NATIONAL GUIDELINE CLEARINGHOUSE™ (NGC) GUIDELINE SYNTHESIS

CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD) PART III. PULMONARY REHABILITATION

Guidelines

1. **American College of Chest Physicians/American Association of Cardiovascular and Pulmonary Rehabilitation (ACCP/AACVPR)**. Pulmonary rehabilitation: joint ACCP/AACVPR evidence-based clinical practice guidelines. Chest 2007 May;131(5 Suppl):4S-42S. [211 references]
2. **Global Initiative for Chronic Obstructive Lung Disease (GOLD)**. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. Bethesda (MD): Global Initiative for Chronic Obstructive Lung Disease, World Health Organization, National Heart, Lung and Blood Institute; 2007. [420 references]
3. **National Collaborating Centre for Chronic Conditions/National Institute for Health and Clinical Excellence (NCCCC/NICE)**. Chronic obstructive pulmonary disease. National clinical guideline on management of chronic obstructive pulmonary disease in adults in primary and secondary care. Thorax 2004 Feb;59 Suppl 1:1-232. [491 references]
4. **Singapore Ministry of Health (SMOH)**. Chronic obstructive pulmonary disease. Singapore: Singapore Ministry of Health; 2006 Oct. 84 p. [155 references]

INTRODUCTION

A direct comparison of the American College of Chest Physicians/American Association of Cardiovascular and Pulmonary Rehabilitation (ACCP/AACVPR), Global Initiative for Chronic Obstructive Lung Disease (GOLD) (a collaborative project of the World Health Organization and the National Heart, Lung, and Blood Institute), the National Collaborating Centre for Chronic Conditions (a collaborating center for the National Institute for Health and Clinical Excellence [NCCCC/NICE]), and Singapore Ministry of Health (SMOH) recommendations for pulmonary rehabilitation of patients with COPD is provided in the tables below.

The GOLD, NCCCC/NICE and SMOH guidelines are broad in scope, providing recommendations on diagnosis and management of both stable COPD and acute exacerbations of disease; the GOLD guideline also addresses prevention strategies. In contrast, the scope of the ACCP/AACVPR guideline is relatively narrow, focusing only on recommendations for pulmonary rehabilitation in patients with COPD. Guideline recommendations for diagnosis and management of stable COPD are compared in Part I of this synthesis; recommendations for

diagnosis and management of acute exacerbations of COPD are compared in Part II of the synthesis.

The ACCP/AACVPR and GOLD guidelines are updates of previous versions. In developing their guidelines both GOLD and SMOH reviewed the 2004 NCCCC/NICE guideline; ACCP/AACVPR and SMOH reviewed the 2005 version of the GOLD guideline.

The tables below provide a side-by-side comparison of key attributes of each guideline, including specific interventions and practices that are addressed. The language used in these tables, particularly that which is used in Table 5, Table 6, and Table 7 is in most cases taken verbatim from the original guidelines:

- Table 1 provides a quick-view glance at the primary interventions considered by each group and which make up the focus of this guideline synthesis.
- Table 2 provides a comparison of the overall scope of the included guidelines.
- Table 3 provides a comparison of the methodology employed and documented by the guideline groups in developing their guidelines.
- Table 4 provides a comparison of the availability of the full-text guidelines and the implementation tools provided by the guideline groups.
- Table 5 provides a more detailed comparison of the specific recommendations offered by each group for the topics under consideration in this synthesis, including:
    - General Recommendations
    - Patient Selection
    - Exercise Training
    - Nutritional Intervention/Counseling
    - Education
    - Psychosocial Interventions
    - Follow-Up
    - Supporting References
- Table 6 lists the potential benefits associated with the implementation of each guideline as stated in the original guidelines
- Table 7 presents the rating schemes used by the guideline groups to rate the level of evidence and the strength of the recommendations.

A summary discussion of the areas of agreement and areas of differences among the guidelines is presented following the content comparison tables.

Abbreviations

- ACCP/AACVPR, American College of Chest Physicians/American Association of Cardiovascular and Pulmonary Rehabilitation
- COPD, chronic obstructive pulmonary disease
- GOLD, Global Initiative for Chronic Obstructive Lung Disease
- HRQOL, health related quality of life
- MRC, Medical Research Council
- NCCCC/NICE, National Collaborating Centre for Chronic Conditions/National Institute for Health and Clinical Excellence
- SMOH, Singapore Ministry of Health
- VMT, ventilatory muscle training

TABLE 1: COMPARISON OF INTERVENTIONS AND PRACTICES CONSIDERED *("✓" indicates topic is addressed)*				
	ACCP/AACVPR (2007)	**GOLD (2007)**	**NCCCC/NICE (2004)**	**SMOH (2006)**
General Recommendations	✓	✓	✓	✓
Patient Selection	✓	✓	✓	✓
Exercise Training	✓	✓	✓	✓
Nutritional Intervention/Counseling	✓	✓	✓	✓
Education	✓	✓	✓	✓
Psychosocial Interventions	✓	✓	✓	✓
Follow-Up	✓	✓		

TABLE 2: COMPARISON OF GUIDELINE SCOPE	
Objective and Scope	
ACCP/AACVPR (2007)	To update the 1997 guidelines published by the American College of Chest Physicians (ACCP) and the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) and to examine new areas of research relevant to pulmonary rehabilitation based on a comprehensive literature review
GOLD (2007)	• To increase awareness of COPD and decrease morbidity and mortality from the disease • To improve prevention and management of COPD through a concerted worldwide effort of people involved in all facets of health care and health care policy • To encourage an expanded level of research interest in this highly prevalent disease • To work toward combating the nihilistic attitude toward COPD by disseminating information about available treatments (both pharmacologic and nonpharmacologic)

	and by working with a network of experts—the Global Initiative for Chronic Obstructive Lung Disease (GOLD) National Leaders—to implement effective COPD management programs developed in accordance with local health care practices
NCCCC/NICE (2004)	• To develop a clinical guideline on the management of chronic obstructive pulmonary disease for use in the National Health Service (NHS) in England and Wales • To offer best practice advice on the identification and care of patients with COPD • To define the symptoms, signs, and investigations required to establish a diagnosis of COPD • To define the factors that are necessary to assess the severity of COPD, provide prognostic information, and guide best management • To provide guidance on the pharmacological and nonpharmacological treatment of patients with stable COPD and on the management of exacerbations • To discuss the interface with surgery and intensive therapy units
SMOH (2006)	To give physicians a practical approach and guide to the care of COPD patients
Target Population	
ACCP/AACVPR (2007)	• United States • Any stable patient with a chronic lung disease who is disabled by respiratory symptoms
GOLD (2007)	• Individuals with COPD
NCCCC/NICE (2004)	• England and Wales • Adults who have a clinical working diagnosis of COPD, including chronic bronchitis, emphysema, and chronic airflow limitation/obstruction **Note**: The guideline does not cover the management of people with asthma, bronchopulmonary dysplasia, and bronchiectasis, nor does it cover children.
SMOH (2006)	• Singapore • Patients with known or suspected COPD
Intended Users	

ACCP/AACVPR (2007)	Advanced Practice Nurses Dietitians Nurses Occupational Therapists Physical Therapists Physician Assistants Physicians Respiratory Care Practitioners Social Workers
GOLD (2007)	Advanced Practice Nurses Allied Health Personnel Nurses Physician Assistants Physicians Public Health Departments Respiratory Care Practitioners
NCCCC/NICE (2004)	Advanced Practice Nurses Allied Health Personnel Dietitians Health Care Providers Hospitals Nurses Occupational Therapists Patients Physical Therapists Physicians Public Health Departments Respiratory Care Practitioners Students
SMOH (2006)	Physicians

TABLE 3: COMPARISON OF METHODOLOGY	
Methods Used to Collect/Select the Evidence	
ACCP/AACVPR (2007)	*Hand-searches of Published Literature (Primary Sources)* *Searches of Electronic Databases* *Described Process*: The literature search was conducted through a comprehensive MEDLINE search from 1996 through 2004, and was supplemented by articles supplied by the guideline panel as well as by a review of

	bibliographies and reference lists from review articles and other existing systematic reviews. The literature search was limited to articles published in peer-reviewed journals only in the English language, and on human subjects. Inclusion criteria primarily included a population of persons with a diagnosis of chronic obstructive pulmonary disease (COPD) determined either by physical examination or by existing diagnostic criteria; however, those with other pulmonary conditions (e.g., asthma or interstitial lung disease) were also included. The search included randomized controlled trials (RCTs), meta-analyses, systematic reviews, and observational studies. The search strategy linked pulmonary rehabilitation or a pulmonary rehabilitation program with each key subcomponent, as listed in section on "Scope of Work" (see the original guideline document). To locate studies other than RCTs, such as systematic reviews and meta-analyses, those key words were used in searching MEDLINE and the Cochrane databases. Informal review articles were included only for hand searching additional references. For the purpose of this review, *pulmonary rehabilitation* was defined operationally as studies involving exercise training plus at least one additional component. Associated outcomes across all components were dyspnea, exercise tolerance, quality of life and activities of daily life, and health-care utilization. An initial review of 928 abstracts was conducted by the American College of Chest Physicians (ACCP) Clinical Research Analyst and the Research Specialist. Full articles (a total of 202) were formally reviewed and abstracted by the Clinical Research Analyst, and a total of 81 clinical trials were included in all evidence tables. Given the length of time required to prepare the final manuscript after the conclusion of the systematic literature review in December 2004, from which the tables were constructed, the committee was allowed to include reference to selected articles published in 2005 and 2006 in the text if the additional information provided by the newer publications was felt to be important. *Number of Source Documents*: A total of 81 clinical trials were included in all evidence tables. *Number of References*: 211
GOLD (2007)	*Hand-searches of Published Literature (Primary Sources)* *Hand-searches of Published Literature (Secondary Sources)*

	Searches of Electronic Databases *Described Process*: **Preparation of Yearly Updates** Immediately following the release of the first Global Initiative for Chronic Obstructive Lung Disease (GOLD) report in 2001, the GOLD Executive Committee appointed a Science Committee, charged with keeping the GOLD documents up-to-date by reviewing published research, evaluating the impact of this research on the management recommendations in the GOLD documents, and posting yearly updates of these documents on the GOLD Website. The first update to the GOLD report was posted in July 2003, based on publications from January 2001 through December 2002. A second update appeared in July 2004, and a third in July 2005, each including the impact of publications from January through December of the previous year. Producing the yearly updates began with a PubMed (http://www.nlm.nih.gov) search using search fields established by the Science Committee: 1) *COPD OR chronic bronchitis OR emphysema, All Fields, All Adult, 19+ years, only items with abstracts, Clinical Trial, Human, sorted by Author;* and 2) *COPD OR chronic bronchitis OR emphysema AND systematic, All Fields, All Adult, 19+ years, only items with abstracts, Human, sorted by Author.* In addition, publications in peer-reviewed journals not captured by PubMed could be submitted to individual members of the Science Committee, provided that an abstract and the full paper were submitted in (or translated into) English. The publications that met the search criteria for each yearly update (between 100 and 200 articles per year) mainly affected Chapter 5, Management of COPD. Lists of the publications considered by the Science Committee each year, along with the yearly updated reports, are posted on the GOLD Website, www.goldcopd.org. *Number of Source Documents*: Not stated *Number of References*: 420
NCCCC/NICE (2004)	*Hand-searches of Published Literature (Primary Sources)* *Hand-searches of Published Literature (Secondary Sources)*

Searches of Electronic Databases

Described Process:

Searching for the Evidence

There were four stages to evidence identification and retrieval:

1. The technical team set out a series of specific clinical questions (see Appendix A of the original guideline document [full version]) that covered the issues identified in the project scope. The Consensus Reference Group met to discuss, refine, and approve these questions as suitable for identifying appropriate evidence within the published literature.
2. A total of 120 questions were identified. The technical team and project executive agreed that a full literature search and critical appraisal process could not be undertaken for all of these areas due to the time limitations within the guideline development process. The technical team identified questions where it was felt that a full literature search and critical appraisal was essential.
3. The Information Scientist developed a search strategy for each evidence-based question to identify the available evidence. Identified titles and abstracts were reviewed for relevance to the agreed clinical questions and full papers obtained as appropriate.
4. The full papers were critically appraised and the pertinent data entered into evidence tables that were then reviewed and analysed by the Guideline Development Group as the basis upon which to formulate recommendations. The evidence tables are available at http://thorax.bmj.com/content/vol59/suppl_1/.

Literature Search

Limited details of the searches with regard to databases and constraints applied can be found in Appendix A of the original guideline document (full version). In general no formal contact was made with authors of identified studies, but occasionally it was necessary to contact authors for clarification of specific points. Additional contemporary articles were identified by the Guideline Development Group on an ad hoc basis. Stakeholder evidence identified via a process established by the National Institute for Clinical Excellence was incorporated where appropriate. Both were assessed for inclusion by the same criteria as evidence

	provided by the electronic searches. Searches were re-run at the end of the guideline development process, thus including evidence published up to the end of May 2003. Studies recommended by stakeholders or Guideline Development Group members that were published after this date were not considered for inclusion. This time-point should be the starting point for searching for new evidence for future updates to this guideline. **Literature Search for Economic Evidence** While evidence on cost effectiveness was extracted from the main searches wherever it existed, this was rare. It was necessary to undertake a separate search for information on the potential costs and benefits of the interventions and management strategies considered in this guideline. These searches were carried out by the health economist. The Guideline Development Group realised that few formal cost effectiveness analyses would be identified; therefore, the search for economic evidence was very broad and designed to identify information about the resources used in providing a service or intervention and/or the benefits that can be attributed to it. No study design criteria were imposed a priori (i.e., the searches were not limited to randomised control trials or formal economic evaluations). Further details of the searches for economic evidence are given in section 15, Appendix E of the original guideline document (full version). *Number of Source Documents*: Not stated *Number of References*: 491
SMOH (2006)	*Searches of Electronic Databases* (Process not described) *Number of Source Documents*: Not stated *Number of References*: 155
Methods Used to Assess the Quality and Strength of the Evidence	
ACCP/AACVPR (2007)	Weighting According to a Rating Scheme (Scheme Given - Refer to Table 7)
GOLD (2007)	Weighting According to a Rating Scheme (Scheme Given - Refer to Table 7)

NCCCC/NICE (2004)	Weighting According to a Rating Scheme (Scheme Given - Refer to Table 7)
SMOH (2006)	Weighting According to a Rating Scheme (Scheme Given - Refer to Table 7)
Methods Used to Analyze the Evidence	
ACCP/AACVPR (2007)	*Review of Published Meta-Analyses* *Systematic Review with Evidence Tables* *Described Process*: Randomized controlled trials were scored using a simplified system that was based on methods of randomization, blinding, and documentation of withdrawals/loss to follow-up. This system follows a method that is based on a 3-point scale, which rates randomization (and appropriateness), blinding (and appropriateness), and tracking of withdrawals and loss to follow-up. Studies were graded on a scale of 0 to 5. No formal quantitative analysis was performed due to the wide variation in methodologies reported in studies.
GOLD (2007)	*Review of Published Meta-Analyses* *Systematic Review with Evidence Tables* *Described Process*: Not stated
NCCCC/NICE (2004)	*Review of Published Meta-Analyses* *Systematic Review with Evidence Tables* *Described Process*: **Synthesising the Evidence** Abstracts of articles identified from the searches were screened for relevance. Hard copies were ordered of papers that appeared to provide useful evidence relevant to each clinical question. Each paper was assessed for its methodological quality against pre-defined criteria using a validated quality appraisal tool. Papers that met the inclusion criteria were then assigned a level according to the evidence hierarchy (see Rating Scheme for the Strength of the Evidence in this summary). Owing to practical limitations, the selection, critical appraisal, and data extraction were undertaken by one reviewer only. Evidence was considered carefully by the Guideline Development

Group (GDG) for accuracy and completeness.

Each clinical question dictated the appropriate study design that was prioritised in the search strategy. In addition certain topics within any one clinical question at times required different evidence types to be considered. Randomised control trials (RCTs) were the most appropriate study design for a number of clinical questions, as they lend themselves particularly well to research into medicines. They were not, however, the most appropriate study design for all clinical questions. For example, the evaluation of diagnostic tests is more suited to alternative research designs. Furthermore, RCTs are more difficult to perform in areas such as rehabilitation and lifestyle, where interventions may be tailored to the needs of the individual. As such, pharmaceutical interventions tend to be placed higher in the evidence hierarchy than other equally important interventions. This should not be interpreted as a preference for a particular type of intervention or as a reflection of the quality of the evidence, particularly for those clinical areas where non-RCT evidence is valid and most appropriate.

Where available, evidence from well-conducted systematic reviews was appraised and presented. Trials included within these reviews are listed in the evidence table but were not critically appraised. Studies identified in addition to those included in the systematic review were included in the appraisal process.

The study populations considered varied between clinical questions. At times evidence was not available from studies that were specific to a chronic obstructive pulmonary disease population; therefore, it was necessary to consider studies in either a heterogeneous respiratory disease population or other chronic conditions.

Study quality, although formally assessed, was not used as a basis for informing the evidence level assigned to evidence statements. Descriptive limitations of studies are included in the evidence statements as appropriate.

Expert Papers

On occasion the GDG identified a clinical question that could not be appropriately answered through undertaking a systematic review (where the evidence was scarce or where the question could not usefully be answered with the largely dichotomous output of a review). These questions were addressed via an expert-drafted discussion paper, subject to consideration by the GDG. In these instances Medline and

	Cochrane databases were searched together with a review of frequently cited papers and key review articles but there was no formal assessment of the studies cited. These review papers were developed and used as a basis for discussion by the GDG as a whole. Finally, national and international evidence based guidelines were referred to during the development process. These were not formally appraised owing to the inherent difficulties of such a process, in that the consistency of process and of evidence base can be difficult to ascertain across such documents.
SMOH (2006)	*Review of Published Meta-Analyses* *Systematic Review* *Described Process*: Not stated
Outcomes	
ACCP/AACVPR (2007)	• Dyspnea • Exercise tolerance • Quality of life and activities of daily life • Health-care utilization
GOLD (2007)	• Mortality • Morbidity, including physician visits, emergency department visits, and hospitalizations • Economic cost and social burden
NCCCC/NICE (2004)	• Signs and symptoms • Activities of daily living • Lung function, as measured by forced expiratory volume in 1 second (FEV_1), forced vital capacity (FVC), and peak expiratory flow • Arterial oxygen saturation • Exercise capacity/tolerance • Quality of life • Hospitalisation • Number or duration of exacerbations • Morbidity • Mortality • Cost measures, including cost effectiveness • Quality adjusted life year
SMOH	• Diagnostic and prognostic utility of tests

(2006)	• Efficacy of management/treatment strategies on:
	  • Symptoms
	  • Exercise capacity
	  • Frequency and severity of acute exacerbations
	  • Health-related quality of life
	  • Progression of disease
	  • Pulmonary function
	  • Survival
	• Side effects and complications of treatments

Methods Used to Formulate the Recommendations	
ACCP/AACVPR (2007)	*Expert Consensus* *Described Process*: The guideline panel was organized under the joint sponsorship of the American College of Chest Physicians (ACCP) and the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR). Panel members were evenly distributed between and selected by the two organizations with a goal of making the panel multidisciplinary and geographically diverse. In addition to several conference calls, the panel met for one 2-day meeting to review the evidence tables and become familiar with the process of grading recommendations. Writing assignments were determined by members' known expertise in specific areas of pulmonary rehabilitation. Each section of the guideline was assigned to one primary author and at least one secondary author. Sections were reviewed by relevant panel members when topics overlapped. The ACCP system for grading guideline recommendations is based on the relationship between the strength of the evidence and the balance of benefits to risk and burden (see "Table 7: Evidence Rating Schemes and References" of this synthesis). Simply stated, recommendations can be grouped on the following two levels: strong (grade 1); and weak (grade 2). If there is certainty that the benefits do (or do not) outweigh risk, the recommendation is strong. If there is less certainty or the benefits and risks are more equally balanced, the recommendation is weaker. Several important issues must be considered when classifying recommendations. These include the quality of the evidence that supports estimates of benefit, risks, and costs; the importance of the outcomes of the intervention; the magnitude and the precision of estimate of the treatment effect; the risks and burdens of an intended therapy; the

	risk of the target event; and varying patient values. Table 2 in the original guideline document describes the balance of benefits to risk and burden, and the level of certainty based on this balance. As stated above, the more certain the balance, or lack thereof, the stronger the recommendation. Patient and community values are important considerations in clinical decision making and are factored into the grading process. In situations in which the benefits clearly do or do not outweigh the risks, it is assumed that nearly all patients would have the same preferences. For weaker recommendations, however, there may not be consistency in patient preferences.
GOLD (2007)	*Expert Consensus (Nominal Group Technique)* *Described Process*: In January 2005, the Global Initiative for Chronic Obstructive Lung Disease (GOLD) Science Committee initiated its work on a comprehensively updated version of the GOLD report. During a two-day meeting, the committee established that the report structure should remain the same as in the 2001 document, but that each chapter would be carefully reviewed and modified in accordance with new published literature. The committee met in May and September 2005 to evaluate progress and to reach consensus on the messages to be provided in each chapter. Throughout its work, the committee made a commitment to develop a document that would reach a global audience, be based on the most current scientific literature, and be as concise as possible, while at the same time recognizing that one of the values of the GOLD report has been to provide background information on chronic obstructive pulmonary disease (COPD) management and the scientific principles on which management recommendations are based. In January 2006, the Science Committee met with the Executive Committee for a two-day session during which another in-depth evaluation of each chapter was conducted. At this meeting, members reviewed the literature that appeared in 2005—using the same criteria developed for the update process. The list of 2005 publications that were considered is posted on the GOLD website. At the January meeting, it was clear that work remaining would permit the report to be finished during the summer of 2006, and the Science Committee requested that, as publications appeared throughout early 2006, they be reviewed carefully for their impact on the recommendations. At the committee's next meeting, in May 2006, publications meeting the search criteria were considered and incorporated into the current drafts of the chapters where appropriate. A final meeting of

	the committee was held in September 2006, at which time publications that appeared prior to July 31, 2006 were considered for their impact on the document. All members of the committee received a summary of citations and all abstracts. Each abstract was assigned to two committee members (members were not assigned papers they had authored), although any member was offered the opportunity to provide an opinion on any abstract. Each member evaluated the assigned abstracts or, where s/he judged necessary, the full publication, by answering specific written questions from a short questionnaire, and indicating whether the scientific data presented affected recommendations in the GOLD report. If so, the member was asked to specifically identify modifications that should be made. The GOLD Science Committee met on a regular basis to discuss each individual publication indicated by at least one member of the committee to have an impact on COPD management, and to reach a consensus on the changes needed in the report. Disagreements were decided by vote. Periodically throughout the preparation of this report (May and September 2005, May and September 2006), representatives from the GOLD Science Committee met with the GOLD National Leaders to discuss COPD management and issues specific to each of the chapters. The GOLD National Leaders include representatives from over 50 countries and many participated in these interim discussions.
NCCCC/NICE (2004)	*Expert Consensus* *Expert Consensus (Nominal Group Technique)* *Described Process*: The National Collaborating Centre for Chronic Conditions is housed by the Royal College of Physicians (RCP) but governed by a multi-professional partners board inclusive of patient groups and National Health Service management. The Collaborating Centre was set up in 2001, to undertake commissions from the National Institute for Clinical Excellence (NICE), to develop clinical guidelines for the National Health Service. The technical team consisted of an information scientist, a systematic reviewer, a lead clinical advisor, and a health economist, supported by project management and administrative personnel. The clinical advisor also acted as the appointed Chair of the Guidelines Development Group (GDG). The technical team met monthly in addition to

partaking in the meetings of the GDG.

The GDG met twelve times at monthly intervals to review the evidence identified by the technical team, to comment on its completeness, and to develop and refine clinical recommendations based on that evidence and other considerations. Editorial responsibility for the guideline rested solely with the GDG, which also developed the audit criteria.

An extension of the GDG, the larger Consensus Reference Group, met three times throughout the process, once early in the development to ensure the aims and clinical questions were appropriate, once after three meetings of the GDG to confirm an operational definition of chronic obstructive pulmonary disease (COPD) and agree recommendations on diagnosis. Finally, at the end of the process to review the validity of the recommendations drafted by the GDG. The group employed formal consensus techniques.

Involvement of People with COPD

As part of the development process, the National Collaborating Centre for Chronic Conditions was keen to ensure that the guideline development process was informed by the views of people with COPD and their carers. This was achieved in two ways:

- By securing patient organisation representation on the guideline development group
- By having a patient with COPD on the guideline development group

The patient and a representative of the British Lung Foundations Breathe Easy patient support groups were present at every meeting of the GDG and Consensus Reference Group. They were therefore involved at every stage of the guideline development process and were able to consult with their wider constituencies throughout the process.

Drafting Recommendations

Evidence for each topic was extracted into tables and summarised in evidence statements. The Guideline Development Group reviewed the evidence tables and statements at each meeting and reached a group opinion. Recommendations were explicitly linked to the evidence supporting them and graded according to the level of the evidence upon which they were based, using the grading

	system detailed in section 3 of the original guideline document (full version) and "Table 7: Evidence Rating Schemes and References" of this synthesis. **Agreeing Recommendations** Once the evidence review had been completed and an early draft of the guideline produced, a one-day meeting of the Consensus Reference Group was held to finalise the recommendations. This included a premeeting vote on the recommendations and a further vote at the Consensus Reference Group meeting, where the group was asked to consider the draft guideline in 2 stages: 1. Are the evidence-based statements acceptable and is the evidence cited sufficient to justify the grading attached? 2. Are the recommendations derived from the evidence justified and are they sufficiently practical so that those at the clinical front line can implement them prospectively? There were 3 types of recommendation to be considered: • A recommendation from the Guideline Development Group based on strong evidence — usually noncontroversial unless there was important evidence that had been missed or misinterpreted • A recommendation that was based on good evidence but where it was necessary to extrapolate the findings to make it useful in the National Health Service the extrapolation approved by consensus • Recommendations for which no evidence exists but which address important aspects of chronic obstructive pulmonary disease care or management — and for which a consensus on best practice could be reached. This formal consensus method has been established within the National Collaborating Centre for Chronic Conditions, drawing on the knowledge set out in the Health Technology Appraisal, and practical experience. **Writing the Guideline** The first formal version of the guideline was drawn up by the technical team in accord with the decisions of the Guideline Development Group.
SMOH (2006)	*Expert Consensus*

	Described Process: Not stated
Financial Disclosures/Conflicts of Interest	
ACCP/AACVPR (2007)	At several stages during the guideline development period, panel members were asked to disclose any conflict of interest. These occurred at the time the panel was nominated, at the first face-to-face meeting, the final conference call, and prior to publication. Written forms were completed and are on file at the American College of Chest Physicians (ACCP). The authors have reported to the ACCP that no significant conflicts of interest exist with any companies/organizations whose products or services may be discussed in this article.
GOLD (2007)	Disclosure forms for Global Initiative for Chronic Obstructive Lung Disease (GOLD) Committees are posted on the GOLD Web site.
NCCCC/NICE (2004)	All group members made a formal Declaration of Interests at the start of the guideline development and provided updates throughout the process. The National Collaborating Centre for Chronic Conditions (NCC-CC) and the Group Chair monitored these.
SMOH (2006)	Not stated

TABLE 4: AVAILABILITY AND IMPLEMENTATION TOOLS PROVIDED	
Composition of Group that Authored the Guideline	
ACCP/AACVPR (2007)	*Members identified; Multidisciplinary; No patient representation*
GOLD (2007)	*Members identified; Affiliations provided; Multidisciplinary; No patient representation*
NCCCC/NICE (2004)	*Members identified; Affiliations provided; Multidisciplinary; Includes patient representation*
SMOH (2006)	*Members identified; Affiliations provided; Multidisciplinary; No patient representation*
Source(s) of Funding	

ACCP/AACVPR (2007)	Not stated.
GOLD (2007)	The Global Initiative for Chronic Obstructive Lung Disease (GOLD) has been made possible by educational grants from: Altana, AstraZeneca, Boehringer Ingelheim, Chiesi, GlaxoSmithKline, Mitsubishi Pharma Corporation, Nikken Chemicals, Co., Ltd., Novartis, and Pfizer.
NCCCC/NICE (2004)	National Institute for Clinical Excellence (NICE)
SMOH (2006)	Singapore Ministry of Health
Guideline Availability	
ACCP/AACVPR (2007)	*Electronic and print distribution* Electronic copies: Available to subscribers of Chest - The Cardiopulmonary and Critical Care Journal. Print copies: Available from the American College of Chest Physicians, Products and Registration Division, 3300 Dundee Road, Northbrook IL 60062-2348.
GOLD (2007)	*Electronic and print distribution; Open access* Electronic copies: Available from the Global Initiative for Chronic Obstructive Lung Disease (GOLD) Web site.
NCCCC/NICE (2004)	*Electronic distribution; Open access* Electronic copies: Available in Portable Document Format (PDF) format from the National Institute for Clinical Excellence (NICE) Web site.
SMOH (2006)	*Electronic and print distribution; Open access* Electronic copies: Available in Portable Document Format (PDF) from the Singapore Ministry of Health Web site.
Implementation Tools	
ACCP/AACVPR (2007)	Quick Reference Guides/Physician Guides
GOLD (2007)	Clinical Algorithm Foreign Language Translations

	Pocket Guide/Reference Cards Slide Presentation
NCCCC/NICE (2004)	Audit Criteria/Indicators Clinical Algorithm Patient Resources Quick Reference Guides/Physician Guides
SMOH (2006)	Audit Criteria/Indicators Clinical Algorithm Quick Reference Guides/Physician Guides Slide Presentation Staff Training/Competency Material

TABLE 5: COMPARISON OF RECOMMENDATIONS FOR PULMONARY REHABILITATION OF COPD	
General Recommendations	
ACCP/AACVPR (2007)	Comprehensive pulmonary rehabilitation programs include patient assessment, exercise training, education, and psychosocial support. The interdisciplinary team of health-care professionals in pulmonary rehabilitation may include physicians; nurses; respiratory, physical, and occupational therapists; psychologists; exercise specialists; and/or others with appropriate expertise. The specific team make-up depends on the resources and expertise available, but usually includes at least one full-time staff member. **Recommendations** • Pulmonary rehabilitation improves the symptom of dyspnea in patients with COPD. **Grade of Recommendation 1A** • Pulmonary rehabilitation improves health related quality of life (HRQOL) in patients with COPD. **Grade of Recommendation 1A** • Pulmonary rehabilitation reduces the number of hospital days and other measures of health-care utilization in patients with COPD. **Grade of Recommendation 2B** • Pulmonary rehabilitation is cost-effective in patients with COPD. **Grade of Recommendation 2C** • There is insufficient evidence to determine if pulmonary rehabilitation improves survival in patients with COPD. **No recommendation is provided.**

	• There are psychosocial benefits from comprehensive pulmonary rehabilitation programs in patients with COPD. **Grade of Recommendation 2B** • Six to 12 weeks of pulmonary rehabilitation produces benefits in several outcomes that decline gradually over 12 to 18 months. **Grade of Recommendation 1A.** Some benefits, such as HRQOL, remain above control at 12 to 18 months. **Grade of Recommendation 1C** • Longer pulmonary rehabilitation programs (12 weeks) produce greater sustained benefits than shorter programs. **Grade of Recommendation 2C** • Maintenance strategies following pulmonary rehabilitation have a modest effect on long-term outcomes. **Grade of Recommendation 2C** • Current scientific evidence does not support the routine use of anabolic agents in pulmonary rehabilitation for patients with COPD. **Grade of Recommendation 2C** • Pulmonary rehabilitation is beneficial for some patients with chronic respiratory diseases other than COPD. **Grade of Recommendation: 1B** • Although no recommendation is provided since scientific evidence is lacking, current practice and expert opinion suggest that pulmonary rehabilitation for patients with chronic respiratory diseases other than COPD should be modified to include treatment strategies specific to individual diseases and patients in addition to treatment strategies common to both COPD and non-COPD patients.
GOLD (2007)	*Rehabilitation* The principal goals of pulmonary rehabilitation are to reduce symptoms, improve quality of life, and increase physical and emotional participation in everyday activities. To accomplish these goals, pulmonary rehabilitation covers a range of non-pulmonary problems that may not be adequately addressed by medical therapy for COPD. Such problems, which especially affect patients with *Stage II: Moderate COPD, Stage III: Severe COPD, and Stage IV: Very Severe COPD,* include exercise de-conditioning, relative social isolation, altered mood states (especially depression), muscle wasting, and weight loss. These problems have complex interrelationships and improvement in any one of these interlinked processes can interrupt the "vicious circle" in COPD so that positive gains occur in all aspects of the illness (see Figure 5.3-9 in the original guideline document). A comprehensive statement on pulmonary rehabilitation has been prepared by the American Thoracic Society/European Respiratory Society.

	See Figure 5.3-10 in the original guideline document for a list of benefits of pulmonary rehabilitation in COPD. <u>Components of Pulmonary Rehabilitation Programs</u> The components of pulmonary rehabilitation vary widely from program to program but a comprehensive pulmonary rehabilitation program includes exercise training, nutrition counseling, and education. See the individual sections of this synthesis for a discussion of these components. <u>Patient Selection and Program Design</u> Ideally, pulmonary rehabilitation should involve several types of health professionals. Significant benefits can also occur with more limited personnel, as long as dedicated professionals are aware of the needs of each patient. Benefits have been reported from rehabilitation programs conducted in inpatient, outpatient, and home settings. Considerations of cost and availability most often determine the choice of setting. The educational and exercise training components of rehabilitation are usually conducted in groups, normally with 6 to 8 individuals per class (**Evidence D**). **Note**: Refer to the following section of this synthesis for recommendations on patient selection.
NCCCC/NICE (2004)	Pulmonary rehabilitation is defined as a multidisciplinary programme of care for patients with chronic respiratory impairment that is individually tailored and designed to optimise each patient's physical and social performance and autonomy. **Grade A** - Pulmonary rehabilitation should be made available to all appropriate patients with COPD. **Grade D** - For pulmonary rehabilitation programmes to be effective, and to improve concordance, they should be held at times that suit patients and in buildings that are easy for patients to get to and have good access for people with disabilities. Places should be available within a reasonable time of referral. **Grade D** - Patients should be made aware of the benefits of pulmonary rehabilitation and the commitment required to gain these.
SMOH (2006)	**Pulmonary Rehabilitation**

	Pulmonary rehabilitation is a structured multidisciplinary program of care for patients with chronic respiratory impairment that is individually tailored and designed to optimize physical and social performance and autonomy. Team members include respiratory physicians, family physicians, nurses, physiotherapists, occupational therapists, dieticians, and medical social workers. Pulmonary rehabilitation can be conducted as inpatient, outpatient or home programs. Consideration of cost, availability and accessibility will determine the patient's choice. Studies have shown that COPD patients undergoing pulmonary rehabilitation have experienced the following benefits: • Improvement in exercise capacity and functional walking distance • Relief of dyspnoea and fatigue as well as enhancement of mastery (sense of control over condition) • Improvement in health related quality of life • Reduction in the number of hospitalizations and days in hospital • Reduction in anxiety and depression
Patient Selection	
ACCP/AACVPR (2007)	Pulmonary rehabilitation is appropriate for any stable patient with a chronic lung disease who is disabled by respiratory symptoms. Patients with advanced disease can benefit if they are selected appropriately and if realistic goals are set.
GOLD (2007)	<u>Patient Selection and Program Design</u> Although more information is needed on criteria for patient selection for pulmonary rehabilitation programs, COPD patients at all stages of disease appear to benefit from exercise training programs, improving with respect to both exercise tolerance and symptoms of dyspnea and fatigue (**Evidence A**). Data suggest that these benefits can be sustained even after a single pulmonary rehabilitation program. Benefit does wane after a rehabilitation program ends, but if exercise training is maintained at home, the patient's health status remains above pre-rehabilitation levels (**Evidence B**). To date there is no consensus on whether repeated rehabilitation courses enable patients to sustain the benefits

	gained through the initial course. The following points summarize current knowledge of considerations important in choosing patients: Functional status: Benefits have been seen in patients with a wide range of disability, although those who are chair-bound appear unlikely to respond even to home visiting programs (**Evidence A**). Severity of dyspnea: Stratification by breathlessness intensity using the MRC questionnaire (**Figure 5.1-3** in the original guideline document) may be helpful in selecting patients most likely to benefit from rehabilitation. Those with MRC grade 5 dyspnea may not benefit (**Evidence B**). Motivation: Selecting highly motivated participants is especially important in the case of outpatient programs. Smoking status: There is no evidence that smokers will benefit less than nonsmokers, but many clinicians believe that inclusion of a smoker in a rehabilitation program should be conditional on their participation in a smoking cessation program. Some data indicate that continuing smokers are less likely to complete pulmonary rehabilitation programs than nonsmokers (**Evidence B**).
NCCCC/NICE (2004)	**Grade D** - Pulmonary rehabilitation should be offered to all patients who consider themselves functionally disabled by COPD (usually MRC grade 3 and above). Pulmonary rehabilitation is not suitable for patients who are unable to walk, who have unstable angina, or who have had a recent myocardial infarction.
SMOH (2006)	**D** - Pulmonary rehabilitation may be considered for patients with the following ("Pulmonary Rehabilitation," 1999; Puhan et al., 2005; Salman et al., 2003): • Persistent symptoms especially dyspnoea • Reduced exercise tolerance or experience a restriction in activities • Recurrent admissions to hospitals over the last 6 months **(Grade D, Level 4)** The following conditions may adversely affect the outcome of pulmonary rehabilitation: 1. Conditions that may interfere with the patient

	undergoing the rehabilitation programme (e.g., advanced arthritis, inability to learn or disruptive behavior). 2. Conditions that may place the patient at undue risk during exercise training (e.g., severe pulmonary hypertension, unstable angina or recent myocardial infarction). 3. Poorly motivated patients who are unable to complete the entire rehabilitation programme.
Exercise Training	
ACCP/AACVPR (2007)	Exercise training is one of the key components of pulmonary rehabilitation. The exercise prescription for the training program is guided by the following three parameters: intensity; frequency; and duration. The characteristics of exercise programs in pulmonary rehabilitation for patients with COPD have not been extensively investigated. • A program of exercise training of the muscles of ambulation is recommended as a mandatory component of pulmonary rehabilitation for patients with chronic obstructive pulmonary disease (COPD). **Grade of Recommendation 1A** • Six to 12 weeks of pulmonary rehabilitation produces benefits in several outcomes that decline gradually over 12 to 18 months. **Grade of Recommendation 1A.** Some benefits, such as HRQOL, remain above control at 12 to 18 months. **Grade of Recommendation 1C** • Longer pulmonary rehabilitation programs (12 weeks) produce greater sustained benefits than shorter programs. **Grade of Recommendation 2C** • Lower-extremity exercise training at higher exercise intensity produces greater physiologic benefits than lower-intensity training in patients with COPD. **Grade of Recommendation 1B** • Both low- and high-intensity exercise training produce clinical benefits for patients with COPD. **Grade of Recommendation 1A** • Addition of a strength training component to a program of pulmonary rehabilitation increases muscle strength and muscle mass. **Strength of evidence: 1A** • Unsupported endurance training of the upper extremities is beneficial in patients with COPD and should be included in pulmonary rehabilitation programs. **Grade of Recommendation 1A** • The scientific evidence does not support the routine use of inspiratory muscle training as an essential component of pulmonary rehabilitation. **Grade of Recommendation 1B**

	• Supplemental oxygen should be used during rehabilitative exercise training in patients with severe exercise-induced hypoxemia. **Grade of Recommendation: 1C** • Administering supplemental oxygen during high-intensity exercise programs in patients without exercise-induced hypoxemia may improve gains in exercise endurance. **Grade of Recommendation: 2C** • As an adjunct to exercise training in selected patients with severe COPD, noninvasive ventilation produces modest additional improvements in exercise performance. **Grade of Recommendation: 2B**
GOLD (2007)	Exercise training. Exercise tolerance can be assessed by either bicycle ergometry or treadmill exercise with the measurement of a number of physiological variables, including maximum oxygen consumption, maximum heart rate, and maximum work performed. A less complex approach is to use a self-paced, timed walking test (e.g., 6-minute walking distance). These tests require at least one practice session before data can be interpreted. Shuttle walking tests offer a compromise: they provide more complete information than an entirely self-paced test, but are simpler to perform than a treadmill test. Exercise training ranges in frequency from daily to weekly, in duration from 10 minutes to 45 minutes per session, and in intensity from 50% peak oxygen consumption (VO2 max) to maximum tolerated. The optimum length for an exercise program has not been investigated in randomized controlled trials but most studies involving fewer than 28 exercise sessions show inferior results compared to those with longer treatment periods. In practice, the length depends on the resources available and usually ranges from 4 to 10 weeks, with longer programs resulting in larger effects than shorter programs. Participants are often encouraged to achieve a predetermined target heart rate, but this goal may have limitations in COPD. In many programs, especially those using simple corridor exercise training, the patient is encouraged to walk to a symptom-limited maximum, rest, and then continue walking until 20 minutes of exercise have been completed. Where possible, endurance exercise training to 60 to 80% of the symptom-limited maximum is preferred. Endurance training can be accomplished through continuous or interval exercise programs. The latter involve the patient doing the same total work but divided into briefer periods of high-intensity exercise, which is useful when performance is limited by other comorbidities. Use of

	a simple wheeled walking aid seems to improve walking distance and reduces breathlessness in severely disabled COPD patients (**Evidence C**). Other approaches to improving outcomes such as use of oxygen during exercise, exercising while breathing heliox gas mixtures, unloading the ventilator muscles while exercising, or use of pursed lip breathing remain experimental at present. Specific strength training is possible but its benefits remain uncertain, as do the effects of supplementation with anabolic steroids and the use of neuromuscular electrical stimulation. The minimum length of an effective rehabilitation program is 6 weeks; the longer the program continues, the more effective the results (Evidence B). However, as yet, no effective program has been developed to maintain the effects over time. Many physicians advise patients unable to participate in a structured program to exercise on their own (e.g., walking 20 minutes daily). The benefits of this general advice have not been tested, but it is reasonable to offer such advice to patients if a formal program is not available. Some programs also include upper limb exercises, usually involving an upper limb ergometer or resistive training with weights. There are no randomized clinical trial data to support the routine inclusion of these exercises, but they may be helpful in patients with comorbidities that restrict other forms of exercise and those with evidence of respiratory muscle weakness. The addition of upper limb exercises or other strength training to aerobic training is effective in improving strength, but does not improve quality of life or exercise tolerance.
NCCCC/NICE (2004)	**Grade A** - Pulmonary rehabilitation programmes should include multicomponent, multidisciplinary interventions, which are tailored to the individual patient's needs. The rehabilitation process should incorporate a programme of physical training, disease education, and nutritional, psychological, and behavioural intervention.
SMOH (2006)	**B** - The physical components of pulmonary rehabilitation should include both lower extremity training (e.g., bicycle, ergometry, treadmill) and upper extremity training (strength and endurance) ("Pulmonary rehabilitation: joint ACCP/AACVPR evidence-based Guidelines," 1997). (**Grade B, Level 2+**)
Nutritional Interventions/Counseling	
ACCP/AACVPR (2007)	There is insufficient evidence to support the routine use of nutritional supplementation in pulmonary rehabilitation of patients with COPD. **No recommendation is provided**

GOLD (2007)	Nutrition counseling. Nutritional state is an important determinant of symptoms, disability, and prognosis in COPD; both overweight and underweight can be a problem. Specific nutritional recommendations for patients with COPD are based on expert opinion and some small randomized clinical trials. Approximately 25% of patients with *Stage II: Moderate COPD to Stage IV: Very Severe COPD* show a reduction in both their body mass index and fat free mass. A reduction in body mass index is an independent risk factor for mortality in COPD patients (**Evidence A**). Health care workers should identify and correct the reasons for reduced calorie intake in COPD patients. Patients who become breathless while eating should be advised to take small, frequent meals. Poor dentition should be corrected and comorbidities (pulmonary sepsis, lung tumors, etc.) should be managed appropriately. Improving the nutritional state of COPD patients who are losing weight can lead to improved respiratory muscle strength. However, controversy remains as to whether this additional effort is cost effective. Present evidence suggests that nutritional supplementation alone may not be a sufficient strategy. Increased calorie intake is best accompanied by exercise regimes that have a nonspecific anabolic action, and there is some evidence this also helps even in those patients without severe nutritional depletion. Specific nutritional supplements (e.g., creatine) may improve body composition, but further studies in large numbers of subjects are required before the routine use of these supplements can be recommended. Anabolic steroids in COPD patients with weight loss increase body weight and lean body mass but have little or no effect on exercise capacity.
NCCCC/NICE (2004)	**Grade A** - Pulmonary rehabilitation programmes should include multicomponent, multidisciplinary interventions, which are tailored to the individual patient's needs. The rehabilitation process should incorporate a programme of physical training, disease education, and nutritional, psychological, and behavioural intervention.
SMOH (2006)	**D** - Psychosocial and behavioral interventions (health education, smoking cessation clinic, and support groups addressing psychosocial issues) as well as nutritional intervention should also be included as non-physical components of the comprehensive pulmonary rehabilitation programs ("Pulmonary Rehabilitation," 1999). (**Grade D, Level 4**)
Education	

ACCP/AACVPR (2007)	Education should be an integral component of pulmonary rehabilitation. Education should include information on collaborative self-management and prevention and treatment of exacerbations. **Grade of Recommendation 1B**
GOLD (2007)	Education. Most pulmonary rehabilitation programs include an educational component, but the specific contributions of education to the improvements seen after pulmonary rehabilitation remain unclear.
NCCCC/NICE (2004)	**Grade A** - Pulmonary rehabilitation programmes should include multicomponent, multidisciplinary interventions, which are tailored to the individual patient's needs. The rehabilitation process should incorporate a programme of physical training, disease education, and nutritional, psychological, and behavioural intervention.
SMOH (2006)	**D** - Psychosocial and behavioral interventions (health education, smoking cessation clinic, and support groups addressing psychosocial issues) as well as nutritional intervention should also be included as non-physical components of the comprehensive pulmonary rehabilitation programs ("Pulmonary Rehabilitation," 1999). (**Grade D, Level 4**)
Psychosocial/Behavioral Interventions	
ACCP/AACVPR (2007)	The data suggest that depression and anxiety are more common among patients with COPD than in the public at large. Data indicate that psychosocial intervention may facilitate behavioral changes, such as smoking cessation, as well as the management of dyspnea. However, psychosocial interventions alone may not lead to reduced psychological distress. • There is minimal evidence to support the benefits of psychosocial interventions as a single therapeutic modality. **Grade of Recommendation 2C** • Although no recommendation is provided since scientific evidence is lacking, current practice and expert opinion support the inclusion of psychosocial interventions as a component of comprehensive pulmonary rehabilitation programs for patients with COPD.
GOLD (2007)	No specific recommendations offered
NCCCC/NICE	**Grade A** - Pulmonary rehabilitation programmes should

(2004)	include multicomponent, multidisciplinary interventions, which are tailored to the individual patient's needs. The rehabilitation process should incorporate a programme of physical training, disease education, and nutritional, psychological, and behavioural intervention.
SMOH (2006)	**D** - Psychosocial and behavioral interventions (health education, smoking cessation clinic, and support groups addressing psychosocial issues) as well as nutritional intervention should also be included as non-physical components of the comprehensive pulmonary rehabilitation programs ("Pulmonary Rehabilitation," 1999). (**Grade D, Level 4**)
Follow-Up	
ACCP/AACVPR (2007)	Maintenance strategies following pulmonary rehabilitation have a modest effect on long-term outcomes. **Grade of Recommendation 2C**
GOLD (2007)	<u>Assessment and Follow-up</u> Baseline and outcome assessments of each participant in a pulmonary rehabilitation program should be made to quantify individual gains and target areas for improvement. Assessments should include: • Detailed history and physical examination • Measurement of spirometry before and after a bronchodilator drug • Assessment of exercise capacity • Measurement of health status and impact of breathlessness • Assessment of inspiratory and expiratory muscle strength and lower limb strength (e.g., quadriceps) in patients who suffer from muscle wasting The first two assessments are important for establishing entry suitability and baseline status but are not used in outcome assessment. The last three assessments are baseline and outcome measures. Several detailed questionnaires for assessing health status are available, including some that are specifically designed for patients with respiratory disease (e.g., Chronic Respiratory Disease Questionnaire, St. George Respiratory Questionnaire), and there is increasing evidence that these questionnaires may be useful in a clinical setting. Health status can also be assessed by generic questionnaires, such as the Medical Outcomes Study Short Form (SF36), to enable comparison of quality of life in different diseases. The Hospital Anxiety

	and Depression Scale (HADS) and the Primary Care Evaluation of Mental Disorders (PRIME-MD) have been used to improve identification and treatment of anxious and depressed patients.
NCCCC/NICE (2004)	No recommendations offered
SMOH (2006)	No recommendations offered

Selected Supporting References **Note from NGC: Bolded** references are cited in more than one guideline. Refer to the original guideline document for a complete listing of supporting references.	
ACCP/AACVPR (2007)	Refer to the original guideline document for a complete listing of supporting references.
GOLD (2007)	Berry MJ, Rejeski WJ, Adair NE, Zaccaro D. Exercise rehabilitation and chronic obstructive pulmonary disease stage. *Am J Respir Crit Care Med* 1999;160(4):1248-53. Foglio K, Bianchi L, Bruletti G, Battista L, Pagani M, Ambrosino N. Long-term effectiveness of pulmonary rehabilitation in patients with chronic airway obstruction. *Eur Respir J* 1999;13(1):125-32. Goldstein RS, Gort EH, Stubbing D, Avendano MA, Guyatt GH. Randomised controlled trial of respiratory rehabilitation. *Lancet* 1994;344(8934):1394-7. **Griffiths TL, Burr ML, Campbell IA, Lewis-Jenkins V, Mullins J, Shiels K, et al. Results at 1 year of outpatient multidisciplinary pulmonary rehabilitation: a randomized controlled trial [published erratum appears in Lancet 2000;355:1280]. *Lancet* 2000;355(9201):362-8.** McGavin CR, Gupta SP, Lloyd EL, McHardy GJ. Physical rehabilitation for the chronic bronchitic: results of a controlled trial of exercises in the home. *Thorax* 1977;32(3):307-11. Wijkstra PJ, Van Altena R, Kraan J, Otten V, Postma DS, Koeter GH. Quality of life in patients with chronic obstructive pulmonary disease improves after rehabilitation at home. *Eur Respir J* 1994;7(2):269-73.

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NCCCC/NICE (2004)	Berry MJ, Rejeski WJ, Adair NE, Ettinger Jr WH, Zaccaro DJ, Sevick MA. A randomized, controlled trial comparing long-term and short-term exercise in patients with chronic obstructive pulmonary disease. *Journal of Cardiopulmonary Rehabilitation* 2003;23:60-8. Bestall JC, Paul EA, Garrod R, Garnham R, Jones PW, Wedzicha JA. Longitudinal trends in exercise capacity and health status after pulmonary rehabilitation in patients with COPD. *Respiratory Medicine* 2003;97:173-80. British Thoracic Society Standards of Care Subcommittee on Pulmonary Rehabilitation. Pulmonary rehabilitation. *Thorax* 2001;56:827-34. Foglio K, Bianchi L, Ambrosino N. Is it really useful to repeat outpatient pulmonary rehabilitation programs in patients with chronic airway obstruction? A 2-year controlled study. *Chest* 2001;119:1696-704. **Griffiths TLB. Results at 1 year of outpatient multidisciplinary pulmonary rehabilitation: a randomized controlled trial [published erratum appears in Lancet 2000 Apr 8;355(9211):1280]. *Lancet* 2000;355:362-8.** Griffiths TL, Phillips CJ, Davies S, Burr ML, Campbell IA. Cost effectiveness of an outpatient multidisciplinary pulmonary rehabilitation programme. *Thorax* 2001;56:779-84. Lacasse Y, Brosseau L, Milne S, Martin S, Wong E, Guyatt GH et al. Pulmonary Rehabilitation for Chronic Obstructive Pulmonary Disease.(Cochrane Review). *The Cochrane Library.Oxford:Update Software* 2003;Issue 3. Lotters F, van Tol B, Kwakkel G, Gosselink R. Effects of controlled inspiratory muscle training in patients with COPD: a meta-analysis. *European Respiratory Journal* 2002;20:570-6. McBride A and Milne R. *Hospital based pulmonary rehabilitation programmes for patients with severe chronic obstructive pulmonary disease.* Southampton: Wessex Institute for Health Research and Development; 1999. Development and evaluation committee report number:94. Ortega F, Toral J, Cejudo P, Villagomez R, Sanchez H, Castillo J

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TABLE 6: BENEFITS AND HARMS	
Benefits	
ACCP/AACVPR (2007)	Appropriate use of pulmonary rehabilitation
GOLD (2007)	The goals of effective COPD management are to: • Relieve symptoms • Prevent disease progression • Improve exercise tolerance • Improve health status • Prevent and treat complications • Prevent and treat exacerbations • Reduce mortality
NCCCC/NICE (2004)	If adopted, these guideline recommendations should lead to better standards of care and thus better outcomes from chronic obstructive pulmonary disease.
SMOH (2006)	Appropriate diagnosis and management of patients with COPD

TABLE 7: EVIDENCE RATING SCHEMES AND REFERENCES	
ACCP/AACVPR (2007)	**High (A)** Evidence based on well designed randomized controlled trials (RCTs) yielding consistent and directly applicable results. In some circumstances, high-quality evidence can be the result of overwhelming evidence from

	observational studies. **Moderate (B)** Evidence based on RCTs with limitations that may include methodological flaws or inconsistent results. Studies other than RCTs that may yield strong results are also included in the moderate-quality category. **Low (C)** Evidence from other types of observational studies (the weakest type of evidence). **Strength of Recommendations** **1A** - Strong recommendation **1B** - Strong recommendation **1C** - Strong recommendation **2A** - Weak recommendation **2B** - Weak recommendation **2C** - Weak recommendation
GOLD (2007)	**Description of Levels of Evidence** A. *Sources of Evidence:* Randomized controlled trials (RCTs). Rich body of data. *Definition*: Evidence is from endpoints of well-designed RCTs that provide a consistent pattern of findings in the population for which the recommendation is made. Category A requires substantial numbers of studies involving substantial numbers of participants. B. *Sources of Evidence*: Randomized controlled trials. Limited body of data. *Definition*: Evidence is from endpoints of intervention studies that include only a limited number of patients, posthoc or subgroup analysis of RCTs, or meta-analysis of RCTs. In general, Category B pertains when few randomized trials exist, they are small in size, they were undertaken in a population that differs from the target population of the recommendation, or the results are somewhat inconsistent. C. *Sources of Evidence*: Nonrandomized trials. Observational studies. *Definition*: Evidence is from outcomes of uncontrolled or nonrandomized trials or from observational studies. D. *Sources of Evidence*: Panel consensus. Judgment. *Definition*: This category is used only in cases where the provision of some guidance was deemed valuable but the

<table>
<tr><td></td><td colspan="4">clinical literature addressing the subject was deemed insufficient to justify placement in one of the other categories. The Panel Consensus is based on clinical experience or knowledge that does not meet the above-listed criteria.</td></tr>
<tr><td rowspan="8">NCCCC/NICE (2004)</td><td colspan="2">Hierarchy of Evidence</td><td colspan="2">Grading of Recommendations</td></tr>
<tr><td>Level</td><td>Type of Evidence</td><td>Grade</td><td>Evidence</td></tr>
<tr><td>Ia</td><td>Evidence from systematic reviews or meta-analysis of randomized controlled trials</td><td>A</td><td>Based on hierarchy I evidence</td></tr>
<tr><td>Ib</td><td>Evidence from at least one randomized controlled trial</td><td></td><td></td></tr>
<tr><td>IIa</td><td>Evidence from at least one controlled study without randomization</td><td rowspan="2">B</td><td rowspan="2">Based on hierarchy II evidence or extrapolated from hierarchy I evidence</td></tr>
<tr><td>IIb</td><td>Evidence from at least one other type of quasi-experimental study</td></tr>
<tr><td>III</td><td>Evidence from non-experimental descriptive studies, such as comparative studies, correlation studies and case-control studies</td><td>C</td><td>Based on hierarchy III evidence or extrapolated from hierarchy I or II evidence</td></tr>
<tr><td>IV</td><td>Evidence from expert committee reports or</td><td>D</td><td>Directly based on hierarchy IV evidence or</td></tr>
</table>

		opinions and/or clinical experience of respected authorities		extrapolated from hierarchy I, II or III evidence
	NICE	Evidence from NICE guidelines or Health Technology Appraisal	NICE	Evidence from NICE guidelines or Health Technology Appraisal programme
	HSC	Evidence from Health Service Circulars	HSC	Evidence from Health Service Circulars
SMOH (2006)	**Levels of Evidence** **Level 1++**: High quality meta-analyses, systematic reviews of randomized controlled trials (RCTs), or RCTs with a very low risk of bias. **Level 1+**: Well conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias. **Level 1-**: Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias **Level 2++**: High quality systematic reviews of case control or cohort studies. High quality case control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal **Level 2+**: Well conducted case control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal **Level 2-**: Case control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal **Level 3**: Non-analytic studies (e.g. case reports, case series) **Level 4**: Expert opinion **Grades of Recommendation** **Grade A**: At least one meta-analysis, systematic review of			

	randomized controlled trials (RCTs), or RCT rated as 1++ and directly applicable to the target population; or A body of evidence consisting principally of studies rated as 1+, directly applicable to the target population, and demonstrating overall consistency of results **Grade B**: A body of evidence including studies rated as 2++, directly applicable to the target population, and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 1++ or 1+ **Grade C**: A body of evidence including studies rated as 2+, directly applicable to the target population and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 2++ **Grade D**: Evidence level 3 or 4; or Extrapolated evidence from studies rated as 2+ **GPP** (good practice points): Recommended best practice based on the clinical experience of the guideline development group.

GUIDELINE CONTENT COMPARISON

The American College of Chest Physicians/American Association of Cardiovascular and Pulmonary Rehabilitation (ACCP/AACVPR), Global Initiative for Chronic Obstructive Lung Disease (GOLD) (a collaborative project of the World Health Organization and the National Heart, Lung, and Blood Institute), the National Collaborating Centre for Chronic Conditions (a collaborating center for the National Institute for Health and Clinical Excellence [NCCCC/NICE]), and Singapore Ministry of Health (SMOH) present recommendations for pulmonary rehabilitation of patients with chronic obstructive pulmonary disease (COPD) and provide explicit reasoning behind their judgments.

As mentioned in the introduction, the GOLD, NCCCC/NICE and SMOH guidelines are broad in scope, providing recommendations on diagnosis and management of both stable COPD and acute exacerbations of disease; the GOLD guideline also addresses prevention strategies. In contrast, the scope of the ACCP/AACVPR guideline is relatively narrow, focusing only on recommendations for pulmonary rehabilitation in patients with COPD. Guideline recommendations for diagnosis and management of stable COPD are compared in Part I of this synthesis; recommendations for diagnosis and management of acute exacerbations of COPD are compared in Part II.

The ACCP/AACVPR and GOLD guidelines are updates of previous versions. In developing their guidelines both GOLD and SMOH reviewed the 2004 NCCCC/NICE guideline; ACCP/AACVPR and SMOH reviewed the 2005 version of the GOLD guideline.

Guideline Methodology

All four guidelines were developed using similar methods. In terms of methods used to collect and select the evidence, all four guideline groups performed searches of electronic databases, with ACCP/AACVPR, GOLD and NCCCC/NICE also performing hand searches of published literature. These three groups also provide relevant information regarding processes used (names of databases searched, date ranges, and inclusion/exclusion criteria).

The four groups performed a review of published meta-analyses and a systematic review with evidence tables to analyze the selected evidence (note that SMOH's systematic review did not incorporate evidence tables), and utilized expert consensus to formulate the recommendations. ACCP/AACVPR, GOLD and NCCCC/NICE provide descriptions of the processes used to analyze the evidence and formulate the recommendations; SMOH does not.

ACCP/AACVPR, NCCCC/NICE and SMOH provide their guidance in the form of recommendation statements supplemented by narrative discussion. The strength of the recommendation statements are graded for all three groups, and SMOH also includes a rating for the strength of the evidence supporting the recommendation. In the full version of the NCCCC/NICE guideline (as opposed to the NICE version), the strength of the evidence supporting major recommendations is rated. GOLD, in contrast to the other groups, provides its guidance in narrative format, and provides evidence ratings for selected recommendations.

All guideline groups provide reference lists (211 for ACP/AACVPR, 420 for GOLD, 491 for NCCCC/NICE and 155 for SMOH).

COPD Part III. Pulmonary Rehabilitation: Comparison of Key Recommendations Between the AACP/AACVPR, GOLD, NCCCC/NICE and SMOH	
ACCP/AACVPR (2007)	• A program of exercise training of the muscles of ambulation is recommended as a mandatory component of pulmonary rehabilitation for patients with COPD. • Both low- and high-intensity exercise training produce clinical benefits for patient with COPD. • There is insufficient evidence to support the routine use of nutritional supplementation in pulmonary rehabilitation of patients with COPD. • Education should be an integral component of pulmonary rehabilitation and should include information on

	collaborative self-management and prevention and treatment of exacerbations. • Current practice and expert opinion support the inclusion of psychosocial interventions as a component of comprehensive pulmonary rehabilitation programs for patients with COPD.
GOLD (2007)	• Exercise training ranges in frequency from daily to weekly, in duration from 10 minutes to 45 minutes per session, and in intensity from 50% peak oxygen consumption (VO2 max) to maximum tolerated. • The minimum length of an effective rehabilitation program is 6 weeks; the longer the program continues, the more effective the results. • Health care workers should identify and correct the reasons for reduced calorie intake in COPD patients. • The specific contributions of education to the improvements seen after pulmonary rehabilitation remain unclear. • Baseline and outcome assessments of each participant in a pulmonary rehabilitation program should be made to quantify individual gains and target areas for improvement.
NCCCC/NICE (2004)	• Pulmonary rehabilitation programmes should include multicomponent, multidisciplinary interventions, which are tailored to the individual patient's needs. The rehabilitation process should incorporate a programme of physical training, disease education, and nutritional, psychological, and behavioural intervention. • Pulmonary rehabilitation should be made available to all appropriate patients with COPD. Patients should be made aware of the benefits of pulmonary rehabilitation and the commitment required to gain these. • For pulmonary rehabilitation programmes to be effective, and to improve concordance, they should be held at times that suit patients and in buildings that are easy for patients to get to and have good access for people with disabilities. Places should be available within a reasonable time of referral.
SMOH (2006)	• Pulmonary rehabilitation can be conducted as inpatient, outpatient or home programs. Consideration of cost, availability and accessibility will determine the patient's choice. • The physical components of pulmonary rehabilitation should include both lower extremity training (e.g., bicycle,

	ergometry, treadmill) and upper extremity training (strength and endurance). • Psychosocial and behavioral interventions (health education, smoking cessation clinic, and support groups addressing psychosocial issues) as well as nutritional intervention should also be included as non-physical components of the comprehensive pulmonary rehabilitation programs.

Areas of Agreement

Patient Selection

There is overall agreement that pulmonary rehabilitation is appropriate for stable patients considered to be functionally disabled by the symptoms of COPD. SMOH notes that it may be considered for patients with persistent symptoms (especially dyspnea), reduced exercise tolerance or experience a restriction in activities, or recurrent admissions to hospitals over the last 6 months. Both GOLD and NCCCC/NICE note that the Medical Research Council (MRC) dyspnoea scale may be helpful in selecting patients most likely to benefit. NCCCC/NICE states that patients for whom pulmonary rehabilitation is appropriate will usually have an MRC grade of 3 and above; GOLD notes that those with MRC grade 5 dyspnea may not benefit. There is also overall agreement that pulmonary rehabilitation is most likely not suitable for patients with certain conditions, such as an inability to walk, unstable angina, or recent myocardial infarction. ACCP does not provide specific exclusion criteria for selecting patients who may benefit from pulmonary rehabilitation, but notes that patients with advanced disease can benefit if they are selected appropriately and if realistic goals are set. There is also overall agreement that the patient's motivation may be an important factor to consider while determining suitability.

Exercise Training

There is overall agreement between the guideline groups that exercise training is the cornerstone of any pulmonary rehabilitation program and should include both lower and upper extremity training. ACCP/AACVPR and GOLD provide recommendations regarding the duration of programs, and agree that the longer a program continues, the more effective the results. ACCP/AACVPR notes that six to 12 weeks of pulmonary rehabilitation produces benefits in several outcomes that decline gradually over 12 to 18 months, and that programs lasting at least 12 weeks produce greater sustained benefits than shorter programs. GOLD provides slightly different figures, but similarly notes that the minimum length of an effective rehabilitation program is 6 weeks. They add that in practice, the length depends on the resources available and usually ranges from 4 to 10 weeks, with longer programs resulting in larger effects than shorter programs. GOLD adds that if no formal program is available to patients, it is reasonable for physicians to advise them to exercise on their own. ACCP/AACVPR also provides recommendations regarding the use of supplemental oxygen and noninvasive ventilation in patients involved in pulmonary rehabilitation.

Nutritional Interventions/Counseling

The four guideline groups agree that nutritional intervention is an appropriate component of most pulmonary rehabilitation programs. GOLD is in agreement with the one recommendation ACCP/AACVPR makes on this topic, which is that there is insufficient evidence to support the routine use of nutritional supplementation in pulmonary rehabilitation patients. GOLD goes into greatest detail, providing recommendations for the identification and correction of reduced calorie intake in COPD patients. They note that a reduction in body mass index is an independent risk factor for mortality in COPD patients. NCCCC/NICE and SMOH recommend that nutritional intervention be included in a program of pulmonary rehabilitation, but do not provide specific recommendations.

Education

There is overall agreement between the guideline groups that education should be included in pulmonary rehabilitation programs. ACCP/AACVPR states that education should include information on collaborative self-management and prevention and treatment of exacerbations. GOLD, NCCCC/NICE and SMOH recommend that education be included in a program of pulmonary rehabilitation, but do not provide specific recommendations. GOLD states that although most pulmonary rehabilitation programs include an educational component, the specific contributions of education to the improvements seen after pulmonary rehabilitation remain unclear.

Psychosocial Interventions

ACCP/AACVPR, NCCCC/NICE, and SMOH agree that psychosocial/behavioral interventions should be included in pulmonary rehabilitation programs. ACCP/AACVPR notes that while there is minimal evidence to support psychosocial interventions as a single therapeutic modality, current practice and opinion do support their inclusion as a component of comprehensive pulmonary rehabilitation programs. SMOH recommends that interventions such as smoking cessation clinics and support groups addressing psychosocial issues be included; NCCCC/NICE does not provide specific recommendations.

Follow-Up

ACCP/AACVPR notes that maintenance strategies following pulmonary rehabilitation have a modest effect on long-term outcomes. GOLD goes into the greatest detail, recommending baseline and outcome assessments be performed to quantify individual gains and target areas for improvement. They cite specific elements that should be included in the assessments, and note that questionnaires can be useful tools in performing recommended assessments. NCCCC/NICE and SMOH do not provide recommendations.

Areas of Differences

There are no significant areas of difference between the guideline groups.

Conclusion

There is overall agreement that pulmonary rehabilitation is appropriate for most stable patients functionally disabled by the symptoms of COPD, but that patients with certain conditions are not suitable. The groups also agree that the fundamental component of pulmonary rehabilitation programs is exercise training, and that educational, nutritional and psychosocial interventions should also be incorporated.

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