA	T: NA W: NA D: NA	NA	3 years	NR	Unclear	
	Interven-tion	Physician CME (nurse educator training + SP visit) & patients with BSTC, n assigned: 335, n analysis: 149	Live, audio, print	Demonstra-tion, readings, standardized patient, telephone counseling	Individu-als	T: NR W: NA D: NR	Multiple time or repetitive	3 years	NR	Unclear	
	Concur-rent control	No physician CME, & patient BSTC only, n assigned: 435, n analysis: 92	Live, audio	Readings, telephone counseling	Individu-als	T: NR W: NA D: NR	Multiple time or repetitive	3 years	NR	Unclear	
Moran, 1996[121]	Interven-tion	Cases - in need of remedial CME as identified by the Manitoba College of Physicians, n assigned: 5	Live	Case-based learning, discussion group	Individu-als	T: 30 W: NR D: 10 days	Multiple time or repetitive	18 months	NR	No	To determine if problem-based, remedial, supportive CME program can cause sustained improvement in practice habits
	Concur-rent control	Controls, n assigned: 10	Live	Case-based learning, discussion group	Individu-als	T: 30 W: NR D: 10 days	Multiple time or repetitive	NR	NR	No	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Mukohara, 2005[13]	Concur-rent control	Received health-related news from email from Yahoo! Health, n assigned: 53, n analysis: 45	Computer-based off-line	Readings	Individu-als	T: NR W: Once only D: NR	Multiple time or repetitive	NR	NR	No	The overall goal of the educational intervention was to see if delivery services such as the WBJC could influence doctors' use of evidence in practice.
	Interven-tion	Received WBJC readings which had summaries of 1 or 2 articles from medical/health journals, n assigned: 54, n analysis: 51	Computer-based off-line	Readings	Individu-als	T: NR W: Once only D: NR	Multiple time or repetitive	NR	NR	No	The overall goal of the educational intervention was to see if delivery services such as the WBJC could influence doctors' use of evidence in practice.
Myers, 2004[148]	Concur-rent control	Control group, n analysis: 198 practices	NA	Readings	Individu-als	T: NR W: NA D: NA	NA	6 years	NR	Yes	"The CDE Study, was designed to evaluate the impact of a physician intervention (i.e., CDE reminder-feedback and educational outreach) on CDE recommendation and performance rates in primary care practices.
	Interven-tion	Physician-oriented reminder-feedback and educational outreach intervention, n analysis: 120 practices	Live, audio, print	Academic detailing, feedback, lecture, readings	Individu-als	T: NR W: NA D: 5 years	Multiple time or repetitive	6 years	NR	Yes	"The CDE Study, was designed to evaluate the impact of a physician intervention (i.e., CDE reminder-feedback and educational outreach) on CDE recommendation and performance rates in primary care practices.

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Norris, 2000[81]	Concur-rent control	No training on physical activity counseling, n assigned: 17 MDs, 463 patients, n analysis: 460 patients	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	To increase the physical activity levels of patients in a health maintenance organization by teaching a counseling program to their primary care providers
	Interven-tion	1-hour workshop on Physician-Based Assessment and Counseling for Exercise, a behavior-based tool for PCPs counseling healthy adults, n assigned: 15 MDs, 384 patients, n analysis: 362 patients	Live, print, follow-up phone calls about protocol	Lecture, point of care, opinion-leader from clinic teaching	Practice setting/ teams	T: 1 W: NR D: NR	Multiple time or repetitive	6 months	NR	No	
Ockene, 1996[124]	Interven-tion	Lipid intervention physician training, n assigned: 17, n analysis: 115	Live, video	Feedback, lecture, role play, standardized patient	Individu-als	T: 3 W: 1 day/week D: 2 weeks	2 types of training sessions, each provided once	Evaluation was conducted over a 2 year time span	NR	No	To help physicians develop nutrition counseling skills.
	Concur-rent control	Usual care, n assigned: 14, n analysis: 92	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
	Interven-tion	Lipid intervention physician training plus practice management, n assigned: 14, n analysis: 118	Live, video	Feedback, lecture, role play, standardized patient	Individu-als, practice settings/ teams	T: 3 W: 1 day/week D: 2 weeks	2 types of training sessions, each provided once	Evaluation was conducted over a 2 year time span	NR	Yes	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Ozer, 2005[104]	Concur-rent control	Comparison group, n assigned: 44, n analysis: 37	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	The goal of this intervention was to increase clinicians' screening and brief counseling of adolescents in the targeted health risk areas of tobacco, alcohol and drug use, sexual behavior, seatbelt use, and helmet use.
	Interven-tion	Intervention group, n assigned: 42, n analysis: 39	Live, print	Discussion group, lecture, role play, screening and charting tools	Practice setting/ teams	T: 8 W: Once only D: NR	One time	8 months	NR	Yes	
Paziran-deh, 2002[128]	Interven-tion	Intervention group receiving didactic lectures on the results of screening and the effect of prudent management on osteoporosis outcome, n analysis: 53	Live, print	Lecture, readings, Q & A period	Individu-als	T: NR W: Once only D: NR	One time	6 months	No	Uncle ar	"To test the impact of focused patient education as well as didactic lecture on physician behavior and patient care outcome, we used focused patient education as a tool to elicit change in physician behavior as it relates to the management of osteoporosis."
	Concur-rent control	Control group receiving no intervention, n analysis: 81	NA	NA	Individu-als	T: NA W: NA D: NR	NA	6 months	No	Un-clear	

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Pereles, 1996[163]	Interven-tion	Wrote commitment to change after CME course, n assigned: 7	Live	NR	Individu-als	T: NR W: NR D: NR	NR	3 months	NR	Un-clear	Goals of the educational intervention not stated but the study is not evaluating the course but the impact of "written commitment to change" after the course on behavior
	Concur-rent control	CME course only, n assigned: 9	Live	NR	Individu-als	T: NR W: NR D: NR	NR	3 months	NR	Un-clear	
Perera, 1983[107]	Interven-tion	Primary care physicians enrolled in a preceptorship for sigmoidoscopy training, 2nd training, n assigned: 13	Live	Clinical experiences, demonstra-tion	Individu-als	T: 8 W: 2 days/week D: 2 days	One time	3 months	Yes	No	"To increase the rate of sigmoidoscopy by physicians in a health maintenance organization"
	Concur-rent control	Primary care physicians who did not sign up for sigmoidoscopy training, n assigned: 74	NA	NA	NA	W: NA	NA	NA	NA	NA	
	Interven-tion	Primary care physicians enrolled in a preceptorship for sigmoidoscopy training, 1st training, n assigned: 13	Live	Clinical experiences, demonstra-tion	Individu-als	T: 8 W: 2 days/week D: 2 days	One time	7-10 months	Yes	No	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Pimlott, 2003[143]	Concur-rent control	Control group receiving mailed packages of feedback education materials on antihypertensives, n analysis: 206	Print	Feedback, readings	Individu-als	T: NR W: NA D: 6 months	Multiple time or repetitive	6 months	NR	Un-clear	To improve prescribing of benzodiazepine hypnotic sedatives to the elderly
	Interven-tion	Intervention group receiving mailed packages of feedback about participants' prescribing (of benzodiazepines) and evidence-based education materials, n analysis: 168	Print	Feedback, readings	Individu-als	T: NR W: NA D: 6 months	Multiple time or repetitive	6 months	NR	Un-clear	
Pinto, 1998[74]	Concur-rent control	Physicians and patients were given a manual about exercise counseling but no formal training or instruction, n assigned: 17, n analysis: 15	Print	Readings	Individu-als	T: NR W: NR D: NR	Given materials to read-exposure up to the physicians	8 months	NR	No	Assist physicians to address barriers to activity counseling: lack of counseling skills and lack of time. To determine if an educational intervention can have an impact on physician counseling on exercise
	Interven-tion	Physicians were given the manual as well as an hour training session and follow-up reminders. Patients were also given reminders about exercise, n assigned: 17, n analysis: 12	Live, print	Discussion group, readings, role play	Individu-als	T: 1 W: Once only D: 1 hour	One time	8 months	NR	No	

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Premi J, 1993[38]	Concur-rent control	Review articles only on the management of chest pain, n assigned: 10, n analysis: 10	Print	Readings	Individu-als	T: NR W: NR D: NR	NR	NR	NR	No	To improve physicians' knowledge about the diagnosis and management of chest pain from different etiologies using a video-workbook educational program.
	Concur-rent control	No education on the management of chest pain, n assigned: 10, n analysis: 7	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NR	NA	
	Interven-tion	educational workbook (video + questions/ answers) and review articles on the management of chest pain, n assigned: 10, n analysis: 4	Video, print	Case-based learning, readings	Individu-als	T: NR W: NR D: NR	NR	NR	NR	No	
	Interven-tion	Educational workbook (video + questions/ answers) on the management of chest pain, n assigned: 10, n analysis: 9	Video, print	Case-based learning, readings	Individu-als	T: NR W: NR D: NR	NR	NR	NR	No	

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Premi, 1994[41]	Concur-rent control	Family and general practice MDs waitlisted for CME and receiving no training, n assigned: 52, n analysis: 46	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	To effectively disseminate new information while simultaneously providing more opportunities for individual learning
	Interven-tion	Family and general practice MDs who participated in twice monthly small group community CME about hormone replacement, asthma, congestive heart failure, otitis media, and other topics, n assigned: 100, n analysis: 76	Live, print	Case-based learning, discussion group, problem-based learning or team-based learning, readings	Individu-als	T: 24 D: 1 year (for this evaluation)	Multiple time or repetitive	3 months	Yes	No	
Rabin, 1998[97]	Interven-tion	Educational materials alone, n assigned: NR	Print	Readings	Individu-als	T: NR W: NR D: NR	NR	3 months	NR	No	To determine if educational materials alone or educational material plus simulated patient instructors were more effective than no intervention at changing physicians practice concerning history-taking and counseling related to sexual behaviors and sexually transmitted disease
	Concur-rent control	No intervention, n assigned: NR	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
	Interven-tion	Educational materials and simulated patient instructor, n assigned: NR	Live, print	Readings, standardized patient	Individu-als	T: NR W: NR D: NR	Multiple time or repetitive	3 months	NR	No	

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Rahme, 2005[100]	Interven-tion	Workshop and decision tree group, n analysis: 84	Live, print	Discussion group, lecture, readings	Individu-als	T: 1.5 W: Once only D: NA	One time	5 months	Yes	Yes	The overall goal of the educational intervention was to increase general practitioners' ability to select the proper pharmacological treatment for patients with osteoarthritis.
	Concur-rent control	Control group, n analysis: 82	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
	Interven-tion	Decision tree group only, n analysis: 54	Print	Readings	Individu-als	T: NA W: NA D: NA	NA	5 months	Yes	Yes	
	Interven-tion	Workshop group only, n analysis: 29	Live	Discussion group, lecture	Individu-als	T: 1.5 W: Once only D: NA	One time	5 months	Yes	Yes	
Ray, 1985[20]	Concur-rent control	No intervention about prescribing behavior, n assigned: 98+150, n analysis: 248	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	To generate sustained improvement in appropriate and cost-effective antibiotic prescribing behaviors
	Interven-tion	Drug-educator visit about contraindicated antibiotics or oral cephalosporins, n assigned: 71+76, n analysis: 147	Live	Academic detailing	Individu-als	T: NR W: Once only D: 1 visit	One time	2 years	NR	No	
	Interven-tion	Physicians receiving a physician-counselor visit about contraindicated antibiotics or oral cephalosporins, n assigned: 44+45, n analysis: 89	Live	Academic detailing	Individu-als	T: 0.25 W: Once only D: 1 visit	One time	2 years	NR	No	

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Ray, 2001[109]	Interven-tion	visit by a physician-educator on the reasons to switch to drugs other than NSAIDS, as well as chart reminder stickers, n assigned: 110, n analysis: 103	Live, print	Academic detailing, readings, chart reminders	Individu-als	T: NR W: NR D: NR	Multiple time or repetitive	1 year	NR	Yes	Evaluate a physician education program that communicated guidelines for management of osteoarthitis in elderly patients that emphasized avoidance of NSAIDs when possible.
	Concur-rent control	No educational intervention on slowing NSAID prescribing, n assigned: 110, n analysis: 106	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	

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Rodney, 1986[77]	Interven-tion	One of 3 small-group courses (12-45 per group), n assigned: 82, n analysis: 61	Live, video	Demonstra-tion, lecture, simulation (other than standardized patient or role-play)	Individu-als	T: 4 W: Once only D: 1 day	One time	12-18 months	Yes	No	1) improved physician compliance with American Cancer Society colorectal cancer screening recommendations; 2) demonstration of safety and efficacy of the flexible sigmoidoscope in the hands of the office-based generalist; 3) promotion of learning through well supervised workshops in sigmoidoscopic techniques
	Interven-tion	Large group course, n assigned: 114, n analysis: 94	Live, video	Demonstra-tion, lecture, simulation (other than standardized patient or role-play)	Individu-als	T: 15 W: 4 days/week D: 4 days	One time	12-18 months	Yes	No	
	Concur-rent control	Randomly contacted physicians, of whom 22% had received other CME on flexible sigmoidoscopy, n assigned: 97, n analysis: 97	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
Rosen-thal, 2005[59]	Concur-rent control	Practices that receive only 1 of the 4-step intervention, n analysis: 22	Review of data	Review of practice's data	Practice settings/ teams	T: NR W: NR D: NR	One time	NR	NR	Yes	The overall goal of the intervention was to improve performance of the practice settings so as to improve parents' reports of physicians' actions and parents' knowledge and behavior.
	Interven-tion	Practices that receive the full 4-step intervention, n analysis: 22	Live, handheld, review of data	Lecture, readings, review of practice's data	Practice setting/ teams	T: NR W: NR D: NR	Multiple time or repetitive	NR	NR	Yes	

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Rost, 2001[22]	Concur-rent control	Primary care practices without a mental health professional on faculty, n assigned: 6 practices (12 doctors), n analysis: 6 practices (12 doctors)	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	To determine whether redefining primary care team roles would improve outcomes for patients beginning a new treatment episode for major depression.
	Interven-tion	Primary care practices without a mental health professional on faculty, n assigned: 6 practices (12 doctors), n analysis: 6 practices (12 doctors)	By phone	Conference calls	Practice setting/ teams	T: 6 W: NR D: 2 months	Multiple time or repetitive	6 months	NR	Yes	
Roter, 1995[84]	Interven-tion	Emotion-handling skills education, n assigned: 22	Live	Discussion group, lecture, role play, standardized patient	Individu-als	T: 8 W: 1 day/week D: 2 weeks	Multiple time or repetitive	Immediate – 6 months	NR	No	To teach physicians communication skills so they will be more successful in distinguishing distressed from non-distressed patients, will be more likely to identify psychological problems of these patients, and will more often manage psychosocial problems.
	Concur-rent control	No education control, n assigned: 24	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
	Interven-tion	Problem defining skills education, n assigned: 23	Live	Discussion group, lecture, role play, standardized patient	Individu-als	T: 8 W: 1 day/week D: 2 weeks	Multiple time or repetitive	Immediate – 6 months	NR	No	

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Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Schect-man, 1991[139]	Interven-tion	Received memo on the use of allergy trial packs, n assigned: 20	Print	Readings, directed physicians to use allergy trial packs	Practice setting/ teams	T: NR W: NR D: NR	NR	NR	NR	Yes	To reduce antihistamine prescribing costs in an HMO
	Concur-rent control	Did not receive memo, n assigned: 190	NA	NA	Practice settings/ teams	T: NA W: NA D: NA	NA	NA	NA	NA	
	Concur-rent control	Did not receive memo, n assigned: 13	NA	NA	Practice settings/ teams	T: NA W: NA D: NA	NA	NA	NA	NA	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Schect-man, 1995[130]	Concur-rent control	Private FFS, received only memo, n assigned: 33 (the study only provides the total in the private practice group)	Print	Readings	NR	T: NR W: NR D: several weeks	Multiple time or repetitive	6 months	NR	Yes	To study the effect of a simple intervention using feedback on prescribing habits on network and group model HMO physician prescribing practices (H2 inhibitors).
	Interven-tion	Private FFS, received memo and feedback on H2 blocker use, n assigned: 33 (the study only provides the total in the private practice group)	Print	Feedback, readings	NR	T: NR W: NR D: several weeks	Multiple time or repetitive	6 months	NR	Yes	
	Concur-rent control	Group model-academic, received only memo, n assigned: 21 (the study only provides the total in the academic group)	Print	Readings	NR	T: NR W: NR D: several weeks	Multiple time or repetitive	6 months	NR	Yes	
	Interven-tion	Group model-academic, received memo and feedback on H2 blocker use, n assigned: 21 (the study only provides the total in the academic group)	Print	Feedback, readings	NR	T: NR W: NR D: several weeks	Multiple time or repetitive	6 months	NR	Yes	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
	Interven-tion	Group model-nonacademic, received memo and feedback on H2 blocker use, n assigned: 9 (the study only provides the total in the nonacademic group)	Print	Feedback, readings	NR	T: NR W: NR D: several weeks	Multiple time or repetitive	6 months	NR	Yes	
	Concur-rent control	Group model, nonacademic and received only memo, n assigned: 9 (the study only provides the total in the nonacademic group)	Print	Readings	NR	T: NR W: NR D: several weeks	Multiple time or repetitive	6 months	NR	Yes	
Schect-man, 1996[16]	Interven-tion	All providers at the largest HMO site receiving memo about anti-histamine use, n assigned: 27	Print, samples of first generation anithista-mines to use with patients	Readings	Practice setting/ teams	T: NR W: NR D: 1 month	One time	6 months	No	Yes	To reduce antihistamine prescribing costs in an HMO.
	Concur-rent control	Providers in 4 control HMO sites, n assigned: 14	NA	NA	NA	T: NA W: NA D: NA	NA	6 months	NA	NA	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Schect-man, 2003[108]	Concur-rent control	No clinician intervention, n analysis: 56	Video, print	NA	Individu-als, practice settings/ teams	T: NR W: NA D: 1 year	NA	1 year	NR	Uncle ar	"to investigate the effect of physician education and individual performance feedback with or without patient educational materials on adherence to a clinical practice guideline for the care of acute low back pain."
	Interven-tion	Clinical practice guideline, n analysis: 50	Live, video, print	Lecture, readings	Individu-als, practice setting/ teams	T: NR W: NA D: 1 year	Multiple time or repetitive	1 year	NR	Uncle ar	
Schroy, 1999[82]	Concur-rent control	Comparison sites, n assigned: 5 comparison sites	NA	NA	NA	T: 1 W: NA D: NA	NA	1 year	NR	Yes	To assess the impact of "academic detailing" in the form of an outreach educational seminar combined with implementation of on-site gastroenterologists on provider compliance.
	Interven-tion	Academic detailing intervention sites, n assigned: 4 intervention sites	Live	Academic detailing, discussion group, lecture	Individu-als, practice setting/ teams	T: 1 W: Once only D: NR	One time	1 year	NR	Yes	
Schwartz berg, 1997[98]	Interven-tion	Attended seminar on homecare and given written materials on the topic, n assigned: 355, n analysis: 131	Live, print	Case-based learning, lecture, readings	Individu-als	T: NR D: half day	One time	3 months	NR	No	To determine if a seminar on home care of geriatric patients had an impact on the behaviors and attitudes of physicians attending the session
	Concur-rent control	No seminar attended, n assigned: 249, n analysis: 204	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Sharif, 2002[94]	Concur-rent control	Pediatricians from 2 inner-city pediatric clinics in the same academic medical center who did not attend workshop, n assigned: 9	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	To train pediatricians in smoking cessation counseling.
	Interven-tion	Pediatricians from 2 inner-city pediatric clinics in the same academic medical center who attended workshop, n assigned: 6	Live	Lecture, role play	Individu-als	T: NR W: Once only D: 1 day	One time	3 weeks	NR	No	
Short, 2006[50]	Concur-rent control	No CME, n assigned: 37, n analysis: 29	NA		NA	T: NA W: NA D: NA	NA	NA	NA	NA	The goal of the educational intervention was to improve the knowledge, attitudes, beliefs, and behavior scores in physicians so as to demonstrate improved dealings with issues regarding intimate partner violence.
	Interven-tion	Online CME program, n assigned: 44, n analysis: 23	Internet, not real time	Lecture, problem-based learning or team-based learning, readings, multiple media, interactivity	Individu-als	T: NR W: NR D: 4 hours minimum and up to 16	Multiple time or repetitive	12 months	Yes	Un-clear	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Sibley, 1982[136]	Concur-rent control	No education, n assigned: 8	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	To improve the quality of clinical care and to determine whether continuing medical education affects the quality of clinical care
	Interven-tion	18 continuing-education packages, n assigned: 8	Audio, print	Case-based learning, lecture, readings	Individu-als	T: 3-4 (median) W: NR D: not clear but seems to be available for an 18 month window	Multiple time or repetitive	18 months	NR	No	
Slotnick, 1993[17]	Interven-tion	Education about a newer drug (Mazicon) through enhanced advertising with a "clinical challenge" scenario, n assigned: 10	Print	Readings	Individu-als	T: NR W: Once only D: 1 session	One time	Immediate	NR	No	To see if important ideas in prescribing information could be made more accessible to doctors, using an educational approach based on adult learning theory
	Interven-tion	Education about a newer drug (Mazicon) through enhanced advertising with a "clinical challenge" scenario and an introduction on how to use the "clinical challenge", n assigned: 11	Print	Readings	Individu-als	T: NR W: Once only D: 1 session	One time	Immediate	NR	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
	Interven-tion	Education about an older drug (Bumex) through enhanced advertising with a "clinical challenge" scenario and an introduction on how to use the "clinical challenge", n assigned: 9	Print	Readings	Individu-als	W: Once only D: 1 session	One time	Immediate	NR	No	
	Interven-tion	Education about a newer drug (Mazicon) through conventional advertising, n assigned: 11	Print	Readings	Individu-als	T: NR W: Once only D: 1 session	One time	Immediate	NR	No	
	Interven-tion	Education about an older drug (Bumex) through enhanced advertising with a "clinical challenge" scenario, n assigned: 8	Print	Readings	Individu-als	T: NR W: Once only D: 1 session	One time	Immediate	NR	No	
	Interven-tion	Education about an older drug (Bumex) through conventional advertising, n assigned: 12	Print	Readings	Individu-als	T: NR W: Once only D: 1 session	One time	Immediate	NR	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Socolar, 1998[134]	Concur-rent control	No formal feedback on charting, n assigned: 75, n analysis: 45	NA	NA	Individu-als	T: NA W: NA D: NA	NA	1 year	NR	No	The goal of the current study was to determine whether chart audit with written feedback improves the chart documentation and knowledge of physicians doing evaluations for child sexual abuse and to learn what other factors are associated with better physician chart documentation and knowledge.
		Received feedback on documentation of child abuse cases, n assigned: 72, n analysis: 42	Print	Feedback, readings	Individu-als	T: NR W: NR D: 1 year	Multiple time or repetitive	1 year	NR	No	
Solomon, 2004[127]	Interven-tion	Intervention group: 3 part intervention for GIOP, n analysis: 10	Live, print	Discussion group, lecture, readings	Individu-als	T: NR W: NR D: 6 weeks	Multiple time or repetitive	6 months	NR	No	"The long-range goal of our work is improving management of GIOP."
	Concur-rent control	Control arm, n analysis: 11	NA	NA	NA	T: NA W: NA D: NA	NA	6 months	NA	No	
Soumerai, 1987[105]	Concur-rent control	No intervention, n assigned: 162, n analysis: 54-70	NA	NA	NA	T: NA W: NA D: NA	NA	9 months	NA	Un-clear	Reduce inappropriate prescribing of three target drugs by Medicaid physicians.
	Interven-tion	Academic detailing and printed materials, n assigned: 141, n analysis: 69-75	Live, print	Academic detailing, readings, brochures	Individu-als	T: 33 minutes W: 1 day/week D: 6 months	Multiple time or repetitive	9 months	NR	Un-clear	
	Interven-tion	Print only educational intervention, n assigned: 132	Print	Readings, brochures	Individu-als	T: NR W: NR D: NR	Multiple time or repetitive	9 months	NR	Un-clear	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Stein, 2001[95]	Concur-rent control	Not counseled to reduce NSAID use, n assigned: 10 homes (77 patients), n analysis: 10 homes (71 patients)	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	To determine the effects of an educational program on NSAID use and clinical outcomes in nursing homes.
	Interven-tion	Education and instructions on how to reduce the use of NSAIDS among residents over 65, n assigned: 10 homes (81 patients), n analysis: 10 homes (76 patients)	Live, handheld, by phone	Readings, study physician visit, algorithm	Practice setting/ teams	T: NR W: NR D: NR	Multiple time or repetitive	3 months	NR	Yes	
Stewart, 2005[43]	Interven-tion	Intervention group receiving case-based on-line learning modules, n assigned: 27	Internet, not real time	Case-based learning, discussion group, readings	Individu-als	T: NR W: NA D: 4 weeks	Multiple time or repetitive	6 months	NR	Yes	The overall goal of the intervention was to increase knowledge, quality of practice, and targeted behaviors compared to family physicians randomized to a wait-listed control group.
	Concur-rent control	Control group, n assigned: 31	NA		NA	T: NA W: NA D: NA	NA	NA	NA	NA	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Stross, 1985[116]	Concur-rent control	Received no intervention, n assigned: 3 communities (>15 primary care physicians each)	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	To improve the community hospital management of osteoarthritis through educationally influential physician peers.
	Interven-tion	Educationally influential physicians received training about osteoarthritis management, n assigned: 3 communities (>15 primary care physicians each)	Live, print, "audiovis-ual materials"	Feedback, readings, use of "education-ally influential" physician	Practice setting/ teams	T: NR W: NR D: NR	Multiple time or repetitive	1 year	NR	No	
Terry, 1981[49]	Concur-rent control	Education on other pulmonary topics, n assigned: 6	Audio, print	Case-based learning, lecture, readings	Individu-als	T: 4 W: NR D: 9 months	Multiple time or repetitive	6 months	Yes	No	To improve the care of patients with chronic bronchitis and emphysema
	Interven-tion	Group meetings about educational needs and 2 audiovisual programs about management and patient counseling, n assigned: 10	Live, audio, print	Case-based learning, discussion group, lecture, readings	Individu-als	T: NR W: NR D: 18 months	Multiple time or repetitive	6 months	Yes	No	
	Interven-tion	Group meetings about educational needs, 2 audiovisual programs about management and patient counseling and feedback on questionnaire performance, n assigned: 7	Live, audio, print	Case-based learning, discussion group, feedback, lecture, readings	Individu-als	T: NR W: NR D: 18 months	Multiple time or repetitive	6 months	Yes	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
	Interven-tion	Two audiovisual programs about management and patient counseling, n assigned: 12	Live, audio, print	Case-based learning, lecture, readings	Individu-als	T: 4 W: NR D: 9 months	Multiple time or repetitive	6 months	Yes	No	
	Interven-tion	Two audiovisual programs about management and patient counseling and feedback on questionnaire performance, n assigned: 9	Audio, print	Case-based learning, feedback, lecture, readings	Individu-als	T: NR W: NR D: 9 months	Multiple time or repetitive	6 months	Yes	No	
Thom, 2000[129]	Interven-tion	CME on patient trust, n assigned: 10	Live, video	Demonstra-tion, discussion group, lecture, role play	Individu-als	T: 7 W: Once only D: NR	One time	6 months	NR	Unclear	To modify physician behaviors (as identified by patients in a previous study) important to establishing patient trust through a short training program to increase patient trust.
	Concur-rent control	No CME, n assigned: 10	NA	NA	Individu-als	T: NA W: NA D: NA	NA	6 months	NR	Unclear	
Tziraki, 2000[141]	Interven-tion	Received the National Cancer Institute training manual on nutrition counseling and systems change, n assigned: 256, n analysis: 205	Print	Readings	Practice settings/ teams	T: NR W: NA D: NA	One time	4-6 months	NR	Yes	To assist primary care physicians in improving their practice behaviors related to nutrition and cancer prevention
	Concur-rent control	Received no training on nutrition counseling and systems change, n assigned: 255, n analysis: 222	NA	NA	NA	T: NA W: NA	NA	NA	NA	NA	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
	Interven-tion	Received a 3-hour training on nutrition counseling and systems change to support nutrition counseling, n assigned: 244, n analysis: 191	Live, print	Discussion group, lecture, problem-based learning or team-based learning, role play	Practice setting/ teams	T: 3 W: Once only D: NA	One time	4-6 months	NR	Yes	
Wells, 2000[151]	Concur-rent control	Usual care, including AHRQ depression practice guidelines, n assigned: 16 clinics, 443 patients, n analysis: 16 clinics, 374 patients	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	To improve quality of care, health outcomes, and employment in patients with depression managed in the primary care setting
	Interven-tion	Quality improvement interventions with either medication adherence support or cognitive behavioral therapy; QI included institutional support, training of local leaders, 2-day MD workshop, manuals, monthly lectures, academic detailing, audit with feedback, 1-day staff workshop, and support materials, n assigned: 30 clinics, 913 patients, n analysis: 30 clinics, 752 patients	Live, print	Academic detailing, discussion group, feedback, lecture, point of care, readings	Practice setting/ teams	T: NR W: NR D: NR	Multiple time or repetitive	NR	NR	Yes	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
White, 1985[48]	Interven-tion	Generalists receiving unitopic (cardiology) university-based CME program, n analysis: 31	Live	NR	Individu-als	T: NR W: 4 days/week D: 4 days	One time	6 months	NR	No	To improve in hospital treatment of acute myocardial infarction by generalist physicians.
	Interven-tion	Generalists receiving a multitopic university-based CME, n analysis: 73	Live	NR	Individu-als	T: NR W: 4 days/week D: 4 days	One time	6 months	NR	No	
	Concur-rent control	Generalists in communities receiving no training on myocardial infarction, n assigned: 40 MDs (4 communities), n analysis: 40 MDs (4 communities)	Live, NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
	Interven-tion	Generalists in communities receiving training on management of myocardial infarction, n assigned: 63 MDs (8 communities), n analysis: 63 MDs (8 communities)	Live	Case-based learning, discussion group, lecture	Individu-als	T: 3.5 W: Once only D: 3.5 hours	One time	6 months		No	
White, 2004[63]	Interven-tion	Small-group problem-based learning (PBL) sessions, n assigned: 23, n analysis: 23	Live	Case-based learning, discussion group	Individu-als	T: 1 W: Once only D: NA	One time	3 months	NR	No	The major objective for both sessions was to provide an update for primary care physicians for the management of asthma in an ambulatory setting.
	Concur-rent control	Didactic lecture sessions, n assigned: 29, n analysis: 29	Live	Case-based learning, discussion group, lecture	Individu-als	T: 1 W: Once only D: NA	One time	3 months	NR	No	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Wilson, 1988[154]	Concur-rent control	Family physicians who received nicotine gum, but no training, n assigned: 27, n analysis: 27	NR	NR	Individu-als	T: NA W: NA D: NA	MDs were told to offer nicotine gum	NA	NA	NA	To teach physicians a smoking cessation counseling protocol involving "simple advice, setting a date for quitting, the offer of nicotine gum with instructions for proper use, a contract for quitting, and the offer of continuing support"
	Concur-rent control	Family physicians who received usual care, n assigned: 25	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NA	NA	
	Interven-tion	Family physicians who received nicotine gum plus training, n assigned: 22	Live	NR	Individu-als	T: 4 hours W: Once only D: NA	One time	1 YEAR	NR	Un-clear	
Winickoff, 1984[23]	Interven-tion	Internists in HMO who received 6 months of monthly feedback on colorectal cancer screening practices compared with colleagues, 1st group to receive intervention, n assigned: 8	Print	Feedback	Practice setting/ teams	T: NR W: NR D: 6 months	Multiple time or repetitive	12 months	NR	Yes	To improve physician performance in colorectal cancer screening
	Interven-tion	Internists in HMO who received 6 months of monthly feedback on colorectal cancer screening practices compared with colleagues, 2nd group to receive intervention, n assigned: 8	Print	Feedback	Practice settings/ teams	T: NR W: NR D: 6 months	Multiple time or repetitive	6 months	NR	Yes	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Worrall, 1999[152]	Concur-rent control	Control participants received a copy of the clinical practice guideline in the mail, n assigned: 20	Print	Readings	Individu-als	T: NA W: NA D: NA	One time	6 months	NR	Un-clear	The objective of our study was to assess whether a workshop on clinical practice guidelines and the provision of follow-up consults with a psychiatrist improved the process of care and outcomes for patients with depression diagnosed by their family physician.
	Interven-tion	Participants who received 3 hour educational intervention and access to a psychiatrist, n assigned: 22	Live	Case-based learning, discussion group, lecture	Individu-als	T: 3 W: Once only D: 3 hours (it was a workshop)	One time	6 months	NR	Un-clear	

Evidence table 3. Description of CME activity

Author, year	Group	Group description, N	Media used	Educational methods	Interven-tion design	Hours in CME activity (T), days/week exposed (W), intervention duration (D)	Amount of exposure	Evaluation duration	Ac-cred-ited	Part of QI or PI pro-ject	Educational goals
Zucker-man, 2004[18]	Concur-rent control	Received only a newsletter, no educational materials, n assigned: 10972	NA	NA	NA	T: NA W: NA D: NA	NA	NA	NR	NA	"The overall goal was to increase the prescribing of beta-blockers to fee-for-service Medicaid patients immediately after a hospitalization for AMI. A secondary project aim was to improve compliance among patients who were prescribed beta-blockers post-AMI, but who were refilling their prescriptions at intervals that suggested poor compliance. The third aim was to evaluate the economic implications of an increase in beta-blocker prescribing."
	Interven-tion	Received "underutilization packages" of educational materials (doctors whose post-AMI patients had not been prescribed a beta-blocker), n assigned: 328	Print	Readings	Individu-als	T: NR W: NA D: 2 weeks	One time	30 days	NR	Un-clear	
	Interven-tion	Received "noncompliant packages" of educational materials (doctors whose post-AMI patients were noncompliant with beta-blocker therapy), n assigned: 157	Print	Readings	Individu-als	T: NR W: NA D: 2 weeks	One time	30 days	NR	Un-clear	

AAN = American Academy of Neurology; ACCESS = Alzheimer's Disease Coordinated Care for San Diego Seniors; ACE = angiotensin-converting enzyme; AHRQ = Agency for Healthcare Research and Quality; AMI = acute myocardial infarction; ARS = audience response system; BSTC = barrier specific telephone counseling; CBE = clinical breast examination; CDE = complete diagnostic evaluation; CDH = chronic daily headache; CHD = coronary heart disease; CME = continuing medical education; DES = diethylstilbestrol; DSM = Diagnostic and Statistic Manual of Mental Disorders; FPs = family practitioner; GIOP = glucocorticoid-induced osteoporosis; GP = general practitioner; HMO = health maintenance organization; IHD = ischemic heart disease; IM = internal medicine; KFP = Key Features Program; LOS = length of stay; MD = medical doctor; MIH = medication induced headache; NA = not applicable; NCEP = National Cholesterol Education Program; NR = not reported; NSAID = non-steroidal anti-inflammatory drugs; OA = osteoarthritis; OSCE = objective structured clinical examination; PBL = problem-based learning; PCP = primary care provider; PHE = physical health examination; PI = practice improvement; QI = quality improvement; SP = standardized patient; TED = teleconferenced education detailing; WAP = written action plan; WBJC = Weekly Browsing Journal Club

Evidence table 4. Quality of studies assessing the effectiveness of continuing medical education

Author, year	Randomized	Randomization scheme described	Blinded evaluation	Blinding described	Withdrawals described	Power analysis described	Sufficient power to detect statistical significance	Total quality score*
Adams, 1998[125]	Yes	No	No	NR	NR	No	No	1
Allison, 2005[147]	Yes	Yes	No	Not described	No	Yes	No	2
Andersen, 1990[36]	Yes	No	NR	NR	No	No	NR	1
Anderson, 1996[103]	Yes	No	NR	NR	Yes	No	NR	2
Beaulieu, 2002[140]	Yes	Inappropriate	Yes	Yes	Yes	Yes	No	3
Beaulieu, 2004[44]	No	NR	No	NR	No	No	NR	0
Bjornson, 1990[14]	Yes	No	NR	Not described	Yes	Yes	No	2
Block, 1988[37]	No	NR	NR	NR	No	No	NR	0
Bloomfield, 2005[68]	Yes	Yes	NR	Not described	Yes	Yes	Yes	3
Brown, 1999[72]	Yes	Inappropriate	NR	NR	NR	Yes	Yes	0
Brown, 2004[135]	Yes	Yes	No	NR	No	No	NR	2
Browner, 1994[122]	Yes	Yes	No	NR	No	Yes	Yes	2
Bunting, 2004[123]	No	NR	NR	NR	No	No	NR	0
Carney, 1995[88]	Yes	No	Yes	Yes	Yes	Yes	Yes	4
Casebeer, 1999[131]	Yes	No	NR	NR	No	No		1
Chan, 1999[21]	Yes	No	NR	Not described	Yes	Yes	Yes	2
Chassin, 1986[106]	Yes	Inappropriate	NR	NR	No	No	NR	0
Cherkin, 1991[83]	No	NR	No	NR	No	No	NR	0
Chodosh, 2006[62]	Yes	No	No	NR	No	No	NR	1

Evidence table 4. Quality of studies assessing the effectiveness of continuing medical education

Author, year	Randomized	Randomization scheme described	Blinded evaluation	Blinding described	Withdrawals described	Power analysis described	Sufficient power to detect statistical significance	Total quality score*
Chung, 2004[54]	Yes	Yes	No	NR	No	Yes	No	2
Clark, 1998[120]	Yes	No	NR	NR	No	No	NR	1
Clark, 2000[78]	Yes	No	NR	NR	Yes	Yes	Yes	2
Cohn, 2002[19]	No	NR	NR	NR	No	No	No	0
Costanza, 1992[35]	No	NR	No	NR	No	Yes	Yes	0
Cummings, 1989[112]	Yes	Yes	Yes	Yes	Yes	No	NR	5
Cummings, 1989[113]	Yes	Yes	Yes	Yes	No	No	NR	4
Cummings, 1989[117]	Yes	Yes	Yes	Yes	No	No	No	4
Curran, 2000[34]	Yes	Yes	NR	NR	No	No	NR	2
Davis, 2004[101]	No	NR	No	NR	No	No	NR	0
Derebery, 2002[153]	No	NR	NR	NR	No	No	No	0
Des Marchais, 1990[61]	Yes	No	NR	NR	No	No	No	1
Dietrich, 2000[110]	Yes	Inappropriate	No	NR	No	No	NR	0
Dormuth, 2004[15]	Yes	Yes	Yes	Not described	No	No	NR	3
Doucet, 1998[40]	No	NR	NR	NR	No	No	NR	0
Elliott, 1997[55]	Yes	No	NR	NR	No	No		1
Evans CE, 1986[56]	Yes	Yes	Yes	Inappropriate	Yes	Yes	Yes	3
Fordis, 2005[42]	Yes	Yes	NR	NR	Yes	Yes	Yes	3
Frush, 2006[87]	Yes	No	NR	NR	No	No	NR	1
Gerbert, 2002[86]	Yes	No	NR	NR	No	No	NR	1
Gerrity, 1999[32]	Yes	Yes	Yes	Yes	Yes	No	NR	5

Evidence table 4. Quality of studies assessing the effectiveness of continuing medical education

Author, year	Randomized	Randomization scheme described	Blinded evaluation	Blinding described	Withdrawals described	Power analysis described	Sufficient power to detect statistical significance	Total quality score*
Gerstein, 1999[53]	No	NR	NR	NR	No	Yes	No	0
Gifford, 1996[46]	Yes	Yes	NR	NR	Yes	Yes	Yes	3
Gifford, 1999[142]	Yes	Yes	Yes	Not described	Yes	Yes	Yes	4
Goldberg, 2001[93]	Yes	No	NR	NR	No	Yes	Yes	1
Goldstein, 2005[146]	Yes	Yes	NR	Not described	Yes	No	NR	3
Goldwater, 2001[157]	No	NR	NR	NR	No	No	NR	0
Gonzales, 1999[111]	No	No	NR	Not described	No	No	NR	0
Grady, 1997[79]	Yes	Yes	NR	NR	Yes	No	NR	3
Greenberg, 1985[25]	No		Yes	Yes	No	No	NR	2
Gullion, 1988[132]	Yes	No	Yes	Not described	Yes	No	NR	3
Hagen, 2005[126]	NR	No	NR	Not described	No	No	NR	0
Harris, 2002[39]	Yes	No	NR	NR	No	No	NR	1
Harris, 2005[75]	Yes	Yes	NR	Not described	No	No	NR	2
Heale, 1988[66]	Yes	Yes	NR	NR	No	No	NR	2
Herbert, 2004[102]	Yes	Yes	Yes	Yes	Yes	No	NR	5
Hergenroeder, 2002[60]	Yes	Yes	Yes	Inappropriate	No	No	NR	2
Howe, 1997[145]	No	NR	NR	NR	No	No	NR	0
Jennett, 1988[76]	Yes	Yes	Yes	Yes	Yes	No	NR	5
Juzych, 2005[92]	No	No	No	Not described	No	No	NR	0
Kemper, 2006[58]	Yes	Yes	No	NR	No	No	NR	2

Evidence table 4. Quality of studies assessing the effectiveness of continuing medical education

Author, year	Randomized	Randomization scheme described	Blinded evaluation	Blinding described	Withdrawals described	Power analysis described	Sufficient power to detect statistical significance	Total quality score*
Kiang, 2005[33]	No	No	NR	Not described	No	Yes	Yes	0
Kim, 1999[137]	Yes	No	NR	NR	Yes	No	NR	2
Kottke, 1989[114]	Yes	Yes	NR	NR	No	Yes	No	2
Kronick, 2003[71]	Yes	No	NR	NR	No	Yes	Yes	1
Kutcher, 2002[65]	No	NR	NR	Not described	No	No	NR	0
Labelle, 2004[67]	No	NR	No	NR	No	No	NR	0
Lane, 1991[69]	No	NR	NR	NR	No	Yes	Yes	0
Lane, 2001[45]	No	NR	NR	NR	Yes	No	NR	1
Leopold, 2005[80]	Yes	No	No	Not described	No	No	NR	1
Levinson, 1993[138]	Yes	No	Yes	Yes	Yes	Yes	Yes	4
Lewis, 1993[70]	No	NR	No	NR	No	No	NR	0
Lin, 1997[73]	No	NR	No	NR	No	No	NR	0
Lin, 2001[133]	Yes	Yes	NR	NR	No	No	NR	2
Lindsay-McIntyre, 1987[115]	Yes	No	No	NR	Yes	No	NR	2
Lockyer, 2002[64]	No	NR	NR	NR	No	No	NR	0
Maclure, 1998[96]	Yes	Inappropriate	NR	NR	No	No	NR	0
Macrae, 2004[85]	Yes	No	Yes	Yes	Yes	Yes	Yes	4
Maiman, 1988[47]	Yes	Yes	Yes	Yes	Yes	No	NR	5
Mann, 1997[52]	Yes	No	NR	NR	No	No	NR	1
Margolis, 2004[118]	Yes	Yes	NR	Not described	No	Yes	Yes	2

Evidence table 4. Quality of studies assessing the effectiveness of continuing medical education

Author, year	Randomized	Randomization scheme described	Blinded evaluation	Blinding described	Withdrawals described	Power analysis described	Sufficient power to detect statistical significance	Total quality score*
Maxwell, 1984[57]	No	NR	Yes	Yes	No	No	NR	2
Mazmanian, 1998[24]	Yes	No	NR	NR	No	No	NR	1
Mazmanian, 2001[161]	Yes	Yes	Yes	Yes	No	No	NR	4
McBride, 2000[144]	Yes	No	No	NR	No	Yes	No	1
McClellan, 2003[119]	Yes	Yes	NR	NR	No	Yes	Yes	2
McMahon, 1988[155]	No	NR	NR	NR	No	No	NR	0
Mehler, 2005[99]	Yes	Yes	No	NR	No	No	NR	2
Meredith, 2000[51]	Yes	Yes	No	NR	No	No	NR	2
Messina, 2002[156]	No	NR	NR	NR	No	No	NR	0
Moran, 1996[121]	No	NR	No	NR	No	No	NR	0
Mukohara, 2005[13]	Yes	Yes	NR	Not described	No	Yes	Yes	2
Myers, 2004[148]	Yes	No	No	NR	No	Yes	No	1
Norris, 2000[81]	Yes	Yes	NR	NR	No	Yes	No	2
Ockene, 1996[124]	Yes	Inappropriate	NR	NR	No	No	NR	0
Ozer, 2005[104]	No	No	NR	Not described	Yes	No	NR	1
Pazirandeh, 2002[128]	No	NR	No	NR	No	No	NR	0
Pereles, 1996[163]	Yes	No	NR	NR	No	No	NR	1
Perera, 1983[107]	Yes	No	NR	NR	Yes	No	NR	2
Pimlott, 2003[143]	Yes	Yes	NR	NR	No	No	NR	2

Evidence table 4. Quality of studies assessing the effectiveness of continuing medical education

Author, year	Randomized	Randomization scheme described	Blinded evaluation	Blinding described	Withdrawals described	Power analysis described	Sufficient power to detect statistical significance	Total quality score*
Pinto, 1998[74]	Yes	Yes	No	NR	No	No	No	2
Premi J, 1993[38]	Yes	No	NR	NR	No	No	No	1
Premi, 1994[41]	No	NR	NR	NR	No	No	NR	0
Rabin, 1998[97]	Yes	No	Yes	Not described	No	No	NR	2
Rahme, 2005[100]	Yes	Yes	NR	NR	No	No	NR	2
Ray, 1985[20]	No	NR	NR	NR	No	No	NR	0
Ray, 2001[109]	Yes	Yes	NR	NR	Yes	No	NR	3
Rodney, 1986[77]	No	NR	No	NR	No	No	NR	0
Rosenthal, 2005[59]	Yes	Yes	No	Not described	No	Yes	Yes	2
Rost, 2001[22]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	5
Roter, 1995[84]	Yes	No	NR	NR	Yes	Yes	Yes	2
Schectman, 1991[139]	No	NR	No	NR	No	No	NR	0
Schectman, 1995[130]	Yes	No	Yes	Yes	No	Yes	Yes	3
Schectman, 1996[16]	No	NR	No	NR	No	No	NR	0
Schectman, 2003[108]	Yes	Yes	NR	NR	No	Yes	Yes	2
Schroy, 1999[82]	No	NR	NR	NR	Yes	Yes	Yes	1
Schwartzberg, 1997[98]	No	NR	NR	NR	Yes	No	NR	1
Sharif, 2002[94]	No	NR	NR	NR	No	No	NR	0
Short, 2006[50]	Yes	Yes	No	NR	Yes	Yes	No	3
Sibley, 1982[136]	Yes	Yes	Yes	Yes	No	Yes	Yes	4
Slotnick, 1993[17]	No	NR	NR	NR	No	Yes	Yes	0

Evidence table 4. Quality of studies assessing the effectiveness of continuing medical education

Author, year	Randomized	Randomization scheme described	Blinded evaluation	Blinding described	Withdrawals described	Power analysis described	Sufficient power to detect statistical significance	Total quality score*
Socolar, 1998[134]	Yes	Inappropriate	NR	NR	Yes	Yes	Yes	1
Solomon, 2004[127]	Yes	No	NR	NR	No	Yes	No	1
Soumerai, 1987[105]	Yes	Yes	NR	Not described	No	No	NR	2
Stein, 2001[95]	Yes	Yes	Yes	Yes	No	No	NR	4
Stewart, 2005[43]	Yes	Yes	NR	NR	NR	Yes	Yes	2
Stross, 1985[116]	Yes	No	NR	Not described	No	No	NR	1
Terry, 1981[49]	Yes	Yes	Yes	Yes	No	No	NR	4
Thom, 2000[129]	No	NR	Yes	Not described	No	No	NR	1
Tziraki, 2000[141]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	5
Wells, 2000[151]	Yes	Yes	NR	NR	Yes	Yes	Yes	3
White, 1985[48]	Yes	Yes	Yes	Yes	No	No	NR	4
White, 2004[63]	Yes	Yes	Yes	NR	No	No	NR	3
Wilson, 1988[154]	Yes	Yes	Yes	Yes	Yes	Yes	No	5
Winickoff, 1984[23]	Yes	No	NR	NR	NR	Yes	Yes	1
Worrall, 1999[152]	Yes	Yes	NR	Not described	No	Yes	Yes	2
Zuckerman, 2004[18]	No	NR	NR	Not described	No	No	NR	0

*Total quality score was calculated using the Jadad[8] criteria: 1) appropriateness of the randomization scheme, 2) appropriateness of the blinding, and 3) description of withdrawals and drop-outs.
NR = not reported

Evidence table 5. Quality of systematic reviews evaluating the effectiveness of simulation in medical education

Author, year	Question clearly stated	Search methods described/ compre-hensive	Inclusion criteria reported/ appropriate	Study quality Assessed/ appropriate	Method-ology repro-ducible	Discuss differences in study design or population	Results combined appropriately	Conclusions supported by data	Tests for publication bias
Psychomotor skills									
Haque, 2006[26]	Yes	Partially/ yes	Yes/ yes	No/ can't tell	Can't tell	Yes	Yes	Yes	No
Aucar, 2005[29]	Partially	Yes/ partially	No/ can't tell	No/ can't tell	Can't tell	Partially	Can't tell	Yes	No
Gerson, 2004[30]	Partially	Yes/ partially	No/ can't tell	Yes/ yes	Can't tell	Yes	Can't tell	Yes	No
Sutherland, 2006[31]	Yes	Yes/ partially	Yes/ yes	Yes/ partially	Can't tell	Yes	Can't tell	Yes	No
Ravert, 2002[159]	Yes	Partially/ partially	Yes/ yes	No/ can't tell	Can't tell	No	Can't tell	Yes	No
Gaffan, 2006[158]	Partially	Yes/ partially	Yes/ yes	No/ can't tell	Can't tell	No	Can't tell	Yes	No
Communication skills									
Gaffan, 2006[158]	Partially	Yes/ partially	Yes/ yes	No/ can't tell	Can't tell	No	Can't tell	Yes	No
Spangler, 2002[160]	Yes	Yes/ partially	Yes/ yes	No/ can't tell	Can't tell	No	Can't tell	Yes	No
Cognitive skills									
Hmelo, 1990[28]	Partially	Yes/ yes	Partially/ partially	No/ can't tell	Can't tell	No	Yes	Partially	No
Gaffan, 2006[158]	Partially	Yes/ partially	Yes/ yes	No/ can't tell	Can't tell	No	Can't tell	Yes	No
Other									
Issenberg, 2005[27]	Yes	Yes/ yes	Yes/ yes	Yes/ yes	Yes	Yes	Yes	Yes	No

Evidence table 6. Reporting of adult learning principles in studies assessing the effectiveness of continuing medical education

Author, year	Enables learners to be active contributors to their learning*	Relate to learners' current work or life experience†	Tailored to learners' current or past experiences‡	Allow learners to identify their own learning goals and direct their education§	Allow learners to practice what they learn‖	Provide support to self-directed learners¶	Receive feedback from teachers and/or peers during active learning#	Allow learners to reflect on learning**	Learners observe the faculty role-model behaviors††
Adams, 1998[125]	Poor	Good	Fair	Poor	Poor	Poor	Fair	Good	Poor
Allison, 2005[147]	Fair	Good	Fair	Poor	Poor	Poor	Poor	Poor	Poor
Andersen, 1990[36]	Poor	Good	Poor	Poor	Poor	Poor	Poor	Poor	Poor
Anderson, 1996[103]	Fair	Good	Fair	Poor	Fair	Poor	Poor	Fair	Poor
Beaulieu, 2002[140]	Fair	Good	Poor	Poor	Fair	Poor	Poor	Poor	Poor
Beaulieu, 2004[44]	Fair	Good	Good	Poor	Poor	Fair	Fair	Poor	Poor
Bjornson, 1990[14]	Poor	Good	Poor	Poor	Poor	Poor	Poor	Fair	Poor
Block, 1988[37]	Poor	Good	Poor	Poor		Poor	Poor	Poor	Poor
Bloomfield, 2005[68]	Fair	Good	Fair	Poor	Poor	Fair	Poor	Poor	Poor
Brown, 1999[72]	Fair	Good	Poor	Poor	Fair	Good	Poor	Good	Poor
Brown, 2004[135]	Fair	Good	Fair	Fair	Poor	Fair	Fair	Poor	Poor
Browner, 1994[122]	Poor	Fair	Poor	Poor	Poor	Poor	Poor	Poor	Poor
Bunting, 2004[123]	Poor	Good	Poor	Poor	Good	Fair	Good	Poor	Poor
Carney, 1995[88]	Fair	Fair	Poor	Poor	Fair	Poor	Poor	Poor	Poor
Casebeer, 1999[131]	Good	Good	Good	Good	Good	Fair	Poor	Poor	Poor
Chan, 1999[21]	Good	Good	Good	Good	Good	Good	Fair	Fair	Poor
Chassin, 1986[106]	Poor	Good	Poor	Poor	Poor	Poor	Fair	Poor	Poor
Cherkin, 1991[83]	Fair	Good	Fair	Poor	Poor	Poor	Poor	Fair	Fair
Chodosh, 2006[62]	Poor	Good	Poor	Poor	Poor	Poor	Poor	Poor	Poor
Chung, 2004[54]	Poor	Fair	Poor	Poor	Poor	Fair	Poor	Poor	Poor

Evidence table 6. Reporting of adult learning principles in studies assessing the effectiveness of continuing medical education

Author, year	Enables learners to be active contributors to their learning*	Relate to learners' current work or life experience[†]	Tailored to learners' current or past experiences[‡]	Allow learners to identify their own learning goals and direct their education[§]	Allow learners to practice what they learn[‖]	Provide support to self-directed learners[¶]	Receive feedback from teachers and/or peers during active learning[#]	Allow learners to reflect on learning**	Learners observe the faculty role-model behaviors[††]
Clark, 1998[120]	Fair	Good	Fair	Poor	Poor	Poor	Poor	Fair	Fair
Clark, 2000[78]	Good	Good	Fair	Fair	Fair	Fair	Fair	Poor	Poor
Cohn, 2002[19]	Poor	Fair	Poor	Poor	Good	Fair	Poor	Poor	Poor
Costanza, 1992[35]	Poor	Fair	Poor	Poor	Fair	Poor	Poor	Poor	Poor
Cummings, 1989[112]	Fair	Good	Good	Fair	Good	Poor	Fair	Fair	Good
Cummings, 1989[113]	Fair	Good	Fair	Fair	Good	Poor	Fair	Fair	Fair
Cummings, 1989[117]	Fair	Good	Poor	Poor	Fair	Poor	Poor	Good	Fair
Curran, 2000[34]	Good	Good	Good	Fair	Poor	Good	Good	Good	Poor
Davis, 2004[101]	Fair	Good	Fair	Poor	Poor	Poor	Fair	Poor	Poor
Derebery, 2002[153]	Good	Good	Fair	Poor	Fair	Poor	Fair	Fair	Fair
Des Marchais, 1990[61]	Fair	Good	Poor	Poor	Fair	Poor	Fair	Good	Poor
Dietrich, 2000[110]	Poor	Good	Poor	Poor	Fair	Fair	Poor	Poor	Poor
Dormuth, 2004[15]	Poor	Good	Poor	Poor	Poor	Fair	Poor	Poor	Poor
Doucet, 1998[40]	Fair	Good	Good	Poor	Fair	Poor	Poor	Fair	Poor
Elliott, 1997[55]	Poor	Poor	Fair	Poor	Poor	Poor	Poor	Poor	Poor
Evans CE, 1986[56]	Poor	Good	Poor	Poor	Poor	Fair	Poor	Poor	Poor
Fordis, 2005[42]	Fair	Good	Poor	Poor	Poor	Fair	Fair	Poor	Poor
Frush, 2006[87]	Poor	Good	Fair	Poor	Fair	Poor	Poor	Poor	Poor
Gerbert, 2002[86]	Fair	Fair	Poor	Poor	Poor	Poor	Fair	Poor	Poor
Gerrity, 1999[32]	Good	Good	Good	Good	Good	Good	Good	Good	Good
Gerstein, 1999[53]	Poor	Good	Poor	Poor	Poor	Poor	Poor	Poor	Poor

Evidence table 6. Reporting of adult learning principles in studies assessing the effectiveness of continuing medical education

Author, year	Enables learners to be active contributors to their learning*	Relate to learners' current work or life experience†	Tailored to learners' current or past experiences‡	Allow learners to identify their own learning goals and direct their education§	Allow learners to practice what they learn‖	Provide support to self-directed learners¶	Receive feedback from teachers and/or peers during active learning#	Allow learners to reflect on learning**	Learners observe the faculty role-model behaviors††
Gifford, 1996[46]	Poor	Good	Poor	Poor	Poor	Good	Poor	Poor	Poor
Gifford, 1999[142]	Poor	Good	Poor	Poor	Poor	Poor	Poor	Poor	Poor
Goldberg, 2001[93]	Good	Good	Poor	Fair	Fair	Fair	Poor	Good	Poor
Goldstein, 2005[146]	Fair	Good	Good	Poor	Poor	Poor	Poor	Poor	Poor
Goldwater, 2001[157]	Poor	Good	Poor	Poor	Good	Poor	Poor	Poor	Poor
Gonzales, 1999[111]	Poor	Good	Fair	Poor	Poor	Poor	Poor	Poor	Poor
Grady, 1997[79]	Poor	Fair	Fair	Poor	Poor	Poor	Good	Poor	Poor
Greenberg, 1985[25]	Fair	Good	Fair	Poor	Poor	Poor	Poor	Poor	Poor
Gullion, 1988[132]	Fair	Good	Good	Poor	Poor	Poor	Fair	Poor	Poor
Hagen, 2005[126]	Poor	Good	Fair	Poor	Poor	Fair	Poor	Poor	Poor
Harris, 2002[39]	Poor	Good	Poor	Poor	Poor	Fair	Poor	Poor	Poor
Harris, 2005[75]	Fair	Good	Fair		Poor	Fair	Poor	Poor	Poor
Heale, 1988[66]	Good	Good	Fair	Poor	Poor	Poor	Poor	Poor	Poor
Herbert, 2004[102]	Good	Good	Fair	Poor	Poor	Fair	Fair	Poor	Poor
Hergenroeder, 2002[60]	Poor	Fair	Poor	Poor	Good	Good	Poor	Poor	Fair
Howe, 1997[145]	Poor	Fair	Poor	Poor	Poor	Poor	Good	Poor	Poor
Jennett, 1988[76]	Fair	Good	Good	Fair	Good	Poor	Good	Fair	Poor
Juzych, 2005[92]	Poor	Good	Fair	Poor	Poor	Fair	Poor	Poor	Poor
Kemper, 2006[58]	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Poor	Poor
Kiang, 2005[33]	Poor	Good	Fair	Poor	Poor	Poor	Poor	Poor	Poor
Kim, 1999[137]	Poor	Good	Poor	Poor	Good	Poor	Good	Fair	Poor

Evidence table 6. Reporting of adult learning principles in studies assessing the effectiveness of continuing medical education

Author, year	Enables learners to be active contributors to their learning*	Relate to learners' current work or life experience†	Tailored to learners' current or past experiences‡	Allow learners to identify their own learning goals and direct their education§	Allow learners to practice what they learn‖	Provide support to self-directed learners¶	Receive feedback from teachers and/or peers during active learning#	Allow learners to reflect on learning**	Learners observe the faculty role-model behaviors††
Kottke, 1989[114]	Fair	Good	Poor	Poor	Fair	Poor	Poor	Fair	Poor
Kronick, 2003[71]	Good	Good	Fair	Good	Poor	Good	Poor	Poor	Poor
Kutcher, 2002[65]	Fair	Good	Poor	Poor	Poor	Poor	Fair	Fair	Poor
Labelle, 2004[67]	Fair	Good	Poor	Poor	Fair	Poor	Good	Poor	Poor
Lane, 1991[69]	Fair	Fair	Poor	Poor	Fair	Poor	Poor	Poor	Poor
Lane, 2001[45]	Poor	Good	Fair	Poor	Good	Good	Good	Good	Poor
Leopold, 2005[80]	Fair	Good	Fair	Poor	Fair	Fair	Fair	Poor	Fair
Levinson, 1993[138]	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor
Lewis, 1993[70]	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor
Lin, 1997[73]	Poor	Good	Fair	Poor	Fair	Poor	Good	Poor	Good
Lin, 2001[133]	Good	Fair	Fair	Poor	Fair	Good	Fair	Fair	Fair
Lindsay-McIntyre, 1987[115]	Poor	Good	Poor	Poor	Fair	Poor	Poor	Poor	Fair
Lockyer, 2002[64]	Fair	Good	Fair	Poor	Fair	Poor	Poor	Poor	Poor
Maclure, 1998[96]	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor
Macrae, 2004[85]	Fair	Good	Poor	Poor	Poor	Poor	Poor	Poor	Poor
Maiman, 1988[47]	Fair	Good	Poor	Poor	Poor	Poor	Poor	Poor	Poor
Mann, 1997[52]	Fair	Good	Poor	Poor	Poor	Fair	Poor	Poor	Fair
Margolis, 2004[118]	Fair	Good	Fair	Poor	Poor	Poor	Fair	Poor	Poor
Maxwell, 1984[57]	Fair	Poor	Poor	Fair	Poor	Poor	Fair	Poor	Poor
Mazmanian, 1998[24]	Poor	Poor	Good	Poor	Poor	Poor	Poor	Poor	Poor

Evidence table 6. Reporting of adult learning principles in studies assessing the effectiveness of continuing medical education

Author, year	Enables learners to be active contributors to their learning*	Relate to learners' current work or life experience†	Tailored to learners' current or past experiences‡	Allow learners to identify their own learning goals and direct their education§	Allow learners to practice what they learn‖	Provide support to self-directed learners¶	Receive feedback from teachers and/or peers during active learning#	Allow learners to reflect on learning**	Learners observe the faculty role-model behaviors††
Mazmanian, 2001[161]	Fair	Poor	Fair	Poor	Poor	Poor	Fair	Poor	Poor
McBride, 2000[144]	Good	Good	Poor	Good	Fair	Good	Poor	Poor	Poor
McClellan, 2003[119]	Poor	Good	Fair	Poor	Poor	Poor	Fair	Poor	Poor
McMahon, 1988[155]	Poor	Fair	Poor	Poor	Poor	Poor	Good	Fair	Poor
Mehler, 2005[99]	Fair	Good	Fair	Poor	Poor	Poor	Poor	Poor	Poor
Meredith, 2000[51]	Poor	Good	Poor	Fair	Poor	Poor	Poor	Poor	Poor
Messina, 2002[156]	Fair	Good	Fair	Poor	Poor	Fair	Poor	Fair	Poor
Moran, 1996[121]	Good	Good	Good	Good	Poor	Good	Fair	Good	Poor
Mukohara, 2005[13]	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Poor	Poor
Myers, 2004[148]	Poor	Good	Fair	Poor	Poor	Good	Fair	Fair	Poor
Norris, 2000[81]	Poor	Good	Poor	Poor	Poor	Fair	Poor	Poor	Poor
Ockene, 1996[124]	Poor	Good	Fair	Poor	Fair	Poor	Fair	Poor	Poor
Ozer, 2005[104]	Fair	Good	Fair	Poor	Poor	Poor	Poor	Poor	Poor
Pazirandeh, 2002[128]	Poor	Good	Poor	Fair	Poor	Poor	Poor	Poor	Poor
Pereles, 1996[163]	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor
Perera, 1983[107]	Poor	Good	Good	Poor	Fair	Poor	Fair	Poor	Fair
Pimlott, 2003[143]	Poor	Good	Fair	Poor	Poor	Poor	Good	Poor	Poor
Pinto, 1998[74]	Good	Good	Poor	Poor	Fair	Fair	Fair	Poor	Poor
Premi J, 1993[38]	Poor	Fair	Poor	Poor	Poor	Poor	Poor	Poor	Fair
Premi, 1994[41]	Good	Good	Fair	Good	Fair	Good	Fair	Fair	Poor

Evidence table 6. Reporting of adult learning principles in studies assessing the effectiveness of continuing medical education

Author, year	Enables learners to be active contributors to their learning*	Relate to learners' current work or life experience†	Tailored to learners' current or past experiences‡	Allow learners to identify their own learning goals and direct their education§	Allow learners to practice what they learn‖	Provide support to self-directed learners¶	Receive feedback from teachers and/or peers during active learning#	Allow learners to reflect on learning**	Learners observe the faculty role-model behaviors††
Rabin, 1998[97]	Poor	Good	Fair	Poor	Poor	Poor	Fair	Poor	Poor
Rahme, 2005[100]	Fair	Good	Fair	Poor	Poor	Poor	Poor	Poor	Poor
Ray, 1985[20]	Fair	Good	Good	Poor	Poor	Poor	Poor	Poor	Poor
Ray, 2001[109]	Poor	Good	Fair	Poor	Good	Fair	Fair	Fair	Poor
Rodney, 1986[77]	Poor	Good	Poor	Poor	Fair	Fair	Fair	Poor	Fair
Rosenthal, 2005[59]	Poor	Good	Fair	Poor	Poor	Poor	Poor	Poor	Poor
Rost, 2001[22]	Fair	Good	Poor	Poor	Poor	Poor	Fair	Poor	Poor
Roter, 1995[84]	Poor	Fair	Poor	Poor	Good	Poor	Fair	Poor	Poor
Schectman, 1991[139]	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor
Schectman, 1995[130]	Poor	Poor	Poor	Poor	Poor	Poor	Fair	Poor	Poor
Schectman, 1996[16]	Poor	Good	Poor	Poor	Poor	Poor	Poor	Poor	Poor
Schectman, 2003[108]	Fair	Fair	Poor	Poor	Poor	Poor	Good	Poor	Poor
Schroy, 1999[82]	Fair	Good	Fair	Poor	Fair	Poor	Poor	Fair	Poor
Schwartzberg, 1997[98]	Poor	Fair	Fair	Poor	Poor	Fair	Poor	Poor	Poor
Sharif, 2002[94]	Fair	Good	Poor	Poor	Fair	Poor	Poor	Poor	Poor
Short, 2006[50]	Good	Good	Fair	Fair	Poor	Fair	Poor	Poor	Poor
Sibley, 1982[136]	Fair	Good	Fair	Fair	Poor	Fair	Fair	Poor	Poor
Slotnick, 1993[17]	Poor	Fair	Fair	Poor	Poor	Poor	Poor	Poor	Poor
Socolar, 1998[134]	Poor	Poor	Fair	Poor	Poor	Poor	Poor	Poor	Poor
Solomon, 2004[127]	Fair	Good	Fair	Poor	Good	Fair	Poor	Fair	Poor
Soumerai, 1987[105]	Fair	Good	Fair	Poor	Poor	Poor	Poor	Fair	Poor

Evidence table 6. Reporting of adult learning principles in studies assessing the effectiveness of continuing medical education

Author, year	Enables learners to be active contributors to their learning*	Relate to learners' current work or life experience[†]	Tailored to learners' current or past experiences[‡]	Allow learners to identify their own learning goals and direct their education[§]	Allow learners to practice what they learn[‖]	Provide support to self-directed learners[¶]	Receive feedback from teachers and/or peers during active learning[#]	Allow learners to reflect on learning**	Learners observe the faculty role-model behaviors[††]
Stein, 2001[95]	Poor	Good	Poor	Poor	Poor	Fair	Poor	Poor	Poor
Stewart, 2005[43]	Fair	Good	Fair	Poor	Poor	Poor	Poor	Poor	Poor
Stross, 1985[116]	Fair	Good	Good	Poor	Poor	Good	Good	Fair	Poor
Terry, 1981[49]	Good	Good	Fair	Poor	Poor	Fair	Fair	Poor	Poor
Thom, 2000[129]	Poor	Fair	Poor	Poor	Poor	Poor	Poor	Poor	Poor
Tziraki, 2000[141]	Good	Good	Good	Good	Fair	Fair	Poor	Poor	Fair
Wells, 2000[151]	Poor	Fair	Poor	Poor	Poor	Poor	Poor	Poor	Poor
White, 1985[48]	Fair	Good	Fair	Poor	Poor	Poor	Poor	Poor	Poor
White, 2004[63]	Fair	Good	Fair	Poor	Poor	Poor	Poor	Poor	Poor
Wilson, 1988[154]	Poor	Good	Poor	Poor	Poor	Poor	Poor	Poor	Poor
Winickoff, 1984[23]	Poor	Good	Fair	Poor	Poor	Poor	Fair	Poor	Poor
Worrall, 1999[152]	Fair	Good	Fair	Fair	Fair	Good	Poor	Poor	Poor
Zuckerman, 2004[18]	Poor	Good	Fair	Poor	Poor	Poor	Poor	Poor	Poor

* Ratings of "good" indicate that two or more of the following were reported: learners identify/choose a question OR actively contribute to finding the answer OR teach the results of their learning to others. Ratings of "fair" indicate that only one of the above were reported OR none of the above were reported but the curriculum employed partially active learning methods such a interactive lectures or group discussions. Ratings of "poor" indicate that none of the above are described.

[†]Ratings of "good" indicate that learners would recognize the curriculum as having practical or immediate value to their work or lives. Ratings of "fair" indicate that learners would recognize the curriculum as having theoretical or future value to their work or lives. Ratings of "poor" indicate that learning addresses an issue that the learners do not recognize as having value to their work or lives OR the curriculum's relevance to the learners is not clear.

[‡]Ratings of "good" indicate that the authors describe a needs assessment AND describe how the curriculum is tailored towards the needs of the learners. Ratings of "fair" indicate that the authors describe only one of the above. Ratings of "poor" indicate that the authors neither describe a needs assessment nor do they describe how the curriculum is tailored towards the needs of learners.

[§]Ratings of "good" indicate that learners received complete freedom to pursue independent studies or projects during part or all of the curriculum. Ratings of "fair" indicate that learners may choose from a range of learning methods or projects, but the range is limited. Ratings of "poor" indicate that the learners are limited to a single curriculum plan or it is not described.

Evidence table 6. Reporting of adult learning principles in studies assessing the effectiveness of continuing medical education

‖Ratings of "good" indicate that the learners engage in applied or simulated activities during at least 50% of curriculum time. Ratings of "fair" indicate learners engage in applied or simulated activities <50% of curriculum time. Ratings of "poor" indicate that the curriculum does not provide opportunities for practicing knowledge or skills or it is not described.
¶Ratings of "good" indicate that the curriculum specifically allots faculty time/resources for supporting learners during independent learning projects. Ratings of "fair" indicate that the curriculum provides only self-learning materials (e.g., online library or bulletin boards) or faculty are available for but not dedicated to supporting self-directed learning. Ratings of "poor" indicate that the curriculum provides none of the above or it is not described.
#Ratings of "good" indicate that the curriculum includes mechanisms for providing formative (feedback that is intended to help learners adjust their learning or activities prior to completion of the curriculum) AND summative (feedback intended to inform learners of their progress upon completion of the curriculum) feedback to learners. Ratings of "fair" indicate that the curriculum only includes mechanisms for providing one of the above. Ratings of "poor" indicate that feedback to learners is not provided or is not described.
**Ratings of "good" indicate that the curriculum describes mechanisms that are specifically intended to help learners reflect on their learning. These may include structured reflection time and debriefing meetings or presentations that are intended for self-reflection. Ratings of "fair" indicate that the curriculum describes learning sessions, such as debriefing meetings or summary presentations, which are not specifically intended for reflection on learning but are likely to involve some reflection by learners. Ratings of "poor" indicate opportunities for self-reflection are not included in the curriculum or are not described.
††Ratings of "good" indicate that the learners observe role models actually practicing goal behavior in clinical settings. Ratings of "fair" indicate learners observe role models in simulated settings. Ratings of "poor" indicate role modeling is not used or is not described.

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Knowledge Objectives Met, Evaluation Duration Not Reported									
Kiang, 2005[33]	Int: NA CC: NA Int: many things were made available but it is not reported as to which groups used what methods; options included live, regional meetings, CD-ROMs, mailings, grandrounds CC: NA	Int: NA CC: NA Int: not clear CC: NA	Int: NA CC: NA Int: not clear CC: not clear	Responses to questions about non-predictive clinical factors and social factors	Knowl-edge Cognitive skills	Yes Yes	In Wisconsin, significant improvement occurred in the responses to the 2 questions about nonpredictive clinical factors and the social factor that may increase the likelihood of prescribing antimicrobial agents. Overall, Wisconsin clinicians demonstrated significant improvement regarding the influence of purulent nasal discharge (p=0.044) and productive cough (p=0.010) after accounting for temporal changes in Minnesota.	In conclusion, this study suggests that the WARN campaign had at least a modest positive effect on the knowledge and decision-making of primary care clinicians in Wisconsin.	Int: NA CC: NA Int: NR CC: NA

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Curran, 2000[34]	Int: Computer-based off-line, Internet, not real time CC: NA Int: Computer-based off-line, Internet, not real time	Int: Case-based learning, Programmed learning, computer-based courseware CC: NA Int: Case-based learning, Programmed learning, computer-based courseware	Int: Multiple time or repetitive CC: NA Int: One time	Physician learning achievement	Knowledge	Yes	These results indicate that those physicians who participated in a computer-mediated instructional courseware program performed significantly better on a cognitive test of dermatologic office procedures than physicians who received no CME. A significant difference was also found between the mean ranked scores of experimental study group I and the control group (p=.000). A Mann-Whitney test of the mean ranked scores of experimental study group II and the control group also revealed a significant difference (p=.000).	This evaluation revealed that a hybrid computer-mediated courseware system was an effective means for increasing knowledge and improving self-reported competency in dermatologic office procedures, and that participants were very satisfied with the self-paced instruction and use of asynchronous computer conferencing for collaborative information sharing among colleagues.	Int: NR CC: NA Int: NR
Costanza, 1992[35]	Int: Live, Print CC: NA	Int: Discussion group, Lecture, Point of care, Simulation (other than standardized patient or role-play) CC: NA	Int: Multiple time or repetitive CC: NA	Physician knowledge and attitudes toward breast cancer screening	Knowledge Attitudes	Yes	Two barriers to use of mammography, concern that mammography is not cost-effective and concern about interpreting ambiguous reports, affected physicians less in the intervention group than in the control.	This study demonstrates that primary care physicians will change their screening practice in response to interventions aimed at altering beliefs regarding mammography benefits or to barriers and their sense of consensus development.	Int: NR CC: NA

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Andersen, 1990[36]	Int: Live, Video CC: NA	Int: Case-based learning, Lecture CC: NA	Int: One time CC: NA	Physicians' diagnostic accuracy for psychiatric conditions, as measured by pre and post-tests incorporating multiple clinical vignettes	Knowledge Cognitive skills	Yes Yes	Compared with control, intervention physicians had significantly better post-test composite scores for affective and anxiety disorders; differences significant in 2 of 4 affective disorders (major depression and dysthymic disorder but not depression with psychotic features or bipolar), no specific anxiety disorders (0 of 4), and no somatic disorders. Pre-test scores negatively correlated with improvement in accuracy (more improvement on incorrect pre-test cases).	A brief, single-session intervention can have an impact on physicians' psychiatric diagnostic abilities. Additionally, physicians' participation in the intervention was more likely to refer psychiatric patients.	Int: 1-8 weeks CC: NA
Block, 1988[37]	Int: Live, Print CC: NA	Int: Lecture, Point of care CC: NA	Int: Multiple time or repetitive CC: NA	Thresholds for treatment of cholesterol identified by physicians on test	Knowledge	Yes	Physicians in the demonstration project reported lower values for normal, for initiation of diet therapy and lipid lowering therapy (p<0.05).	Physicians in a community with both physician and public education reported changing their practice more significantly than physicians in a comparison community.	Int: NR CC: NA

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Premi J, 1993[38]	Int: Video, Print Int: Video, Print CC: Print CC: NA	Int: Case-based learning, Readings Int: Case-based learning, Readings CC: Readings CC: NA	Int: NR Int: NR CC: NR CC: NA	Knowledge of chest pain diagnosis and manage-ment, as measured by test	Knowl-edge	Yes	Using the test questions based on the workbook content, there was a significant increase in posttest scores of intervention (67->83) vs. control group (stable at 70) (p=0.0001), with no significant effect of review articles. Using general question about chest pain (not covered in the workbook), there was no difference comparing posttest to pretest scores in the groups (control 63.1-> 64.6%, intervention 59.9 -> 61.6%).	"The program proved successful in improving the participating physicians' knowledge about the diagnosis and management of chest pain."	Int: NR Int: NR CC: NR CC: NA

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Knowledge Objectives Met, Evaluation Duration Less Than or Equal to 30 Days									
Harris, 2002[39]	Int: Internet, not real time CC: NA	Int: Case-based learning, Feedback, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Physician knowledge, attitudes, and practice behaviors in managing domestic violence cases, as measured by survey	Knowl-edge Attitudes	Yes Yes	Compared with control group, intervention group had a statistically significant better improvement in scores regarding provider fear of offending patients (p=0.008) and victim-blaming (p=0.022). Compared with control group, intervention group had greater improvements in knowledge scores (p<0.001), but no statistically significant improvements in perceived system support or perceived frequency of asking about domestic violence.	"An on-line DV education program can improve physician confidence (as measured by self efficacy), attitudes, and self-reported knowledge in managing DV patients."	Int: 3 weeks CC: 3 weeks

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Knowledge Objectives Met, Evaluation Duration Greater Than 30 Days									
Doucet, 1998[40]	Int: Live CC: Live	Int: Problem-based or team-based learning CC: Discussion group, Lecture	Int: Multiple time or repetitive CC: One time	The Key Feature Problems examination (evaluation of clinical reasoning skills)	Knowledge Cognitive skills	Yes Yes	Whereas those enrolled in the lecture group had a mean score of 28 (SD = 5.23), participants of the PBL group had a mean examination score of 34.76 (SD = 5.96). This represents a 25% difference, deemed educationally significant. The difference in scores between the intervention and control groups was highly statistically significant (p=0.001).	"Tests of knowledge acquisition and the KFP tests of clinical reasoning skills indicated that the PBL group benefited more than the lecture group. In addition, physicians participating in the PBL sessions enjoyed the interactive approach and rated the program more highly. Participants in the PBL group rated the program sessions more favorably than did their counterparts in the lecture group across seven of the nine program dimensions. However, physicians in the lecture group did report that the program held their interest, contributed to their knowledge and skills and provided content useful to their practice. Physicians in the lecture group also agreed that the facilitators presented the concepts effectively, but were less inclined to agree that the discussion component of the lecture enhanced their learning."	Int: 3 months CC: 3 months

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Doucet, 1998[40]	Int: Live CC: Live	Int: Problem-based or team-based learning CC: Discussion group, Lecture	Int: Multiple time or repetitive CC: One time	Pre-Post test assessing "knowledge acquisition in the area of headache diagnosis and management" (40 items, developed by a neurologist)	Knowledge	Yes	There was no statistically significant difference observed in knowledge regarding headache diagnosis and management between the intervention and control groups at baseline (p=0.69). On the post-test, the intervention group performed at a statistically significantly higher level than the control group (p=0.05). Mean score for PBL group=33.30 (with SD = 3.67). Mean score for lecture group=31.38 (SD = 4.42). The authors, however, note that the observed post-test difference, at 6%, was not educationally significant.	"Tests of knowledge acquisition and the KFP tests of clinical reasoning skills indicated that the PBL group benefited more than the lecture group. In addition, physicians participating in the PBL sessions enjoyed the interactive approach and rated the program more highly. Participants in the PBL group rated the program sessions more favorably than did their counterparts in the lecture group across seven of the nine program dimensions. However, physicians in the lecture group did report that the program held their interest, contributed to their knowledge and skills and provided content useful to their practice. Physicians in the lecture group also agreed that the facilitators presented the concepts effectively, but were less inclined to agree that the discussion component of the lecture enhanced their learning."	Int: 3 months CC: 3 months

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Premi, 1994[41]	Int: Live, Print CC: NA	Int: Case-based learning, Discussion group, Problem-based or team-based learning, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Knowledge about asthma, CHF, hormone replacement, and otitis media, as assessed on true-false test >3 months after topic discussed	Knowledge	Yes	Pretest scores were similar in intervention and control (64.7 vs. 64.4) but improved to 76.8 (SD 11.7) in intervention vs. 65.7 in control (12.0), for a gain of 12.1% in intervention (p=0.0001).	Small-group community CME may lead to knowledge gains in topics discussed; unclear about practice behavior without rigorous evaluation	Int: 3 months CC: NA

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Fordis, 2005[42]	Int: Live, Print, Risk calculator Int: Internet, real time (e.g., streaming), Internet, not real time, Print, Risk calculator CC: NA	Int: Case-based learning, Lecture, Programmed learning, Readings Int: Case-based learning, Lecture, Programmed learning, Readings CC: NA	Int: One time Int: Multiple time or repetitive CC: NA	Knowledge of cholesterol manage-ment, as measured by pretest to posttest 1 (immediate) and posttest 2 (12 week) scores	Knowl-edge	Yes	Regarding the group main effect, the online CME group scored slightly higher than the live CME group when averaged across all 3 testing occasions (4.8% additional items correct, 95% CI, 0.6%-9.0%; partial w2= 0.01; p=.03). For both groups combined, posttest 1 scores surpassed pretest levels, and posttest 2 scores surpassed both pretest and posttest 1 levels (p<.001). The sizes of the differences from pretest to posttest 1 and pretest to posttest 2 were large, representing increases in percentage of items correct of 31.0% (95% CI: 27.0%-35.0%) and 36.4% (95% CI: 32.2%-40.6%), respectively. Although the increase from posttest 1 to posttest 2 was statistically significant (p<.001), the percentage increase was only 5.4% (95% CI: 2.6%-8.2%).	Appropriately designed, evidence-based online CME can produce objectively measured changes in behavior as well as sustained gains in knowledge that are comparable or superior to those realized from effective live activities.	Int: 5 months Int: 5 months CC: NA

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Stewart, 2005[43]	Int: Internet, not real time CC: NA	Int: Case-based learning, Discussion group, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Physician knowledge	Knowledge	Yes	The intervention was associated with increased knowledge. Knowledge scores among the intervention group family physicians were higher than among control group family physicians on the prevention topic, at both 2 months and 6 months. The difference for the diabetes topic was in the expected direction but was not significant.	The case-based on-line discussion demonstrated a mixed effect, with significant differences on only one of two cases and for only two of the three outcomes (family physicians' knowledge and quality of practice). The study identified a promising continuing education format (case-based, on-line learning), as well as questions for future research regarding the content and order of cases presented in on-line education.	Int: 6 months CC: NA

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Beaulieu, 2004[44]	Int: Live, Print Int: Live Int: Print CC: NA	Int: Case-based learning, Discussion group, Problem-based or team-based learning, Programmed learning, Readings Int: Case-based learning, Discussion group, Problem-based or team-based learning, Readings Int: Discussion group, Programmed learning, Readings CC: NA	Int: One time Int: One time Int: One time CC: NA		Knowledge	Yes	Median pre and posttest scores (evaluating knowledge retention) were compared, showing an improvement in score for both questions describing patients with ($p<0.1$), and patients without GI risk factors ($p<0.0001$). Improvement was also said to be sustained at the 6 month evaluation.	"The results of the initial evaluations have demonstrated that these evidence-based interventions were successful not only in improving physicians' knowledge regarding the diagnosis and management of OA, but also—more importantly—in changing their behavior to make more appropriate therapy choices for their patients. The observed modification of their prescription patterns reflects an improvement in their medical practice, which may lead to better patient outcomes and generate greater cost efficiencies for the health care system."	Int: 6 months Int: 6 months Int: 6 months CC: 6 months
Cohn, 2002[19]	Int: Live, Print Int: Live, Print CC: NA	Int: Academic detailing Int: Academic detailing CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NA	Provider knowledge	Knowledge	Yes	Data strongly suggest that intervention increased DES knowledge (statistically significant among double, but not single intervention community). There were also significant increases in the proportion of healthcare providers in the intervention group who read national DES guidelines.	"Academic detailing can increase DES knowledge and history taking among primary care providers."	Int: 3-6 months Int: 3-6 months CC: 3-6 months

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Lane, 2001[45]	Int: Live CC: NA	Int: Lecture, Standardized patient CC: NA	Int: One time CC: NA	One main outcome measure was whether or not physicians referred 90-100% of women over age 50 to get a mammogram every 1-2 years. The other main outcome was a reduction in the score of needing the CME activity (improved knowledge and under-standing)	Knowl-edge Practice behavior	Yes Yes	There was improvement in the need for CME scores of more physicians in the intervention group than the control group. The intervention significantly improved knowledge and behaviors about breast cancer screening practices.	Participation in the CME activity improved physicians' awareness, knowledge, and behaviors regarding clinical breast exams and breast cancer screening practices, as compared to a control group.	Int: 6 months CC: NA
Gifford, 1996[46]	Int: Video, Print CC: NA	Int: Programmed learning, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Factual knowledge about movement disorders, as measured by test	Knowl-edge	Yes	For 6/7 factual knowledge questions, neurologists' knowledge about movement disorders was higher in the intervention group than in the control group (p<.01). Range for intervention was 44-86% correct and control 32-74% correct.	The educational course improved neurologists' reported decision-making.	Int: 4-5 months CC: 4-5 months

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Maiman, 1988[47]	Int: Live, Print Int: Print CC: NA	Int: Discussion group, Lecture, Readings Int: Readings CC: NA	Int: Multiple time or repetitive Int: One time CC: NA	Physician compliance knowledge	Knowledge	Yes	Tutorial and printed materials increased pediatricians' knowledge about adherence-enhancing techniques; tutorials more than printed materials alone.	CME increased physician knowledge and compliance-enhancing practices and resulted in improvement in mothers' adherence to therapy.	Int: 6 months Int: 6 months CC: NA
White, 1985[48]	Int: Live CC: NA Int: Live Int: Live	Int: Case-based learning, Discussion group, Lecture CC: NA Int: NR Int: NR	Int: One time CC: NA Int: One time Int: One time	Knowledge gains on management of myocardial infarction after CME in multitopic, unitopic, or community CME, as measured by knowledge test pre-, post-, and 6 months post-	Knowledge	Yes	Generalizability study: Physicians in all groups had significant knowledge gains with retention at 6 months (baseline of 68.8-81.5% improving to 80.2-91.7% on post-test and 75.6-82.8% at six months post-test; p<0.01).	"A carefully conceived and executed traditional CME program can result not only in significant increases in physician's knowledge but also in related changes in their patient care practices" ... "both knowledge and behavioral change can persist for at least 6 months"	Int: 6 months CC: NA Int: 6 months Int: 6 months

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Terry, 1981[49]	Int: Live, Audio, Print	Int: Case-based learning, Discussion group, Feedback, Lecture, Readings	Int: Multiple time or repetitive	Knowledge and judgment in COPD manage-ment, as measured by self-assessment question-naires at baseline, 8 months, and 18 months	Knowl-edge Cognitive skills	Yes Yes	Intervention groups showed a 23% significant increase in scores on posttest 1 to match those of pulmonologists, while there was no improvement for control groups (p>0.05 for group differences). Intervention groups receiving feedback had similar scores on posttest 2 to intervention groups not receiving feedback. Among intervention physicians who did not agree to participate in standardized patients, posttest scores dropped to baseline.	Physicians completing a home study AV program increased knowledge about diagnosis and treatment of COPD, but their behavior in simulated exercises was not different from controls. Experimental group physicians did use more patient-education and smoking cessation information during patient visits. Group meetings for needs assessment and feedback (given 2 weeks after tests) had no apparent effect beyond the audiovisual materials.	Int: 6 months
	Int: Live, Audio, Print	Int: Case-based learning, Discussion group, Lecture, Readings	Int: Multiple time or repetitive						Int: 6 months
	Int: Audio, Print	Int: Case-based learning, Feedback, Lecture, Readings	Int: Multiple time or repetitive						Int: 6 months
	Int: Live, Audio, Print	Int: Case-based learning, Lecture, Readings	Int: Multiple time or repetitive						Int: 6 months
	CC: Audio, Print	CC: Case-based learning, Lecture, Readings	CC: Multiple time or repetitive						CC: 6 months

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Short, 2006[50]	Int: Internet, not real time CC: NA	Int: Lecture, Problem-based or team-based learning, Readings, multiple media, interactivity CC: NA	Int: Multiple time or repetitive CC: NA	Educational outcome measure	Knowl-edge Attitudes	Yes Yes	The MANOVA results showed a significant time by group interaction for the overall physician PREMIS scores (Wilks's lambda = 0.274, p=0.001), indicating a change over 12 months for the study group that was significantly greater than for the control group. There were significant positive changes for the two background PREMIS scales (perceived preparation, p=0.000, and perceived knowledge, p=0.000), five of the six opinion scales (preparation, p=0.000; legal requirements, p=0.011; workplace issues, p=0.002; self-efficacy, p=0.013; and victim understanding, p=0.044); and the practice issues scale (p=0.000). Actual knowledge also improved, but the change was only significant at p <= 0.10 (p=0.06). The only scale that clearly showed no improvement was the opinions scale related to alcohol/drugs and IPV (p=0.445).	This study shows that an asynchronous, interactive, online CME program developed by a cadre of national experts, in accordance with current online education best practices, can be successful in changing a number of physicians' IPV knowledge, attitudes, beliefs, and self-reported behaviors and practices, and that these changes can persist over >= 12 months.	Int: 12 months CC: NA

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Mere-dith, 2000[51]	Int: Live, Print Int: Live, Print CC: NA	Int: Lecture, Readings Int: Lecture, Readings CC: NA	Int: Multiple time or repetitive Int: NA CC: NA	Clinician knowledge about depression treatment	Knowl-edge	Yes	Compared to physicians in usual care, physicians in both the intervention groups showed greater increases in overall depression knowledge (p=0.06). The change in overall depression knowledge scores was most pronounced for the QI therapy group (p=0.01 compared to usual care and p=0.09 compared to QI-meds). Knowledge scores did not change significantly for general treatment & antidepressant medication but there were significant increases in psychotherapy knowledge scores for the QI meds and QI therapy groups compared to usual care (p=0.04 & 0.04 respectively).	Clinicians exposed to multifaceted QI programs for depression in managed primary care practices gained knowledge about assessing and treating depression over 18 months following implementation. The main activity accompanying this gain in knowledge was direct participation in the specific types of formal and informal educational activities that were part of the study protocol.	Int: 12 months (18 months after implementation) Int: 12 months (18 months after implementation) CC: NA

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Mann, 1997[52]	Int: Live, Video, Print Int: Live, Video, Print Other: cue stickers on medical chart CC: NA	Int: Case-based learning, Demonstration, Discussion group, Readings, Simulation (other than standardized patient or role-play) Int: Case-based learning, Demonstration, Discussion group, Point of care, Readings, Simulation (other than standardized patient or role-play) CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NR	Physician knowledge, as measured by posttests	Knowl-edge	Yes	Significant (p=0.002) group x time effect was seen in the overall knowledge score; statistically significantly higher scores were seen in the intervention group (compared to control, p=0.02) at posttest. Statistically significant increases in knowledge of screening, selecting and managing patients and on dietary modification principles, and a nonsignificant, but increasing trend (p=0.09) in dietary assessment techniques, was also seen when comparing the control group to both intervention groups.	Educational training workshops appear to be effective in changing physicians' behavior, and should thus, be continued along with additional research on the mechanisms of which behavior change occurs.	Int: 15 months Int: 15 months CC: 15 months

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Ger-stein, 1999[53]	Int: Live CC: NA	Int: Case-based learning, Discussion group CC: NA	Int: One time CC: NA	Knowledge, attitudes, and practice behavior regarding diabetes care, based on participant question-naire	Knowl-edge Attitudes Practice behavior	Yes Yes Yes	After 40 days, participants' overall scores improved significantly while there was no change in the controls' scores (F =24.14; p<0.0001). Significant improvement was also noted in domains of attitude (F=31.75; p<0.0001), knowledge (F=4.23; P =0.041), and practice behavior (F=10.43; p=0.0014). However, improvement was not apparent after a year. Participants who completed 425-day assessment scored lower in attitude subscale compared to controls, despite having initially scored higher at the 40-day assessment.	An interactive, small group, diabetes continuing education program effectively disseminates practice guidelines to family physicians. The impact of such a program declines after 1 year.	Int: 24 months CC: NA
Knowledge Objectives Not Met, Evaluation Duration Not Reported									
Gerrity, 1999[32]	Int: Live, Video, Audio, Print CC: NA	Int: Clinical experiences, Discussion group, Feedback, Lecture, Readings, Role play CC: NA	Int: Multiple time or repetitive CC: NA	Knowledge about depression diagnosis and manage-ment, as measured on a 54-item written test	Knowl-edge	No	Intervention and control group did not differ significantly in mean scores (41.5 vs. 39.3, p=0.136) or in their assessment of their knowledge in depression (64% vs. 44% rating selves as very knowledgeable about antidepressants, p=0.175).	The Depression Education Program changed physicians' behavior and may be an important component in the efforts to improve the care of depressed patients.	Int: 2-6 weeks CC: NA

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Knowledge Objectives Not Met, Evaluation Duration Greater Than 30 Days									
Chung, 2004[54]	Int: Live, Internet, not real time CC: Live	Int: Case-based learning, Lecture, Readings CC: Lecture	Int: Multiple time or repetitive CC: One time	Knowledge of diagnosis and management of victims of bioterrorism.	Knowl-edge	No	There was no significant change from baseline to 1 and 6 month follow-up for the intervention or control group.	"Even shortly after a bioterrorist attack, physicians were unable to demonstrate an increase in knowledge after voluntarily participating in a web-based educational intervention. ...passive learning through the creation of medical Web sites on the concepts of bioterrorism may not be the most effective method to educate clinicians and, thus, prepare for future attacks."	Int: 6 months CC: 6 months
Elliott, 1997[55]	CC: NA Int: Live, Print	CC: NA Int: Case-based learning, Clinical experiences, Discussion group, Lecture, Readings	CC: NA Int: Multiple time or repetitive	Physician and nurse knowledge of CPM	Knowl-edge	No	There was a trend toward improved knowledge in the intervention group, but it was not statistically significant.	With the exception of attitudes of patients and caregivers, there was a trend toward improvement in pain ratings as well as provider attitudes and knowledge but the effect was minor and the overall results were not overwhelmingly convincing	CC: NA Int: 15 months

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Evans CE, 1986[56]	Int: Print CC: NA	Int: Readings, Chart cue materials offered, but not necessarily implemented CC: NA	Int: Multiple time or repetitive CC: NA	Physician knowledge of hyper-tension, as measured by multiple-choice posttest	Knowl-edge	No	Mean knowledge scores did not differ between groups (50 and 52%, p>0.05). There were no significant correlations between scores and patients' blood pressures, but a weak correlation between scores and patient compliance (r=0.25, p<0.05).	"Our study demonstrates no influence of a mailed continuing medical education program on the practices of physicians or on the control of blood pressure of hypertensive patients referred from a community survey to these physicians after the program was begun.	Int: 21 months CC: 21 months
Knowledge Objectives With Mixed Results, Evaluation Duration Not Reported									
Max-well, 1984[57]	Int: Live CC: NA	Int: Case-based learning, Discussion group CC: NA	Int: Multiple time or repetitive CC: NA	Knowledge gains on topics under discussion in medical care evaluation committees, as measured by 30-item multiple-choice tests	Knowl-edge	Mixed	Statistically significant improvement pre- to post- in only 1 of 3 departments. Scores improved in "successful committees" on specific topics compared with those of matched controls or their own scores on control topics (p<0.01).	Medical care evaluation meetings have educational value	Int: NR CC: NR

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Kemper, 2006[58]	Int: Internet, not real time	Int: Discussion group, Problem-based or team-based learning	Int: online discussions; case-based, self-instructional modules	Differences of the three types of scores between the four groups	Knowledge Attitudes	No control group	No significant difference in any of the three outcome scores by delivery strategy.	Results from this study have important implications for professional education & future research. Educators wishing to use the Internet can be confident that improvements are not heavily dependent on the curriculum delivery strategy. The delivery method that is easiest for instructors (boluspush), may present the fewest barriers for completion (such as full mailboxes & institutional firewalls), particularly for short, introductory courses. The delivery strategy that is easiest does not appear to result in substantially worse outcomes. Additional interventions are needed to improve clinicians' communication behavior. This study demonstrated that Internet education can substantially improve clinicians' knowledge & confidence regardless of the delivery strategy.	Int: NR
	Int: Internet, not real time	Int: Discussion group, Problem-based or team-based learning	Int: online discussions; case-based, self-instructional modules						Int: NR
	Int: Internet, not real time	Int: Discussion group, Problem-based or team-based learning	Int: online discussions; case-based, self-instructional modules						Int: NR
	Int: Internet, not real time	Int: Discussion group, Problem-based or team-based learning	Int: online discussions; case-based, self-instructional modules						Int: NR

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Kemper, 2006[58]	Int: Internet, not real time	Int: Discussion group, Problem-based or team-based learning	Int: online discussions; case-based, self-instructional modules	Changes in knowledge, confidence and communi-cation scores	Knowl-edge Attitudes	No con-trol group	Statistically significant improvement in scores after they were taken.	Results from this study have important implications for professional education & future research. Educators wishing to use the Internet can be confident that improvements are not heavily dependent on the curriculum delivery strategy. The delivery method that is easiest for instructors (boluspush), may present the fewest barriers for completion (such as full mailboxes & institutional firewalls), particularly for short, introductory courses. The delivery strategy that is easiest does not appear to result in substantially worse outcomes. Additional interventions are needed to improve clinicians' communication behavior. This study demonstrated that Internet education can substantially improve clinicians' knowledge & confidence regardless of the delivery strategy.	Int: NR
	Int: Internet, not real time	Int: Discussion group, Problem-based or team-based learning	Int: online discussions; case-based, self-instructional modules						Int: NR
	Int: Internet, not real time	Int: Discussion group, Problem-based or team-based learning	Int: online discussions; case-based, self-instructional modules						Int: NR
	Int: Internet, not real time	Int: Discussion group, Problem-based or team-based learning	Int: online discussions; case-based, self-instructional modules						Int: NR

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Rosen-thal, 2005[59]	Int: Live, Handheld, Review of data CC: Review of data	Int: Lecture, Readings, Review of practice data CC: Review of practice's data	Int: Multiple time or repetitive CC: One time	Parent reports of knowledge	Knowledge	No con-trol group	For parents of both 1-month-olds and 6-month-olds, the control and intervention parents did not differ in the adjusted change in the proportion of parents reporting parent knowledge in age-specific topics.	An office system intervention improved parent reports of quantity of anticipatory guidance but did not change parent knowledge or parent behavior.	Int: NR CC: NR
Hergen-roeder, 2002[60]	Int: Video, Print Int: Live, Video, Print	Int: Demonstration Int: Demonstration, Feedback, Simulation (other than standardized patient or role-play)	Int: One time Int: One time	Physician knowledge of performing a physical exam	Knowledge	No con-trol group	There was a statistically significant increase between baseline and followup in knowledge test scores for both intervention groups, and there was a significant difference between the groups at followup.	"This study demonstrated that improvements in physicians' knowledge and skills in performing ankle and knee physical examinations were associated with the physicians' participation in either intervention. The improvements in physicians' knowledge and skills in the ankle and knee examinations were greater in the videotape plus skills intervention group than in the videotape-alone group."	Int: NR Int: NR

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Des Mar-chais, 1990[61]	Int: Live, Video Int: Live, Video	Int: Case-based learning, Demonstration, Discussion group, Reflection about personal experiences Int: Case-based learning, Demonstration, Discussion group, Reflection about personal experiences	Int: NR Int: NR	Appropriate assessment of interpersonal skills of videotaped physicians-in-training, as measured by participants' scoring of the video compared with median score in group	Knowl-edge	No con-trol group	Both groups showed increased interrater agreement after the first portion of training, but no substantial or significant increase beyond that after the second portion of the training. Order of training (theoretical vs. practical first) had no significant effect. Psychiatrists had a higher reliability score before and after training compared with family physicians.	A short, specific training can increase interrater agreement in the assessment of the doctor-patient relationship.	Int: NR Int: NR

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Knowledge Objectives With No Control Group, Evaluation Duration Less Than or Equal to 30 Days									
Slotnick, 1993[17]	Int: Print Int: Print Int: Print Int: Print Int: Print Int: Print	Int: Readings Int: Readings Int: Readings Int: Readings Int: Readings Int: Readings	Int: One time Int: One time Int: One time Int: One time Int: One time Int: One time	Knowledge of prescribing information as applied to clinically-oriented test questions on a post-intervention test	Knowledge	No control group	Higher mean test scores were seen for clinical challenge readers vs. conventional ad readers, with a reported effect size of 0.45 SD. There was no difference with an introductory ad explaining the use of the clinical challenge. Knowledge scores were higher for older drug than newer drug. Compared with those reading conventional ads, physicians using enhanced ads had RR 1.48 (1.07-2.05) for correctly answering questions drawn from the clinical challenge scenario, vs. RR 1.12 (NS) for those not covered in the scenario.	Pharmaceutical ads with enhanced clinical challenges increase physician knowledge on testing, specifically for questions that were drawn from the clinical challenges themselves.	Int: immediate Int: immediate Int: immediate Int: immediate Int: immediate Int: immediate

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Knowledge Objectives With Mixed Results, Evaluation Duration Greater Than 30 Days									
Cho-dosh, 2006[62]	Int: Live, Internet, not real time, Print CC: NA	Int: Discussion group, Lecture CC: NA	Int: Multiple time or repetitive CC: NA	Providers' knowledge regarding dementia care, as measured by test	Knowl-edge	Mixed	Higher percentage of intervention than usual-care clinic providers answered both of knowledge-related questions on capacity determination correctly (adjusted OR 2.4, 95% CI: 1.2-4.8). No difference existed for questions on knowledge of areas of delirium evaluation, patient safety, and depression treatment.	Despite a successful intervention demonstrating significant improvements in quality of care for patients with dementia, providers' knowledge and attitudes were minimally affected.	Int: 9 months CC: NA

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Knowledge Objectives With No Control Group, Evaluation Duration Greater Than 30 Days									
White, 2004[63]	Int: Live CC: Live	Int: Case-based learning, Discussion group CC: Case-based learning, Discussion group, Lecture	Int: One time CC: One time	Performance of question-naire (knowledge)	Knowl-edge	No con-trol group	Groups did not differ on their performance. Their performance, however, varied across time, as indicated by the significant main effect for time, F (2,33)=18.10, p<.01, which was consistent for both groups. Both groups significantly improved their performance at the second administration and retained this level at the third, delayed testing. For the knowledge measure, there was a significant drop in performance comparing the delayed test 3 months later to the immediate post-test, but it was still significantly better than performance on the pretest.	This study found no evidence that PBL is any better than more didactic learning sessions in facilitating knowledge gain, knowledge retention, or changes in attitude about asthma management. However, this study, similar to other studies, suggests that there is weak evidence that physicians attribute additional value to the more interactive PBL approach to CME.	Int: 3 months CC: 3 months

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Lockyer, 2002[64]	Int: Live Int: Live	Int: Case-based learning, Discussion group, Lecture, Role play Int: Case-based learning, Discussion group, Lecture	Int: One time Int: One time	Physician practice behaviors: knowledge scores	Knowl-edge	No con-trol group	Both track 1 (introductory course) and track 2 (advanced course) participants improved statistically significantly between pre and posttest scores; track 1 had a moderate effect size difference (0.5), and track 2 a minimal effect size (0.2). Between tracks comparisons showed statistically significant differences between tracks for precourse assessment of knowledge but not for post-course assessment of knowledge.	Track 1 (introductory course) physicians improved moderately, while track 2 (advanced course) physicians showed a small or negligible change in knowledge, comfort, and involvement in patient care for dementia patients. Tracking in CME - assigning physicians to courses based on pre-course ability, interest, or skill - needs further study.	Int: 3 months Int: 3 months
Kutcher, 2002[65]	Int: Live, Print Int: Live, Print	Int: Academic detailing, Discussion group, Lecture, Readings Int: Discussion group, Lecture, Readings	Int: One time Int: One time	Knowledge test	Knowl-edge	No con-trol group	Both enhanced and general intervention groups improved from pre to post test (p<0.0001), but no comparison between groups was made.	"A well-designed, directional, brief, simple, and low-cost educational program can increase family physicians' knowledge of depression, improve their diagnostic skills, and optimize their treatment of depression."	Int: 6 months Int: 6 months

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Heale, 1988[66]	Int: Live Int: Live Int: Live	Int: Lecture Int: Case-based learning, Discussion group Int: Problem-based or team-based learning	Int: One time Int: One time Int: One time	Physician knowledge of six topic areas addressed by CME	Knowl-edge	No con-trol group (No for techni que)	Performance assessments on the knowledge MCQ were not provided. The only statement was that there was no difference in acquired or retained knowledge (7 months) among the three learning formats.	Within a one day CME course in family medicine, the learning format had no effect on acquired or retained knowledge or on physician performance in three patient problems. Physicians rated the small group problem based format higher.	Int: 7 months Int: 7 months Int: 7 months
Green-berg, 1985[25]	Int: Live Int: Live	Int: Lecture Int: Case-based learning	Int: One time Int: One time	Knowledge regarding common pediatric problems, as assessed by a multiple-choice test on one of 4 topics	Knowl-edge	No con-trol group (No for techni que)	Case-based learners showed improvement on 64% of the post-tests vs. 29% of lecture-based learners, but this was not statistically significant. 6-9 months later, 55% of the lecture-based learners and 43% of the case-based learners showed a decline in test scores; no tests of significance were reported.	Case-based learning, compared with lecture-based learning, was associated with some significant advantages in teaching skills and behavior in management of common pediatrics problems.	Int: 6-9 months Int: 6-9 months

Evidence table 7. Effectiveness of continuing medical education on short-term and long-term knowledge outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objec-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Labelle, 2004[67]	Int: Live, Print	Int: Case-based learning, Demonstration, Discussion group, Lecture, Problem-based or team-based learning, Role play, Standardized patient	Int: Multiple time or repetitive	Long-term knowledge of written action plans and related asthma management criteria, as assessed by OSCE	Knowl-edge	No con-trol group	Written action plan (WAP) knowledge increased between baseline and 12 months for those GPs in the second group (participating in the OSCE (objective structured clinical examination) at 6 months) p=0.01. WAP knowledge did increase, but not to a statistically significant degree for those not participating in the OSCE at 6 months (group 1), p=0.28.	"This study demonstrated a positive impact of the combination of a case-based, interactive asthma workshop featuring a preformatted tool to aid in drafting of WAPs, with a reinforcing OSCE 6 months post-workshop, on GP knowledge and self-reported use of WAPs. These results support the conclusion of reviews of CME programs that interactive and sequential educational activities providing opportunities to practice appear promising in changing physician practice."	Int: 12 months
	Int: Live	Int: Case-based learning, Role play, Standardized patient	Int: Multiple time or repetitive						Int: 12 months

CC = concurrent control; CI = confidence interval; CME = continuing medical education; COPD = chronic obstructive pulmonary disease; DES = diethylstilbestrol; DV = domestic violence; GI = gastrointestinal; GP = general practitioner; Int = intervention group; KFP = Key Features Program; MANOVA = multiple analysis of variance; MCQ = multiple choice questionnaire; NA = not applicable; NR = not reported; NS = not significant; OR = odds ratio; OSCE = objective structured clinical examination; PBL = problem-based learning; PREMIS = Physician Readiness to Manage Intimate Partner Violence Survey; QI = quality improvement; SD = standard deviation

Evidence table 8. Grading of the body of evidence for the effectiveness of continuing medical education and the effectiveness of simulation in medical education

	Key Question 1/2 – Effectiveness of CME on Acquisition/Retention				
	Knowledge	**Attitudes**	**Skills**	**Practice Behaviors**	**Clinical Outcomes**
Quantity of Evidence: Number of studies	40	36	22	114	39
Quality and Consistency of Evidence: Were study designs mostly randomized trials (high quality), non-randomized controlled trials (medium quality), observational studies (low quality)?	High	High	High	High	High
Did the studies have serious (-1) or very serious (-2) limitations in quality? (Enter 0 if none)	-1	-1	-2	-1	-1
Did the studies have important inconsistency? (-1)	-1	-1	-1	-1	-1
Was there some (-1) or major (-2) uncertainty about the directness (i.e. extent to which the people, interventions and outcomes are similar to those of interest?	-1	-1	-1	-1	-1
Were data imprecise or sparse? (-1) (i.e. lack of data or very wide confidence intervals that may change conclusions)	-1	-1	-1	-1	-1
Did the studies have high probability of reporting bias? (-1)	-1	-1	0	-1	-1
Did the studies show strong evidence of association between intervention and recruitment outcome? ("strong" if significant relative risk or odds ratio > 2 based on consistent evidence from 2 or more studies with no plausible confounders or some other measure that suggests a large difference between study groups (+1); "very strong" if significant relative risk or odds ratio > 5 based on direct evidence with no major threats to validity or some other measure that suggests a very large difference between study groups (+2))- use your clinical judgment for absolute differences.	0	0	+1	0	0
Did the studies have unmeasured plausible confounders that most likely reduced the magnitude of the observed association? (+1)	0	0	+1	0	+1
Overall grade of evidence (high, moderate, low, very low)	Very low	Very low	Low	Very low	Low

High = further research is very unlikely to change our confidence in the estimates; moderate = further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate; low = further research is likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate; very low = any estimate of effect is very uncertain.

Evidence table 8. Grading of the body of evidence for the effectiveness of continuing medical education and the effectiveness of simulation in medical education

	Key Question3			
	Psychomotor Skills	**Communication Skills**	**Cognitive Skills**	**Total**
<u>Quantity of Evidence:</u> Number of studies	7 172 studies	2 14	2 37	9 223
<u>Quality and Consistency of Evidence:</u> Were study designs mostly randomized trials (high quality), non-randomized controlled trials (medium quality), observational studies (low quality)?	Yes	No	No	
Did the studies have serious (-1) or very serious (-2) limitations in quality? (Enter 0 if none)	Only 1/6 had reproducible methodology Quality of studies assessed in only 3	None had reproducible methods Only 1 of 3 assessed study quality	Not reproducible No assessment of study quality	-2
Did the studies have important inconsistency? (-1)	Yes	No	Yes	-1
Was there some (-1) or major (-2) uncertainty about the directness (i.e. extent to which the people, interventions and outcomes are similar to those of interest?	No	No	No	0
Were data imprecise or sparse? (-1) (i.e. lack of data or very wide confidence intervals that may change conclusions)	Sparse, only 2 had quantitative data	Sparse	Sparse	-1
Did the studies have high probability of reporting bias? (-1)	Yes	Yes	Yes	-1
Did the studies show strong evidence of association between intervention and recruitment outcome? ("strong" if significant relative risk or odds ratio > 2 based on consistent evidence from 2 or more studies with no plausible confounders or some other measure that suggests a large difference between study groups (+1); "very strong" if significant relative risk or odds ratio > 5 based on direct evidence with no major threats to validity or some other measure that suggests a very large difference between study groups (+2))<u>- use your clinical judgment for absolute differences.</u>	Of the quantitative results, one showed strong associations between transference of skills to OR (task completion rate and error rate)	Not quantitated, but consistently better with role play and or simulated patients	Average effect size 0.63 across 33 studies that collected data in one review Effect sizes ranged -.04 for computer assisted trauma management teaching to 5.06 for anesthesia simulator	+1

Evidence table 8. Grading of the body of evidence for the effectiveness of continuing medical education and the effectiveness of simulation in medical education

	Key Question3			
	Psychomotor Skills	**Communication Skills**	**Cognitive Skills**	**Total**
Did the studies have unmeasured plausible confounders that most likely reduced the magnitude of the observed association? (+1)	Yes, large differences in types of learners, skill taught, intensity and frequency of simulation method, and outcome measures.	Yes differences in learners, intensity and frequency, and measures	Yes, differences in learners, and content being taught	+1
Overall grade of evidence (high, moderate, low, very low)	Moderate	Low	Low	Low-Moderate

High = further research is very unlikely to change our confidence in the estimates; moderate = further research is likely to have an important impact on our confidence in the estimate of effect and <u>may</u> change the estimate; low = further research is likely to have an important impact on our confidence in the estimate of effect and <u>is likely to</u> change the estimate; very low = any estimate of effect is very uncertain.

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Attitudinal Objectives Met, Evaluation Duration Not Reported									
Bloomfield, 2005[68]	Int: Live, Print, Patient letter prompting patient to discuss with provider about treatment Int: Live, Print, Chart reminders appearing on cover page of patient's medical record Int: Live, Print, Progress notes reminding PCP about appropriate approach CC: NA	Int: Discussion group, Lecture: Patient informs provider Int: Discussion group, Lecture Point of care Int: Discussion group, Lecture Point of care CC: NA	Int: One time Int: One time Int: One time CC: NA	Provider view of live education, opinion leader, and prompts	Attitudes	Yes	99% of respondents agreed somewhat or completely that the workshop increased their knowledge and 86% stated that they were more likely to treat as a result of the workshop. 60% felt that the opinion leader had influenced their prescribing decisions and about 50% stated that they agreed or strongly agreed that the prompts positively influenced their prescribing, while 40% found the prompts annoying and 14% felt the prompts did more harm than good.	In conclusion, this study shows that a relatively simple intervention (an educational workshop, opinion leader influence and prompts) based on a theoretical model of provider behavior, which is designed to address empirically identified barriers, can result in substantial improvement in provider prescription behavior.	Int: NR Int: NR Int: NR CC: NA
Mukohara, 2005[13]	Int: Computer-based off-line CC: Computer-based off-line	Int: Readings CC: Readings	Int: Multiple time or repetitive CC: Multiple time or repetitive	Time spent reading	Attitudes	Yes	The control group reported a significant increase in the time they spent reading medical journals, amounting to 20% (26 minutes per week), while the WBJC group's reading time decreased by 7% (10 minutes per week). The difference in the change in reading time between the groups was 35.3 minutes (95% CI: 5.1, 65.6).	While doctors appreciated these summaries, which improved their reading efficiency, the intervention had little impact on their use of research evidence in practice.	Int: NR CC: NR

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Curran, 2000[34]	Int: Computer-based off-line, Internet, not real time CC: NA Int: Computer-based off-line, Internet, not real time	Int: Case-based learning, Programmed learning, computer-based courseware CC: NA Int: Case-based learning, Programmed learning, computer-based courseware	Int: Multiple time or repetitive CC: NA Int: One time	Self-reported performance change	Attitudes	Yes	Wilcoxon tests of the retrospective responses to the performance statements revealed significant differences between self-reported pre- and post-learning performance at $p<.05$. This suggests that participants experienced improved competencies in all performance areas related to dermatologic office procedures as a result of participating in the computer-mediated instructional program.	This evaluation revealed that a hybrid computer-mediated courseware system was an effective means for increasing knowledge and improving self-reported competency in dermatologic office procedures, and that participants were very satisfied with the self-paced instruction and use of asynchronous computer conferencing for collaborative information sharing among colleagues.	Int: NR CC: NA Int: NR
Curran, 2000[34]	Int: Computer-based off-line, Internet, not real time CC: NA Int: Computer-based off-line, Internet, not real time	Int: Case-based learning, Programmed learning, computer-based courseware CC: NA Int: Case-based learning, Programmed learning, computer-based courseware	Int: Multiple time or repetitive CC: NA Int: One time	To determine participant (physician) reaction to the computer-based CME activity	Attitudes	Yes	Participants were very satisfied with the self-paced instruction and use of asynchronous computer conferencing for collaborative information sharing among colleagues.	This evaluation revealed that a hybrid computer-mediated courseware system was an effective means for increasing knowledge and improving self-reported competency in dermatologic office procedures, and that participants were very satisfied with the self-paced instruction and use of asynchronous computer conferencing for collaborative information sharing among colleagues.	Int: NR CC: NA Int: NR

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of object-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Cost-anza, 1992[35]	Int: Live Print CC: NA	Int: Discussion group, Lecture, Point of care, Simulation (other than standardized patient or role-play) CC: NA	Int: Multiple time or repetitive CC: NA	Physician knowledge and attitudes toward breast cancer screening	Knowl-edge Attitudes	Yes	Two barriers to use of mammography, concern that mammography is not cost-effective and concern about interpreting ambiguous reports, affected physicians less in the intervention group than in the control.	This study demonstrates that primary care physicians will change their screening practice in response to interventions aimed at altering beliefs regarding mammography benefits or to barriers and their sense of consensus development.	Int: NR CC: NA
Lane, 1991[69]	Int: Live Print Int: Live Print Int: NA CC: NA	Int: ARS, Clinical experiences, Demonstration, Discussion group, Feedback, Lecture Mentor/Precep-tor, Readings Int: ARS, Clinical experiences, Demonstration, Discussion group, Feedback, Lecture, Mentor/Precep-tor, Readings Int: NA CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive Int: NO CME intervention, just free mammo-graphy CC: NA	Change in physicians' attitudes about making mammo-graphy referrals	Attitudes	Yes	Physicians remained concerned about cost, radiation exposure, unnecessary biopsies, cost effectiveness, patient discomfort and sufficiency of physician exams, as well as insufficient time with patients. However, there was a statistically significant reduction in concern about cost, radiation exposure and cost-effectiveness in the intervention group whereas there was no significant change in any attitudes in the control sites.	Physicians in the interventions reported (self) an increase in the number of mammography referrals.	Int: NR Int: NR Int: NA CC: NA

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of object-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Ander-sen, 1990[36]	Int: Live, Video CC: NA	Int: Case-based learning, Lecture CC: NA	Int: One time CC: NA	Physicians' treatment recommen-dations for psychiatric conditions, as measured by pre- and post-tests incorporating multiple case vignettes	Attitudes Practice behavior	Yes Yes	Compared with control, intervention physicians were significantly more inclined to refer patients to mental health professional and less inclined to treat them in primary care. Referral was high on pretest for both groups, but experimental group showed increase for 6 of 7 (1 tie) disorders while control did for 2 of 5 (3 ties). For medication, there were no significant effects. For behavioral therapy, there were significant increases for intervention group.	A brief, single-session intervention can have an impact on physicians' psychiatric diagnostic abilities. Additionally, physicians participating in the intervention were more likely to refer psychiatric patients.	Int: 1-8 weeks CC: NA

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Attitudinal Objectives Met, Evaluation Duration Less Than or Equal to 30 Days									
Harris, 2002[39]	Int: Internet, not real time CC: NA	Int: Case-based learning, Feedback, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Physician knowledge, attitudes, and practice behaviors in managing domestic violence cases, as measured by survey	Knowledge Attitudes	Yes Yes	Compared with control group, intervention group had a statistically significant better improvement in scores regarding provider fear of offending patients (p=0.008) and victim-blaming (p=0.022). Compared with control group, intervention group had greater improvements in knowledge scores (p<0.001), but no statistically significant improvements in perceived system support or perceived frequency of asking about domestic violence.	"An on-line DV education program can improve physician confidence (as measured by self efficacy), attitudes, and self-reported knowledge in managing DV patients."	Int: 3 weeks CC: 3 weeks
Harris, 2002[39]	Int: Internet, not real time CC: NA	Int: Case-based learning, Feedback, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Physician self-efficacy in managing domestic violence cases, as measured by survey	Attitudes	Yes	In the intervention group, self-efficacy improved by 17.8% versus -0.6% mean change in control group (p<0.001).	"An on-line DV education program can improve physician confidence (as measured by self efficacy), attitudes, and self-reported knowledge in managing DV patients."	Int: 3 weeks CC: 3 weeks

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Attitudinal Objectives Met, Evaluation Duration Greater Than 30 Days									
Doucet, 1998[40]	Int: Live CC: Live	Int: Problem-based learning or team-based learning CC: Discussion group, Lecture	Int: Multiple time or repetitive CC: One time	Program evaluation assessing satisfaction	Attitudes	Yes	85% of the PBL respondents rated the program as excellent compared to 35% of the control group (p = 0.001). Except for "were well organized" and "facilitator presented concepts effectively," there were highly statistically significant differences between the two groups' self-reported satisfaction with the program domains. These were: 1. "Met its objectives" - p = 0.013 2. "Met my expectations" - p = 0.001 3. "Contributed to my knowledge and skills" - p = 0.004 4. "Program material was helpful" - p = 0.019 5. "Discussions enhanced my learning" - p = 0.000	"Tests of knowledge acquisition and the KFP tests of clinical reasoning skills indicated that the PBL group benefited more than the lecture group. In addition, physicians participating in the PBL sessions enjoyed the interactive approach and rated the program more highly. Participants in the PBL group rated the program sessions more favorably than did their counterparts in the lecture group across seven of the nine program dimensions. However, physicians in the lecture group did report that the program held their interest, contributed to their knowledge and skills and provided content useful to their practice. Physicians in the lecture group also agreed that the facilitators presented the concepts effectively, but were less inclined to agree that the discussion component of the lecture enhanced their learning."	Int: 3 months CC: 3 months

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of object-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Lewis, 1993[70]	Int: Live, Video Int: Print CC: NA	Int: Discussion group, Lecture Int: Readings CC: NA	Int: One time Int: One time CC: NA	Physician attitudes toward the course on HIV	Attitudes	Yes	58% approved of the activity, 20% were neutral, and 22% disapproved at the start. After the intervention, 68% approved, 18% were neutral, and 14% disapproved. This represented a positive impact of the intervention.	These results suggest that a medical education program that goes beyond standard lectures and incorporates interactive formats can change physician behaviors.	Int: 3 months Int: 3 months CC: NA

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Kronick, 2003[71]	Int: Live CC: NA	Int: Case-based learning, Demonstration CC: NA	Int: One time CC: NA	Physician comfort level with accessing medical information via internet.	Attitudes Practice behavior	Yes Mixed	Intervention group physicians increased their frequency of and comfort with accessing Internet medical information. Statistically significant differences in change from baseline between intervention and control group were seen with frequency of use of the Internet to address patient related questions (p=.009), in the comfort level using online databases (p=.032) and in the frequency of accessing online databases (p=.044). Non-statistically significant differences were seen in frequency of accessing email to answer patient-related questions and comfort in using email, the Internet, opinion of the value of the Internet and in accessing online full-text journals.	"Rural physicians' comfort and competence in use of computers to address patient problems can be improved by an individualized 3-hour training session. These data suggest that physicians distant from medical libraries can have excellent access to evidence-based resources; as connection to the Internet becomes faster, more uniform, and reliable across communities, the training will become easier to deliver."	Int: 3 months CC: 3 months

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Fordis, 2005[42]	Int: Live, Print, Risk calculator Int: Internet, real time (e.g., streaming), Internet, not real time, Print, Risk calculator CC: NA	Int: Case-based learning, Lecture, Programmed learning, Readings Int: Case-based learning, Lecture, Programmed learning, Readings CC: NA	Int: One time Int: Multiple time or repetitive CC: NA	Participant satisfaction, as measured by questionnaire	Attitudes	Yes	All live CME participants and 94% of online CME participants rated the learning experience as “good” or “excellent.” Nonparametric correlations revealed no significant associations between course satisfaction and test performance. Nearly all of the 40 online CME participants (95%) who attended the live Web conference rated it as “useful” or “very useful” and indicated that it provided an opportunity to solidify guideline knowledge and obtain answers to questions.	Appropriately designed, evidence-based online CME can produce objectively measured changes in behavior as well as sustained gains in knowledge that are comparable or superior to those realized from effective live activities.	Int: 5 months Int: 5 months CC: NA

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Brown, 1999[72]	Int: Live CC: NA	Int: Clinical experiences, Discussion group, Lecture, Role play, Clinicians audiotaped interaction with patients and listened between workshops CC: NA	Int: Multiple time or repetitive CC: NA	Self-assessment of clinicians' communication skills, attitudes, and behavior, as measured by participant questionnaire	Attitudes Skills (psycho, motor, or procedural skills) Practice behavior	Yes Yes Yes	Intervention group noted substantial improvements compared with control in 8 of 24 skills / attitudes / behaviors: awareness of and confidence in dealing with patients whom they found difficult; abilities to compliment patients' efforts, ask open-ended questions, address psychosocial factors, express empathy and reassurance, and clarify expectations. 33% of clinicians reported that fewer than 5% of visits were frustrating after the program (compared with 21% of clinicians at baseline). Three months after the program, clinicians in the intervention group reported that it had improved communication with patients. On average, however, the scores for clinicians' rating of improvement in patient satisfaction and improvement in clinicians' personal satisfaction in their work decreased below the midpoint on the five-point scale (mean rating, 2.85 for both items).	"Thriving in a Busy Practice: Physician-Patient Communication," a typical continuing medical education program geared toward developing clinicians' communication skills, is not effective in improving general patient satisfaction. To improve global visit satisfaction, communication skills training programs may need to be longer and more intensive, teach a broader range of skills, and provide ongoing performance feedback.	Int: >=6 months CC: NA

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Lin, 1997[73]	CC: NA Int: Live, Video, Print	CC: NA Int: Academic detailing, Feedback, Lecture, Readings, Role play	CC: NA Int: Multiple time or repetitive	Physician attitudes toward the intervention	Attitudes	Yes	This outcome was alluded to in the study but was not a primary endpoint in this paper (it was reported elsewhere). However, immediately post-intervention, physicians did have significant improvements in how they felt about the depression care they were delivering.	The results do not support the concept that this complex and aggressive intervention effected a sustain change in practice behaviors 6 months after the intervention. In fact, some positive changes were noted immediately after the intervention (i.e. prescribing patterns) but were lost 6 months after the intervention was over	CC: NA Int: 6 months
Mai-man, 1988[47]	Int: Live, Print, Int: Print CC: NA	Int: Discussion group, Lecture, Readings Int: Readings CC: NA	Int: Multiple time or repetitive Int: One time CC: NA	Physician self-report of compliance enhancing behavior	Attitudes	Yes	78.2% of physicians in tutorial group, 62.9% of pediatricians in print only group, and 45.9% of controls reported undertaking 8 or more specific behaviors in their practice related to enhancing compliance.	CME increased physician knowledge and compliance-enhancing practices and resulted in improvement in mothers' adherence to therapy.	Int: 6 months Int: 6 months CC: NA
Pinto, 1998[74]	CC: Print Int: Live, Print	CC: Readings Int: Discussion group, Readings, Role play	CC: Given materials to read- exposure up to the physicians Int: One time	Physician confidence in counseling on exercise	Attitudes	Yes	The intervention group had a statistically significant higher rating of confidence than the control group (p<.05).	The program improved physician confidence in counseling and patient satisfaction, but did not increase the physician reports of exercise counseling provided to all patients.	CC: 8 months Int: 8 months

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Short, 2006[50]	Int: Internet, not real time CC: NA	Int: Lecture, Problem-based learning or team-based learning, Readings, multiple media, interactivity CC: NA	Int: Multiple time or repetitive CC: NA	Educational outcome measure	Knowledge Attitudes	Yes Yes	The MANOVA results showed a significant time by group interaction for the overall physician PREMIS scores (Wilks's lambda = 0.274, p = 0.001), indicating a change over 12 months for the study group that was significantly greater than for the control group. There were significant positive changes for the two background PREMIS scales (perceived preparation, p = 0.000, and perceived knowledge, p = 0.000), five of the six opinion scales (preparation, p = 0.000; legal requirements, p = 0.011; workplace issues, p = 0.002; self-efficacy, p = 0.013; and victim understanding, p = 0.044); and the practice issues scale (p = 0.000). Actual knowledge also improved, but the change was only significant at p <= 0.10 (p = 0.06). The only scale that clearly showed no improvement was the opinions scale related to alcohol/drugs and IPV (p = 0.445).	This study shows that an asynchronous, interactive, online CME program developed by a cadre of national experts, in accordance with current online education best practices, can be successful in changing a number of physicians' IPV knowledge, attitudes, beliefs, and self-reported behaviors and practices, and that these changes can persist over >= 12 months.	Int: 12 months CC: NA

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Harris, 2005[75]	Int: Live, Audio, Print, Teleconference CC: NA	Int: Case-based learning, Lecture, Readings CC: NA	Int: Multiple time or repetitive CC: NA	Evaluation of quality of teleconferenced educational detailing CME	Attitudes	Yes	65% of FPs felt their knowledge of the Canadian Diabetes Association guidelines was considerably increased, 76% (22/29) were stimulated to implement new office strategies, and 100% felt the specialist moderators were excellent. Half of the FPs felt they learned as effectively as at a typical CME event.	CME delivered by teleconference was feasible, well attended, well received by participants, and improved some key diabetes management practices and outcomes, although primary goal of improving HbA1C was not achieved.	Int: 12 months CC: NA
Jennett, 1988[76]	Int: Live, Print, Teleconference Int: Live, Print, Teleconference CC: NA	Int: Discussion group, Feedback, Mentor/Preceptor, Readings Int: Discussion group, Feedback, Mentor/Preceptor, Readings CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NA	Value of the educational experience in cardiovascular medicine	Attitudes	Yes	FPs rated the program as 4.3 for value and 4.4 for relevance on a scale of 1-5, with 5 at high end of scale.	A carefully planned CME program, adhering to essential learning principles, was effective in changing office practice of volunteer doctors as long as 12 months after the intervention.	Int: 12 months Int: 12 months CC: 12 months

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of object-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Jennett, 1988[76]	Int: Live, Print, Teleconference Int: Live, Print, Teleconference CC: NA	Int: Discussion group, Feedback, Mentor/Precep-tor, Readings, Int: Discussion group, Feedback Mentor/Precep-tor, Readings CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NA	Value of the educational experience in cancer medicine	Attitudes	Yes	FPs rated the value and relevance of the program as 3.4 and 3.5 on scale of 1-5, with 5 representing the high end of the scale.	A carefully planned CME program, adhering to essential learning principles, was effective in changing office practice of volunteer doctors as long as 12 months after the intervention.	Int: 12 months Int: 12 months CC: 12 months
Mann, 1997[52]	Int: Live, Video, Print Int: Live, Video, Print, Cue stickers on medical chart CC: NA	Int: Case-based learning, Demonstration, Discussion group, Readings, Simulation (other than standardized patient or role-play) Int: Case-based learning, Demonstration, Discussion group, Point of care, Readings, Simulation (other than standardized patient or role-play) CC: NA	Int: Multiple time or repetitive Int: Multiple time or repetitive CC: NR	Physician attitude, as measured by posttests	Attitudes	Yes	Significant (p=0.03) group x time effect was seen in the overall attitude score. Pretest scores showed statistically significantly more positive attitudes (p=0.02) of some among the control group. Among other attitudes, the intervention groups had more positive attitudes (p=0.02) at posttest.	Educational training workshops appear to be effective in changing physicians' behavior, and should, thus, be continued along with additional research on the mechanisms of which behavior change occurs.	Int: 15 months Int: 15 months CC: 15 months

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of object-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Rodney, 1986[77]	Int: Live, Video Int: Live, Video CC: NA	Int: Demonstration, Lecture, Simulation (other than standardized patient or role-play) Int: Demonstration, Lecture, Simulation (other than standardized patient or role-play) CC: NA	Int: One time Int: One time CC: NA	Attitudes towards sigmoidos-copy, as measured by phone or written survey	Attitudes	Yes	Both small and large group learners reported that sigmoidoscopy was a positive contribution to practice.	Physicians who participate in courses in flexible sigmoidoscopy have a higher probability of office utilization of these skills than those who do not take courses. Minimal differences found between large and small group CME formats.	Int: 12-18 months Int: 12-18 months CC: NA

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Rodney, 1986[77]	Int: Live, Video Int: Live, Video CC: NA	Int: Demonstration, Lecture, Simulation (other than standardized patient or role-play) Int: Demonstration, Lecture, Simulation (other than standardized patient or role-play) CC: NA	Int: One time Int: One time CC: NA	Behavior related to flexible sigmoidoscopy use, as measured by phone or written survey	Attitudes Cognitive skills Practice behavior	Yes No Yes	Small group learners were more likely to acquire additional training and teaching attachments for their sigmoidoscopes, and less likely to use small (35 cm) scopes; there was no difference in biopsy utilization. 90% of large group learners acquired scopes after training vs. 40-56% of small groups. Small groups were associated with shorter procedure times ($p<0.05$) for first 10 procedures, but otherwise no differences in times, insertion depths, or number of exams performed. Compared to a randomly surveyed group of physicians, those with CME were significantly more likely to perform flexible sigmoidoscopy.	Physicians who participate in courses in flexible sigmoidoscopy have a higher probability of office utilization of these skills than those who do not take courses. Minimal differences found between large and small group CME formats.	Int: 12-18 months Int: 12-18 months CC: NA

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Clark, 2000[78]	Int: Live, Video CC: NA	Int: Case-based learning, Demonstration, Lecture CC: NA	Int: Multiple time or repetitive CC: NA	Patient parent perception of physician performance.	Attitudes	Yes	Parents of patients of physicians in the intervention group were more likely to report that the doctor had communicated and educated effectively, and that the physician paid close attention to the family.	Participating physicians reported that they communicated and taught patients in a more sophisticated way. Parents of intervention patients reported that physicians used a range of communication and education strategies to enhance patient learning and satisfaction. Intervention patients showed a decrease in hospitalization.	Int: 2 years CC: 2 years

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Gerstein, 1999[53]	Int: Live CC: NA	Int: Case-based learning, Discussion group CC: NA	Int: One time CC: NA	Knowledge, attitudes, and practice behavior regarding diabetes care, based on participant questionnaire	Knowledge Attitudes Practice behavior	Yes Yes Yes	After 40 days, participants' overall scores improved significantly while there was no change in the controls' scores (F =24.14; p<0.0001). Significant improvement was also noted in domains of attitude (F=31.75; p<0.0001), knowledge (F=4.23; P =0.041), and practice behavior (F=10.43; p=0.0014). However, improvement was not apparent after a year. Participants who completed 425-day assessment scored lower in attitude subscale compared to controls, despite having initially scored higher at the 40-day assessment.	An interactive, small group, diabetes continuing education program effectively disseminates practice guidelines to family physicians. The impact of such a program declines after 1 year.	Int: 24 months CC: NA
Attitudinal Objectives Not Met, Evaluation Duration Not Reported									
Block, 1988[37]	Int: Live, Print CC: NA	Int: Lecture, Point of care CC: NA	Int: Multiple time or repetitive CC: NA	Impact of CME on physician attitudes and behaviors as measured by questionnaire	Attitudes	No	Physicians in demonstration project felt equally strong influence of CME courses and consensus statements on their practice behaviors compared with physicians in control group.	MDs in a community with both physician and public education reported changing their practice more significantly than MDs in a comparison community.	Int: NR CC: NA

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of object-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Attitudinal Objectives Not Met, Evaluation Duration Greater Than 30 Days									
Chod-osh, 2006[62]	Int: Live, Internet, not real time, Print CC: NA	Int: Discussion group, Lecture CC: NA	Int: Multiple time or repetitive CC: NA	Providers' perceptions of care quality, as measured by question-naire	Attitudes	No	No difference in providers' perceptions existed about quality of care.	Despite a successful intervention demonstrating significant improvements in quality of care for patients with dementia, providers' knowledge and attitudes were minimally affected.	Int: 9 months CC: NA
Elliott, 1997[55]	CC: NA Int: Live, Print	CC: NA Int: Case-based learning, Clinical experiences, Discussion group, Lecture, Readings	CC: NA Int: Multiple time or repetitive	Physician and nurse attitudes toward CPM	Attitudes	No	There was a trend toward improved attitudes in the intervention group, but it was not statistically significant.	With the exception of attitudes of patients and caregivers, there was a trend toward improvement in pain ratings as well as provider attitudes and knowledge but the effect was minor and the overall results were not overwhelmingly convincing	CC: NA Int: 15 months

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Mann, 1997[52]	Int: Live, Video, Print	Int: Case-based learning, Demonstration, Discussion group, Readings, Simulation (other than standardized patient or role-play)	Int: Multiple time or repetitive	Physicians' perceptions of self-efficacy in cholesterol-lowering practices, as measured on Likert scale survey (14 items)	Attitudes	No	Overall posttest scores did not differ between intervention and control groups. Intervention groups (workshop and workshop + chart cue) had statistically significantly higher confidence on 1 of 14 practices at posttest 1 (dietary counseling) and 2 of 14 practices at posttest 2 (identifying patients to be screened and interpreting test results to patient). Results possibly due to multiple comparisons.	Educational training workshops appear to be effective in changing physician behavior, and should, thus, be continued along with additional research on the mechanisms of which behavior change occurs.	Int: 15 months
	Int: Live, Video, Print, Cue stickers on medical chart	Int: Case-based learning, Demonstration, Discussion group, Point of care, Readings, Simulation (other than standardized patient or role-play)	Int: Multiple time or repetitive						Int: 15 months
	CC: NA	CC: NA	CC: NR						CC: 15 months

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of object-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Attitudinal Objectives With No Control Group, Evaluation Duration Not Reported									
Grady, 1997[79]	CC: Live, Print Int: Live, Print Int: Live, Print	CC: Lecture, Readings Int: Lecture, Point of care, Readings Int: Feedback, Lecture, Point of care, Readings, Financial reward for compliance	CC: One time Int: Multiple time or repetitive Int: Multiple time or repetitive	Physician acceptance of the intervention	Attitudes	No con-trol group	Overall 38.7% of physicians used the educational materials and the Likert scale ratings of the cueing procedures, feedback, etc ranged from 2.9-3.8 (scale 1-5).	Cueing (posters and chart stickers) had a positive impact on mammography referral, completion, and compliance above and beyond education only. However, there was no added benefit from feedback and financial rewards for compliance. In addition, physician acceptance of the interventions was marginal. There also appears to be a complex impact of the physician characteristics on the results of the intervention	CC: NR Int: NR Int: NR

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Kemper, 2006[58]	Int: Internet, not real time	Int: Discussion group, Problem-based learning or team-based learning	Int: Online discussions; case-based, self-instructional modules	Differences of the three types of scores between the four groups	Knowledge Attitudes	No control group	No significant difference in any of the three outcome scores by delivery strategy.	Results from this study have important implications for professional education & future research. Educators wishing to use the Internet can be confident that improvements are not heavily dependent on the curriculum delivery strategy. The delivery method that is easiest for instructors (boluspush), may present the fewest barriers for completion (such as full mailboxes & institutional firewalls), particularly for short, introductory courses. The delivery strategy that is easiest does not appear to result in substantially worse outcomes. Additional interventions are needed to improve clinicians' communication behavior. This study demonstrated that Internet education can substantially improve clinicians' knowledge & confidence regardless of the delivery strategy.	Int: NR
	Int: Internet, not real time	Int: Discussion group, Problem-based learning or team-based learning	Int: Online discussions; case-based, self-instructional modules						Int: NR
	Int: Internet, not real time	Int: Discussion group, Problem-based learning or team-based learning	Int: Online discussions; case-based, self-instructional modules						Int: NR
	Int: Internet, not real time	Int: Discussion group, Problem-based learning or team-based learning	Int: Online discussions; case-based, self-instructional modules						Int: NR

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of object-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Kemp-er, 2006[58]	Int: Internet, not real time	Int: Discussion group, Problem-based learning or team-based learning	Int: Online discussions; case-based, self-instructional modules	Changes in knowledge, confidence and communi-cation scores	Knowl-edge Attitudes	No control group	Statistically significant improvement in scores after they were taken.	Results from this study have important implications for professional education & future research. Educators wishing to use the Internet can be confident that improvements are not heavily dependent on the curriculum delivery strategy. The delivery method that is easiest for instructors (boluspush), may present the fewest barriers for completion (such as full mailboxes & institutional firewalls), particularly for short, introductory courses. The delivery strategy that is easiest does not appear to result in substantially worse outcomes. Additional interventions are needed to improve clinicians' communication behavior. This study demonstrated that Internet education can substantially improve clinicians' knowledge & confidence regardless of the delivery strategy.	Int: NR
	Int: Internet, not real time	Int: Discussion group, Problem-based learning or team-based learning	Int: Online discussions; case-based, self-instructional modules						Int: NR
	Int: Internet, not real time	Int: Discussion group, Problem-based learning or team-based learning	Int: Online discussions; case-based, self-instructional modules						Int: NR
	Int: Internet, not real time	Int: Discussion group, Problem-based learning or team-based learning	Int: Online discussions; case-based, self-instructional modules						Int: NR

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of object-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Rosen-thal, 2005[59]	Int: Live, Handheld, Review of data CC: Review of data	Int: Lecture, Readings, Review of practice's data CC: Review of practice data	Int: Multiple time or repetitive CC: One time	Parent reports of preventive health behaviors	Attitudes	No con-trol group	For parents of both 1-month-olds and 6-month-olds, the control and intervention parents did not differ in the adjusted change in the proportion of parents reporting parent behaviors in age-specific topics.	An office system intervention improved parent reports of quantity of anticipatory guidance but did not change parent knowledge or parent behavior.	Int: NR CC: NR

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Leopold, 2005[80]	Int: Print, Int: Computer-based off-line Int: Live	Int: Readings Int: Demonstration, Readings Int: Demonstration, Feedback, Mentor/Preceptor, Simulation (other than standardized patient or role-play)	Int: NA Int: NA Int: One time	Confidence in task	Attitudes	No control group	Before the instruction, confidence skills did not differ between the three randomized groups. When stratified by demographic variables, gender and type of practitioner were considered to be significantly different with confidence of skill prior to instruction. After instruction, confidence levels increased for all groups.	Even low-intensity forms of instruction improve individuals' confidence, competence, and self-assessment of their skill in performing the fairly straightforward psychomotor task of simulated knee injection. However, men and physicians disproportionately overestimated their skills both before and after training, a finding that worsened as confidence increased. The inverse relationship between confidence and competence that we observed before the educational intervention as well as the demographic differences that we noted should raise questions about how complex new procedures should be introduced and when self-trained practitioners should begin to perform them.	Int: NR Int: NR Int: NR

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of object-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Attitudinal Objectives With Mixed Results, Evaluation Duration Greater Than 30 Days									
Norris, 2000[81]	Int: Live, Print, Followup phone calls about protocol CC: NA	Int: Lecture, Point of care, Opinion-leader from clinic teaching CC: NA	Int: Multiple time or repetitive CC: NA	Physician self-reported knowledge, attitudes, skills, and behavior in counseling patients about physical activity, as measured by question-naire	Attitudes	Mixed	Significant differences in 3 of 10 reported items: Intervention providers perceived themselves to be more knowledgeable about physical activity counseling (p=0.002), perceived time and effectiveness to be less of a barrier to counseling (p=0.003), and were 22% more likely to counsel patients about physical activity (p=0.03) than control physicians.	"A one-time PACE counseling session with minimal reinforcement, in a setting with high baseline levels of activity, does not further increase activity. Contemplators advanced in stage of behavior change."	Int: 6 months CC: NA
Chod-osh, 2006[62]	Int: Live, Internet, not real time, Print CC: NA	Int: Discussion group, Lecture CC: NA	Int: Multiple time or repetitive CC: NA	Providers' attitudes regarding dementia care, as measured by question-naire	Attitudes	Mixed	More intervention physicians strongly endorsed statement "Older patients with dementia are difficult to manage in primary care" (p=0.03). No other differences in attitude between intervention and usual-care providers were observed.	Despite a successful intervention demonstrating significant improvements in quality of care for patients with dementia, providers' knowledge and attitudes were minimally affected.	Int: 9 months CC: NA

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Unclear if Attitudinal Objectives Met, Evaluation Duration Greater Than 30 Days									
Schroy, 1999[82]	Int: Live CC: NA	Int: Academic detailing, Discussion group, Lecture CC: NA	Int: One time CC: NA	Provider attitudes or practices related to colorectal cancer screening as determined from a pre-educational vs. post-educational survey instrument, based on an instrument that was similar to one used by the American Cancer Society in 1989	Attitudes Practice behavior	Unclear Yes	At year 1, there were no significant differences in concern about patient fear and discomfort, time, procedural skills, or cost. However, the mean scores for equipment availability, efficacy, and yield were all significantly higher in the noncompliant group than the compliant group (p = 0.001). Most of the compliant providers were at the intervention sites, which indicate that availability of on-site screening may trump perceived barriers for sigmoidoscopy adherence. At baseline, 24% of providers at intervention sites and 19% at comparison sites reported recommending screening sigmoidoscopy. Overall, self-reported compliance rates increased by 36% at the intervention site, vs. 7% at the comparison site (p = 0.001).	"In summary, this study clearly shows that academic detailing in the form of an outreach didactic educational seminar followed by the implementation of on-site sigmoidoscopy services is an effective strategy for enhancing provider compliance with screening guidelines."	Int: 1 year CC: 1 year

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Schroy, 1999[82]	Int: Live CC: NA	Int: Academic detailing, Discussion group, Lecture CC: NA	Int: One time CC: NA	Physician concerns about patient fear, discomfort, time, procedural skill, cost, equipment availability, evidence and yield	Attitudes	Unclear	Providers were asked to rate their concerns on a Likert scale survey pre and one year post intervention. Results were NR by study groups but by compliant vs. noncompliant providers, with the statement that more compliant providers were in the intervention group.	"In summary, this study clearly shows that academic detailing in the form of an outreach didactic educational seminar followed by the implementation of on-site sigmoidoscopy services is an effective strategy for enhancing provider compliance with screening guidelines."	Int: 1 year CC: 1 year
Attitudinal Objectives With No Control Group, Evaluation Duration Greater Than 30 Days									
White, 2004[63]	Int: Live CC: Live	Int: Case-based learning, Discussion group CC: Case-based learning, Discussion group, Lecture	Int: One time CC: One time	Program evaluation	Attitudes	No control group	There was no significant difference between the two groups with respect to the overall rating of the CME program or to the knowledge gained at each test administration. The only statistically significant difference was found in the subjective assessment of the educational value of the program (4.36 vs. 3.93; $p=.04$) in the PBL session. The attrition rates for the third test administration for the lecture-based participants were higher than the attrition rate of PBL participants.	This study found no evidence that PBL is any better than more didactic learning sessions in facilitating knowledge gain, knowledge retention, or changes in attitude about asthma management. However, this study, similar to other studies, suggests that there is weak evidence that physicians attribute additional value to the more interactive PBL approach to CME.	Int: 3 months CC: 3 months

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of object-tive	Ob-jec-tives met	Summary of results	Overall conclusions	Evaluation duration
Lock-yer, 2002[64]	Int: Live Int: Live	Int: Case-based learning, Discussion group, Lecture, Role play Int: Case-based learning, Discussion group, Lecture	Int: One time Int: One time	Physician practice behaviors: comfort level	Attitudes	No con-trol group	Both track 1 (introductory course) and track 2 (advanced course) participants improved statistically significantly between pre and post-test scores; track 1 had a moderate effect size difference (0.5), and track 2 a minimal effect size (0.2). Between tracks comparisons showed statistically significant differences between tracks for both precourse and postcourse assessment of comfort.	Track 1 (introductory course) physicians improved moderately, while track 2 (advanced course) physicians showed a small or negligible change in knowledge, comfort, and involvement in patient care for dementia patients. Tracking in CME - assigning physicians to courses based on pre-course ability, interest, or skill - needs further study.	Int: 3 months Int: 3 months
Cher-kin, 1991[83]	Int: Live, Video Int: Live, Video	Int: Demonstration, Discussion group, Lecture Int: Demonstration, Discussion group, Lecture	Int: Multiple time or repetitive Int: One time	Self-assessment of provider knowledge of how to manage back pain	Attitudes	No con-trol group	The percentage of providers who believed they knew exactly what they needed to do to effectively manage patients with low back pain increased from 32% to 71% (p<0.01).	Both HMO and private practice achieved the first goal. As a result of the intervention about 50% of the physicians felt more confident in their ability to manage back pain.	Int: 4 months Int: 1-2 months
Cher-kin, 1991[83]	Int: Live, Video Int: Live, Video	Int: Demonstration, Discussion group, Lecture Int: Demonstration, Discussion group, Lecture	Int: Multiple time or repetitive Int: One time	Satisfaction with the intervention	Attitudes	No con-trol group	85% of the providers felt the 3 didactic components to have been "somewhat" useful, almost half (46-48%) found the first two components to be "very" useful.	Both HMO and private practice achieved the first goal. As a result of the intervention about 50% of the physicians felt more confident in their ability to manage back pain.	Int: 4 months Int: 1-2 months

Evidence table 9. Effectiveness of continuing medical education on short-term and long-term attitude outcomes

Author, year	Media used	Educational techniques	Amount of exposure	Main outcome measure	Type of objective	Objectives met	Summary of results	Overall conclusions	Evaluation duration
Cherkin, 1991[83]	Int: Live, Video Int: Live, Video	Int: Demonstration, Discussion group, Lecture Int: Demonstration, Discussion group, Lecture	Int: Multiple time or repetitive Int: One time	Level of physician comfort in the management of back pain	Attitudes	No control group	62% of participants felt "somewhat" more confident with back-pain management. About 50% felt more knowledgeable about the psychosocial and scientific aspects of low back pain.	Both HMO and private practice achieved the first goal. As a result of the intervention about 50% of the physicians felt more confident in their ability to manage back pain.	Int: 4 months Int: 1-2 months
Heale, 1988[66]	Int: Live Int: Live Int: Live	Int: Lecture Int: Case-based learning, Discussion group Int: Problem-based learning or team-based learning	Int: One time Int: One time Int: One time	Perception of the program by participants	Attitudes	No control group (yes for technique)	The small group problem-based learning participants differed significantly, and gave the CME day the highest rating (p value not provided).	Within a one day CME course in family medicine, the learning format had no effect on acquired or retained knowledge or on physician performance in three patient problems. Physicians rated the small group problem based format higher.	Int: 7 months Int: 7 months Int: 7 months

ARS = audience response system; ATP = allergy trial pack; CC = concurrent control; CME = continuing medical education; DV = domestic violence; FP = family practitioner; Int = intervention group; IPV = intimate partner violence; KFP = Key Features Program; MANOVA = multiple analysis of variance; NA = not applicable; NR = not reported; PBL = problem-based learning; PCP = primary care provider; SD = standard deviation; WBJC = Weekly Browsing Journal Club;