Coordinated School Health Programs and Academic Achievement: A Systematic Review of the Literature

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ABSTRACT

BACKGROUND: Few evaluations of school health programs measure academic outcomes. K-12 education needs evidence for academic achievement to implement school programs. This article presents a systematic review of the literature to examine evidence that school health programs aligned with the Coordinated School Health Program (CSHP) model improve academic success.

METHODS: A multidisciplinary panel of health researchers searched the literature related to academic achievement and elements of the CSHP model (health services, counseling/social services, nutrition services, health promotion for staff, parent/family/community involvement, healthy school environment, physical education, and health education) to identify scientifically rigorous studies of interventions. Study designs were classified according to the analytic framework provided in the *Guide* developed by the Community Preventive Services Task Force.

RESULTS: The strongest evidence from scientifically rigorous evaluations exists for a positive effect on some academic outcomes from school health programs for asthmatic children that incorporate health education and parental involvement. Strong evidence also exists for a lack of negative effects of physical education programs on academic outcomes. Limited evidence from scientifically rigorous evaluations support the effect of nutrition services, health services, and mental health programs, but no such evidence is found in the literature to support the effect of staff health promotion programs or school environment interventions on academic outcomes.

CONCLUSIONS: Scientifically rigorous evaluation of school health programs is challenging to conduct due to issues related to sample size, recruitment, random assignment to condition, implementation fidelity, costs, and adequate follow-up time. However, school health programs hold promise for improving academic outcomes for children.

Keywords: academic achievement; coordinated school health; asthma management; physical education.

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Over the past decade, public education has been increasingly held accountable through measures of academic achievement such as standardized testing. Pressure to improve test scores has resulted in greater emphasis on traditional classroom drills at the expense of programs like health for which there is little accountability required. In such a climate, it becomes important for coordinated school health programming to be able to demonstrate its impact on academic performance. The goal of this article was to systematically review the evidence assessing the link between health programming and academic achievement and to suggest ways in which that topic might be better studied in the future.

Education is a strong predictor of lifelong health and quality of life.[1] This finding is exhibited in different populations, places, and time.[2] At least 1 investigator[3] has argued that education *causes* health; however, the pathways through which education leads to better health and longer life expectancy are still not clearly understood. We do know that education, health, and social outcomes are very closely interdependent.[4] Success in school and years of schooling are major factors in determining social and occupational status in adulthood and health status throughout life.[5]

Among schoolchildren, academic success, health status, and risk behaviors are related in an interdependent, cyclical fashion. Poor school performance predicts health-compromising behaviors and physical, mental, and emotional problems.[6-8] Poor nutrition, substance abuse, sedentary behavior, violence, depression, and suicidality compromise school performance. This negative cycle, established during the school years, has profound consequences for the success and productivity of our communities.[9-11] Schools are a key part of the solution to this challenge and the school is a powerful force in American society. The education community is striving to enhance academic accomplishment through activities at the federal level, such as the No Child Left Behind Act; at the state level, through allocations of state funding and state laws ; and at the local level, by incorporating curriculum choices, hiring talented personnel, maintaining facilities with limited resources, and raising funds through local bond elections.

Systematic reviews of the literature are important for decision making in health and education to provide evidence-based support for health programs and policy applications in the school setting. This article describes a comprehensive literature review of the evidence that Coordinated School Health Programs (CSHP) improve academic outcomes. CSHP provide policies, activities, and services in an organized manner to promote the health of school students and staff through: comprehensive school health education; family and community involvement; physical education; school counseling, psychological, and social services; school health services; school nutrition services; and school-site health promotion for staff and faculty.[12] The purpose of this systematic review was to identify and summarize evidence about CSHP-related determinants of academic achievement.

METHODS

Research Panel

A multidisciplinary panel was formed of 6 nonfederal, nonadvocate health researchers representing the fields of pediatrics, psychology, behavioral and social science, health promotion, and education from 3 different, collaborating Prevention Research Centers. These Prevention Research Centers are part of a national network of 33 academic centers, each with public health agency and community partners that conduct applied research and practice in chronic disease prevention and control, and are funded by the Centers for Disease Control and Prevention. Each panel member consulted experts in the fields of nutrition, physical activity, mental health, school health services, parent involvement, or school environment and policy for further information to increase the effectiveness of the search process.

Construct Definitions

For the purposes of this research review, the term *evidence* includes: ''(1) information that is appropriate for answering questions about an intervention's effectiveness; (2) the applicability of effectiveness data; (3) the intervention's other effects (ie, side effects, intended or unintended, and health or nonhealth outcomes); and (4) barriers that have been observed when implementing interventions.''[13] The dependent variable, *academic achievement*, was operationalized and measured as course grades, grade point averages (GPAs), attendance, tardiness, homework performance, study skills, classroom behavior, social skills, disciplinary action such as suspension or expulsion, dropout status, grade promotion, grade retention, educational aspirations, and/or performance on standardized tests. The independent variables were CSHP related and were operationalized and measured as physical activity/education, nutrition/food services, mental health and social services, school environment and policy, health education, health promotion, school health/clinical services, and family/parent and community involvement.

Identification of Primary Studies

The literature was searched through computerized medical, public health, and education databases containing publications from 1945 forward, with an

emphasis on those from 1980 to date. The primary databases searched were The Combined Health Information Database [CHID], CINAHL, all EBM Reviews, EBSCO (All Education Databases and All Health and Wellness Databases), EconLit, ERIC, Medline, National Academy Press, PsycARTICLES, PsycInfo, PubMed, and Social Science Citations. An extensive bibliography of references was generated and provided to the panel. Research assistants located library texts and research articles, extracted information about further studies from journal and book chapter reference lists, and obtained paper copies of each document, some requiring English translation. Scientific evidence was given precedence over anecdotal experience. Randomized controlled designs were considered the ''gold standard,'' although there were very few published in the literature, and case studies were not selected for review. Primary studies were also located from published and nonpublished reviews, and other articles were provided by expert informants. A manual search was also conducted of key journals.

Inclusion/Exclusion Criteria

Using a brief gold standard screening tool, the initial exclusion criteria applied was lack of measurement of variables related to CSHP constructs and academic achievement. The *Guide* standard data abstraction form[14] was used by 2 reviewers to record information about: ''(1) the intervention being studied; (2) the context in which the study was done; (3) the evaluation design; (4) study quality; and (5) the results.''[13] The inclusion criteria necessitated adequate description of the sampling techniques, sociodemographic characteristics of the sample and population from which it was drawn, intervention, measures, and data collection methods used, statistical analyses, results, and conclusions supported by the data. The review panel predetermined that peer-reviewed publications were highly valued because they were widely available to the health and education community in journals, many of which are now available online.

Extraction of Data from Primary Studies

Data were extracted using the standardized, pretested *Guide* developed as a systematic tool for extracting evidence by the Community Preventive Services Task Force.[13] Six reviewers were involved in the extraction process following the methods outlined in the *Guide* and 5 other experts were recruited to complete second reviews. Because of the paucity of research conducted in the relatively new field of CSHP and academic achievement, the data extraction form was not intended for use as a means of determining effect sizes for CSHP research interventions. At this initial stage of review of existing research literature, the intent was to identify scientifically rigorous studies of interventions and associations between CSHP components and student health and academic achievement.

Initial classification of the study design involved was based on the analytic framework provided in the *Guide*, for example, studies that were noncomparative, cross-sectional, case-control, or prospective or retrospective cohort, and trials that were nonrandomized or randomized. Those study designs that were ranked as highest in quality involved the use of concurrent comparison groups, for example, controls and prospective measurement of exposure to the CSHP programs and achievement outcomes. Those that were deemed moderately suitable incorporated retrospective designs or multiple pre/post-measurements but had no concurrent control group. Although still evaluated, study designs rated as least suitable involved those with single pre-/post-measurements that lacked a concurrent comparison group or those that measured exposure and outcome in a single group at the same point in time, for example, correlation studies.

RESULTS

Results of the systematic review are summarized in Table 1 according to the rigor of the research design and indicating the 8 domains of the CSHP model are as follows: health education, health services, physical education, food services, mental health services, school environment, staff health promotion, and parental involvement. Although the best programs coordinate among the 8 components and programs that coordinate more than 1 component met the standards for inclusion in the review, for clarity of presentation we elected to present programs in this format. A total of 4 research projects met the most stringent criteria of this review, a randomized controlled trial incorporating components of the CSHP model as predictors and measures of academic achievement as outcomes. An additional 13 research reports met the next most stringent criteria of a quasiexperimental study with longitudinal measurement and controls matched on relevant variables. Together, these reports provide evidence that school health programs can enhance academic outcomes.

The most rigorous studies used a randomized controlled design and evaluated the effect of health education and parental involvement or physical education on academic performance. An asthma self-management program incorporating health education and parental involvement increased academic grades for low–income minority children.[15] A subsequent study of the asthma self-management program was expanded to include health education for asthmatic

Table 1. **School Health Programs and Academic Achievement**

	Sample, Design, and Intervention	Outcome	Domain
Strongest evidence from experimental longitudinal intervention studies			
Evans et al[15]	Sample: N = 239 low-income predominantly Hispanic and African American students from grades 3-5 with at least 3 episodes of asthma in prior year, attending 12 participating schools; New York City Design: random assignment of schools within matched pairs. Pretest-posttest analysis of change in achievement Intervention: asthma self-management program consisting of six 60-minute sessions on asthma management skills; parents received written information about curriculum and activities Achievement measures: index of grades (11 subjects/skills including oral expression); standardized tests for mathematics (diagnostic mathematics test) and reading (CAT); teacher-rated classroom behavior (6 categories); attendance (school records)	Significant improvements noted among health education program participants compared with controls: for academic grades (4% vs 0%; p = .05), mathematics (8% vs −3%; p = .03), science (5% vs −4%; p = .005), and oral expression (6% vs −1%; p = .04). No significant difference between groups in standardized test scores for reading or math, for teacher-rated classroom behavior, or for attendance	☐ SHS ☐ SCSS ☐ SNS ☐ HPS ☒ PFCI ☐ HSE ☐ PE ☒ HE
Clark et al[16]	Sample: N = 835 predominantly African American students from grades 2-5 with either a physician's diagnosis of asthma or 3 or more asthma symptoms in prior year, attending 14 elementary schools, Detroit Design: random assignment of schools. Pretest-posttest analysis of change in achievement Intervention: asthma self-management; classroom sessions on respiratory health and asthma for classmates; orientation to asthma and control strategies for principals and counselors; briefings and walk-throughs for custodians; school fairs for parents; communications with clinicians Achievement measures: grades from school records; absences from school records and parent report	Science grades for treatment children declined less than controls over 2 years (0.27 drop vs 0.44 drop; p < .02). For intermittent and persistent, 12-month drop also. No significant differences for math or reading. Significantly fewer asthma-related absences reported by parents in previous 3 months (p < .0001) and 12 months (p < .05), but no significant differences in school record absences	☒ SHS ☒ SCSS ☐ SNS ☐ HPS ☒ PFCI ☒ HSE ☐ PE ☒ HE
Sallis et al[17]	Sample: N = 1538 students in 2 samples: those whose achievement was tested (n = 754), mostly white (79%) and mean age = 9.5 years (SD = 0.43); those who did not take an achievement test (n = 387) who were 85% white and mean age = 9.6 years (SD = 0.52) Design: randomized control study of a 2-year intervention Intervention: Project SPARK implemented in 7 public elementary schools in California that incorporated moderate to 30-minute classes: 15 minutes of health-fitness activity (high-intensity aerobic) and 15 minutes of a skill-fitness activity for a minimum of 3 days per week through the school year (36 weeks) Achievement measures: the Metropolitan Achievement Test (versions MAT6 and MAT7)	Despite devoting twice as many minutes per week to physical education as the control schools, experimental schools adopting the Project SPARK health-related physical education program did not show it interfered with academic achievement: reading scores on the Metropolitan Achievement Test were higher for program participants (p = .02), although those for language were lower (p = .04) at follow-up compared with control group. No significant difference was noted between groups on the mathematics or composite basic battery scores	☐ SHS ☐ SCSS ☐ SNS ☐ HPS ☐ PFCI ☐ HSE ☒ PE ☐ HE
Dwyer et al[18]	Sample: N = 519 grade 5 (mean age = 10 years) students in 7 Australian schools in 1978 Design: random assignment of students to control or to a 14-week intervention: 3 group comparison (fitness, skill, and control) Intervention: the fitness and skill groups engaged in organized activity daily for 15 minutes in a morning class and 60 minutes in an afternoon class period—the fitness group engaged in aerobic activity; the skill group engaged in nonstrenuous motor skills; the control group received three 30-minute periods of usual physical education per week Achievement measures: 2 Australian education standardized tests: ACER arithmetic test, GAP reading test and teachers' ratings of classroom behavior	Children in the 14-week fitness and skill groups exhibited significantly greater changes in positive teacher-rated classroom behavior (p < .05), a positive trend toward increased arithmetic scores, but no significant changes in reading scores when compared with controls	☐ SHS ☐ SCSS ☐ SNS ☐ HPS ☐ PFCI ☐ HSE ☒ PE ☐ HE

Table 1. **Continued**

	Sample, Design, and Intervention	Outcome	Domain
Strong evidence from quasiexperimental intervention studies			
O'Donnell et al[19]	Sample: N = 177 public elementary students in grade 6 at high risk for school failure or dropout (subsample of larger study involving all fifth-grade students in 18 Seattle elementary schools in 1984); control group (n = 102); intervention group (n = 75); 42% from low-income families; 49% white and 22% African American; 19% Asian American; 6% Native American; ethnic data not provided; 54% female. At the end of grade 6, 60% completed surveys: control group (n = 62) and intervention group (n = 44) Design: random assignment of students to intervention and control classrooms. Pretest-posttest analysis of change from grades 5-6 Intervention: the 6-year Seattle Social Development Project (grades 1-6) is a multifocus student (cognitive and social skills training), teacher (proactive classroom management, interactive teaching, and cooperative learning), and parent (child behavior management, academic support, and antisocial prevention) education program Achievement measures: self-report survey collected from students in fall of 1985 (entering fifth grade) and in spring of 1987 (when sixth grade completed): perceived opportunities, academic skills, and reinforcements in the classroom; perceived interactions with peers and problem behavior (drug use and delinquency). CAT battery: math, reading, language arts; grades; teacher child behavior checklist for each student in the spring of sixth grade for social and school work status: attachment to school and commitment to school	Participants significantly increased their CAT combined language arts, mathematics, and reading scores (boys, $p \leq .05$) school grades (boys, $p \leq .05$); attachment to school (girls, $p \leq .05$); commitment to school work (girls and boys, $p \leq .05$); classroom use of cooperative team learning methods (girls, $p \leq .05$); perceived opportunity for classroom involvement (girls, $p \leq .05$); and teacher-rated social competence in the classroom, study skills, and persistence in working on school work (boys, $p \leq .05$) compared with those who did not participate	☐ SHS ☐ SCSS ☐ SNS ☐ HPS ☒ PFCI ☒ HSE ☐ PE ☒ HE ☒ Teacher training
Hawkins et al[20]	Sample: N = 598 grade 12 students in Seattle, Washington; 76% of eligible students (n = 643) were assessed at baseline in the fall of 1985; 93% (n = 598) completed follow-up measures in the spring of 1993; as part of a larger study of adolescent behavior (N = 808), among fifth-grade multiethnic students enrolled in 18 urban public schools in high-crime areas. Sociodemographics: 44% white, 26% African American, 22% Asian, Hispanic ethnicity not reported more than 56% from low-income families Design: quasiexperimental (NRC) with 6-year follow-up Intervention: Seattle Social Development Project: a multifocus student (cognitive and social skills training), teacher (proactive classroom management, interactive teaching, and cooperative learning), and parent (child behavior management, academic support, and antisocial prevention). Program: full intervention provided in grades 1-6; in-service training for teachers yearly; parenting classes for parents of children in grades 1-3 and 5-6; social competence training for children in grades 1 and 6. A late intervention was provided in grades 5 and 6 only Achievement measures: CAT results, GPA, school disciplinary action reports (through age 17); suspensions and expulsions; Dropout and grade repetition (school records)	Full intervention including parent education and school participation component led to improved academic achievement and reduction of school dropout. Full intervention student group reported greater commitment ($p = .03$) and attachment ($p = .006$) to school (resiliency factors), better academic achievement (CAT scores, GPA, dropout, and grade repetition) ($p = .01$), and less school misbehavior (school disciplinary action reports through age 17; suspensions and expulsions) ($p = .02$) than controls. Children in grades 5 and 6 receiving late intervention only did not show significant change in health-risk behaviors in adolescence	☐ SHS ☐ SCSS ☐ SNS ☐ HPS ☒ PFCI ☒ HSE ☐ PE ☒ HE ☒ Teacher training

Table 1. **Continued**

	Sample, Design, and Intervention	Outcome	Domain
McCord et al[21]	Sample: N = 332 high-risk grade 6-12 students from low-income, mostly minority families (85% African American) who were enrolled in alternative schools (only 26% usually graduate or are promoted and over 30% were pregnant or supporting a child). Among these, 189 were registered to use the SBC; 159 actually used SBC services and 52% were female Design: quasiexperimental NRC study examined retrospective data records from school year (August 1990 to May 1991) Intervention: school-based health clinic in an alternative high school, staffed by part-time physician, nurse practitioner, and clerk; and a full-time registered nurse, social worker, and clerk Achievement measures: attendance; suspension; dropout from school; and graduation/promotion rate (records for 1990-1991 school year)	SBC users were as likely as nonusers to be absent or suspended but were twice as likely to stay in school and almost twice as likely to graduate or be promoted (31% vs 20%, total) (especially true for African American males who were 3 times more likely to stay in school than those who did not use the clinic): odds ratio = 0.35; 95% confidence interval = 0.16–0.78. Among African American males who graduated from school or were promoted, two third were clinic users. Only clinic use and percent of enrolled days absent were significantly associated with graduation/promotion, predicting 23% of the variance in promotion status	☒ SHS ☐ SCSS ☐ SNS ☐ HPS ☐ PFCI ☐ HSE ☐ PE ☐ HE
Elias et al[22]	Sample: N = 426 grade 9-11 students who had participated in program in grades 4 and 5 (95% participation rate); New Jersey community of 15,000; mostly mid-low family income Design: quasiexperimental nonrandomized comparison (NRC) of 2 experimental student cohorts (2 schools with high program fidelity; 2 schools with moderate fidelity) with control group; 5- and 6-year follow-up Intervention: Improving Social Awareness-Social Problem Solving program implemented in grades 4 and 5. Components: twenty 40-minute lessons for student interpersonal cognitive problem-solving curriculum with goal planning; teacher education to help students resolve conflicts and to problem solve in classroom, as well as teacher support provided by education consultant Achievement measures: CTBS and attendance (school records)	Participants exceeded control students in overall achievement based on national percentile scores on the CTBS, but in language arts and math subscales, only the group receiving the highest level of training exceeded the controls. Compared with controls, 6 years after the program, those who received the highest level of exposure showed improved school attendance, with difference in mean days absent each school year = 2.06 days, $p \leq .05$	☐ SHS ☐ SCSS ☐ SNS ☐ HPS ☐ PFCI ☐ HSE ☐ PE ☒ HE ☒ Teacher training
Eggert et al[23]	Sample: N = 259 grade 9-12 students from 4 urban public high schools in Washington who were at high risk for school failure or dropout. Sampling frame: n = 542 high-risk students were randomly selected and invited to join the study Design: quasiexperimental (NRC) 2 group, repeated measures, intervention trial Intervention: Personal Growth Class: 1 semester, 55 minutes per day, 5-month elective; classroom social skills development intervention with integrated group support and life-skills training Achievement measures: semester GPA and class absences (school records)	At baseline, the experimental group experienced significantly lower attendance, GPA, and reported lower perceived school performance and attendance than control group. Ten months later, participants showed significant increases in GPA (actual, p = .024; perceived, p = .002), school bonding, and perception of school performance compared with controls, whose GPA scores did not change significantly. No significant reductions in truancy or absenteeism were noted in the experimental group	☐ SHS ☐ SCSS ☐ SNS ☐ HPS ☐ PFCI ☐ HSE ☐ PE ☒ HE ☒ Teacher training
Meyers et al[24]	Sample: N = 1023 children in grades 3-6 in 6 public elementary schools in Lawrence, Masschusetts; 80.5% students from low-income families qualified for the SBP; participants ate at least 60% of provided SBP meals Sampling frame: N = 1954 Design: Quasiexperimental (NRC) conducted for 1 school year: pretest measured in second semester of 1986-1987 school year; posttest measured in second semester of 1987-1988 Intervention: SBP offered to low-income students enrolled in public elementary schools Achievement measures: CTBS battery; attendance and tardiness (school records)	After 1 year, increases in scores were significantly greater for the SBP participants in CTBS battery total scale score ($p < .01$), language subscore ($p < .05$), and approached significance for math and reading ($p < .1$). Tardiness rate decreased for participants and increased for nonparticipants ($p < .01$), although pre-/posttest participation was negatively associated with attendance (N/S) and tardiness (p = .0014)	☐ SHS ☐ SCSS ☒ SNS ☐ HPS ☐ PFCI ☐ HSE ☐ PE ☐ HE

Table 1. **Continued**

	Sample, Design, and Intervention	Outcome	Domain
Murphy et al[25]	Sample: N = 133 inner-city public elementary and middle school students who ate breakfast 80% or more of days present at school, who also provided both academic and attendance records; 85 of these students provided psychosocial interview data and 76 provided teacher ratings of classroom behavior. The sample was drawn from 492 low–socioeconomic status predominantly African American (>70%) families attending 3 schools in Baltimore (n = 2) and Philadelphia (n = 1); 78% (n = 384) were in grades 3-5 and 22% (n = 108) in grades 6-8. Sampling frame: N = 1627 Design: quasiexperimental nonrandomized study (comparison groups based on level of implementation of intervention). Measures taken at baseline and 4 months after exposed to intervention, assessed change in breakfast program participation and outcomes among students whose participation was often, sometimes, rare, or never Intervention: UFSBP. Participated often (ate 80% or more meals when present at school); sometimes (ate 20-79%); or rarely (ate less than 20% of meals when present at school) Achievement measures: letter grades in math, science, social studies, and reading (collected from school records for fall and spring terms); attendance and tardiness (school records); student self-report on Children's Depression Inventory; Revised Children's Manifest Anxiety Scale; PSC-Y (parent report); and Conners' Teacher Rating Scale-39 (symptom checklist of behavioral problems of school-age children)	UFSBP participants received significantly higher math grades ($p = .001$), fewer parent-reported child psychosocial symptoms (scores of 13.9 vs 18.9 on standard depression and anxiety scales, $p = .007$), and lower teacher-reported mean student hyperactivity index t scores (49.1 vs 63.3, $p = .02$) compared with those who participated rarely or not at all. SBP participants' showed significantly better outcomes for attendance (absence of 1.5 vs 2.8 days, $p = .02$), tardiness (0.4 vs 1.2 days, $p = .003$), math grades (numeric score of 2.8 vs 1.9, $p = .01$), and teacher report of mean hyperactivity index score (47.3 vs 58.3, $p = .003$) compared with students who participated rarely or not at all in the UFSBP	☐ SHS ☐ SCSS ☒ SNS ☐ HPS ☐ PFCI ☐ HSE ☐ PE ☐ HE
Gall et al[26]	Sample: a 4-year study of 383 public high school students in the United States; among 13- to 18-year olds (mean age = 16 and SD = 2.1) who received school-based mental health and counseling services, 74% were Hispanic, 54% were male, 7% were single parents, and 33% were on Medicaid; Of the 30-50% of all students enrolled in SBHC (n = 404), 95% agreed to complete the screening survey (n = 383) Design: quasiexperimental (NRC) Intervention: school-based mental health/counseling services Achievement measure: student-report PSC-Y to determine case status	Decreased absenteeism by 50% and reduced tardiness by 25% 2 months after referral ($p < .0001$). Student cases (PSC-Y) were significantly more likely to be referred for mental health services than those who were not cases ($p < .0001$) and had significantly lower academic functioning—lower self-reports of overall scholastic performance (48% with poor grades vs 17% fair, 5% good, 7% excellent), higher rates of absences and tardiness confirmed from school records; students referred for mental health services significantly decreased absence from school by two thirds of a day; those not referred increased absence and tardiness ($p < .0001$)	☐ SHS ☒ SCSS ☐ SNS ☐ HPS ☐ PFCI ☐ HSE ☐ PE ☐ HE
Felner et al[27]	Sample: N = 1204 students in entry grade (5 or 6) who attended 4 STEP schools (urban, suburban, and rural); low income (44%); multiethnic (17% minorities); controls (n = 761) students in 4 non-STEP comparison schools Design: quasiexperimental 5-year longitudinal (NRC) Intervention: STEP program (to facilitate successful adaptation to the transition from elementary to middle and secondary schools, and to increase coping resources available to students by modifying the ecology of the school context). Restructuring of roles of teachers and guidance staff: teacher-based advisories, team structuring, increased support and multidisciplinary planning. Restructured school ecology to a schools-within-schools format Achievement measures: school records—graduation, transfer, and dropout data. Permanent record of grades (GPA) and attendance records	First 2 years of 5-year study: Program Process Evaluation—after partialling out the effects of student race, sex, and parental education, multivariate analysis of variance showed significant unique effects of STEP participation on students' experiences of school environment and levels of support they received ($F = 10.57$, $p < .001$). Comparison to non-STEP schools showed that STEP students reported significantly lower levels of school transition stress and better adjustment. Teachers reported these students to have significantly more favorable classroom behavioral adjustment on each of the classroom behavioral problem dimensions ($F = 2.84$, $df = 14,620$, $p < .001$). STEP student grades and attendance were significantly more favorable than those in non-STEP schools (0.6 points higher, $F = 117.6$, $p < .01$)	☐ SHS ☐ SCSS ☐ SNS ☐ HPS ☐ PFCI ☒ HSE ☐ PE ☐ HE ☒ Teacher training

Table 1. **Continued**

	Sample, Design, and Intervention	Outcome	Domain
Felner et al[28]	Sample: N = 31 schools in 1991-1992 school year, classified into 3 groups: highest level of implementation of program (n = 9), partial implementation (n = 12), and low implementation (n = 10). Student sample within these 3 groups contains 15,762 students, 10- to 15-year olds (provided 14,347 teacher-student rating scales). About 900 teachers and 29 school administrators participated Design: quasiexperimental nonrandomized study (comparison groups based on level of implementation of intervention) Intervention: Project on High-Performing Learning Communities (HiPlaces) emerged from STEP (see Felner et al[27]) to develop systematic broader whole school improvement efforts in conditions and policies to improve teaching and learning for all K-12 students. HiPlaces linked to the Illinois Middle Grades Network, studying more than 97 schools committed to implementing school reform plan: administrator, teacher, other staff, student, and parent education components. Integrated literacy-numeracy emphasis curricula; professional development for teachers Achievement measures: composite score of sixth- and eighth-grade state achievement test scores (Iowa Tests of Basic Skills and California Tests of Basic Skills); teacher report of classroom behavior; student self-report of school climate	1-year correlations of increase in implementation of HiPlaces program with increases in eighth-grade reading (.51) and mathematics (.30) scores (both $p < .001$); similar correlations were found for 2-year changes in implementation and achievement scores with correlations of .53 and .35, respectively (both $p < .001$). Average gains in math/reading scores across 2-year periods: in most fully implemented group, average gain was approximately 21 points (25 points if a full ½ standard deviation on the scale); well-implemented schools showed average achievement gains of more than 15 points; lowest LOI schools showed average score gains of almost 12 points; schools with lowest levels of implementation showed average gains of less than 3 points; compared with schools with little or no implementation that showed declines in average test scores. More fully implemented schools showed more positive teacher reports of classroom behavior and student self-report of positive experience of school climate	☐ SHS ☐ SCSS ☐ SNS ☐ HPS ☒ PFCI ☒ HSE ☐ PE ☒ HE ☒ Teacher training
Flay et al[29]	Sample: N = 60 schools (36 in Nevada and 24 in Hawaii) Design: quasiexperimental nonrandomized matched-control comparison study over 2 years (Nevada) to 3 years (Hawaii); schools matched on percentage of free/reduced lunch program enrollment, student mobility rates, and ethnic distributions Intervention: PA program provided an academic curriculum of over one hundred and forty 15-20 minute social/emotional development, health, and safety lessons yearly per grade in classrooms for students K-6; teacher education includes manuals and materials for 15-20 minute daily classroom lessons; parent education included 42 multiage weekly lessons based on student curriculum; principal's education provided directions for the school climate program; community program involved activities and information about PA Achievement measures: grade 4 Terranova CTBS and disciplinary data were provided from 12 PA schools and 24 control schools in Nevada over a 2-year period; similar academic achievement (grade 4 Stanford achievement test) and disciplinary data were reported from 8 PA schools and 16 control schools in Hawaii over 3 years	Data suggest that the PA program was effective at improving school performance and reducing problem behavior requiring disciplinary referral or suspensions. Compared with control schools, PA schools in Nevada reported significant gains in math (21%), reading (13%), and language (15%) scores, as well as in combined math/reading/language (16%) scores ($p = .001$). Most incidents of violence were significantly lower for PA schools in comparison to all non-PA schools (n = 87) in Nevada except for possession of weapons. All measures were significantly lower for PA schools in comparison to matched controls. A reduction of the rate of violent incidents per 1000 students by 85% on average ($p = .013$) and for student to staff violence by 100% ($p = .022$). No significant reductions were noted for absenteeism	☐ SHS ☐ SCSS ☐ SNS ☐ HPS ☐ PFCI ☒ HSE ☐ PE ☒ HE ☒ Teacher training
Blair et al[30]	Sample: N = 3846 school employees participating (68% teachers). Sampling frame: n = 12,000 district employees Design: quasiexperimental longitudinal (NRC) study Intervention: personalized aerobics lifestyle system program: a health screening evaluation and intensive 10-week intervention program emphasizing health education, peer support, and behavior management policies. Involved a 50-minute class held weekly in each school before work; 5 evening seminars for participants and spouses to educate, reinforce learning, and generate spousal support; and 55-minute supervised exercise sessions held 1 day per week after school Staff/faculty outcome measures: self-reported health status and health habits; attendance (district personnel records)	Significant improvements in self-reported health status and health habits among treatment group; less absenteeism among treatment group (1.25 days per year) compared with control group ($p = .05$)	☐ SHS ☐ SCSS ☐ SNS ☒ HPS ☐ PFCI ☐ HSE ☐ PE ☐ HE

Table 1. **Continued**

	Sample, Design, and Intervention	Outcome	Domain
Ialongo et al[31]	Sample: 657 children and their families from 2 cohorts of first graders entering 9 Baltimore city public elementary schools (mean age = 6.2 years); two third received free or reduced-cost lunch Design: randomized block design, with schools serving as the blocking factor (3 first grade classrooms in each of the schools were randomly assigned to 1 of the 2 intervention conditions or a control condition); 5-year follow-up in sixth grade Intervention: (1) CC intervention for first grade teachers: curriculum enhancement to improve achievement; enhanced behavior management practice training to reduce aggressive and shy child behavior; and backup strategies for children not performing adequately. (2) FSP (a) training for teachers and relevant school staff in parent-teacher communication and partnership building, (b) weekly home-school learning and communication activities, and (c) series of 9 workshops on effective disciplinary, child management, and problem-solving strategies for parents Achievement measures: CTBS—Version IV—a group-administered standardized achievement test for verbal, language, and quantitative skills; Teacher Observation of Classroom Adaptation-Revised (first grade); Teacher Report of Classroom Behavior—Checklist Form (sixth grade—also frequency of skipping school, child conduct problems, school suspension in past year, and need for mental health services); Structured Interview of Parent Management Skills and Practices (Parent Version); Child Behavioral/Mental Health: mental health service utilization (parent interview and school report); Diagnostic Interview Schedule for Children (sixth grade, lifetime diagnosis of Conduct Disorder)	In spring of grade 6 (or at age 12), CC and FSP intervention children received significantly lower ratings from their teachers for conduct problems than control children. CC and FSP children were also significantly less likely than control children to meet diagnostic criteria for Conduct Disorder ($<.001$ and $<.01$, respectively) and to have been suspended from school in the last year. In addition, the CC intervention was associated with significantly lower rates of child mental health service need and utilization ($p < .001$), as well as significantly lower rates of suspension from school ($p < .001$). Among girls, those in the FSP intervention were significantly less likely ($p < .01$) to have been suspended during the sixth-grade year than girls in the control condition	☐ SHS ☐ SCSS ☐ SNS ☐ HPS ☒ PFCI ☒ HSE ☐ PE ☒ HE ☒ Teacher training

CAT, California achievement test; SBC, school-based clinic; NRC, nonrandomized control; CTBS, comprehensive test of basic skills; SBP, school breakfast program; UFSBP, universally free school breakfast program; PSC-Y, pediatric symptom checklist; PA program, Positive Action program; STEP, school transitional environment project; SHS, school health services; SCSS, school counseling/social services; SNS, school nutrition services; HPS, health promotion for staff; PFCI, parent/family/community involvement; HSE, healthy school environment; PE, physical education; HE, health education; N/S, nonsignificant; SBHC, school based health center; LOI, level of implementation.

children and their classmates, orientation for school principals and counselors, briefings for school custodians, school fairs including caretakers, and communication with clinicians demonstrated higher grades for science but not math or reading and fewer absences attributed to asthma as reported by parents but not fewer school-recorded absences.[16] A rigorous evaluation of Project SPARK, a physical education program, demonstrated significant gains for reading, losses for language, and no differences for math scores on a standardized test, suggesting that, even with time taken away from the academic program for physical education, overall academic functioning was not impaired.[17] In a randomized trial of physical education programs incorporating fitness or skill training for 75 minutes per day, compared with usual physical education offered 3 times a week for 30 minutes, students in the fitness and skill groups demonstrated no significant decrement in test scores compared with controls.[18] These studies suggest that implementation of physical education will not impair academic achievement on standardized tests, and implementation of asthma management programs may enhance some academic grades for low–income asthmatic children.

The Seattle Social Development Project incorporated parent involvement through parent education, health education through social skills training, and healthy school environment through teacher training in classroom management evaluated initially in a randomized controlled design for children in grades 1-4 and subsequently in a quasiexperimental design in which the panel was expanded to include additional children and schools. A substudy of the Seattle Social Development Project, including children from the original sample enrolled in first grade, randomly assigned to intervention and control condition and evaluated in fifth grade reported significant improvements in achievement test scores and grades for boys but not for girls.[19] The long-term follow-up of the original trial augmented in fifth grade with a larger panel and a late intervention in grades 5 and 6 implemented in a quasiexperimental design found 18-year-old students receiving the full intervention

(grades 1-6) reported better school achievement by grade 12 as measured by a combination of self-reported GPA and number of grades repeated along with better school commitment and attachment to school. No effect was demonstrated on standardized test scores.[20] In young adulthood, these students were significantly more likely to have graduated from high school and complete 2 or more years of college.[32]

Among those studies examining food/nutrition service provision in US schools, improved academic achievement outcomes were found by Meyers et al[24] and Murphy et al[25] Murphy et al's[25] quasiexperimental 1 group pretest-postest design lacks rigor but provides evidence that, among primarily African American low-income students in Pennsylvania and Maryland, an increase in participation in a school breakfast program over 4 months was related to a significant increase in math grades (but not science, social studies, or reading) and a decrease in absences and tardy rates. Meyers et al's[24] earlier study comparing changes in achievement test scores for participants versus nonparticipants in school breakfast programs in 6 Massachusetts schools found that participants' total scale scores and language scores improved significantly compared with nonparticipants, with positive trends for mathematics and reading and decreases in tardiness. Kleinman et al[33] conducted a similar 1 group pretest-posttest study among inner-city children from the start of a school breakfast program to a 6 month follow-up and found that children who decreased their nutrition risk showed improvements in reading, math, social studies, and science and improvements in attendance. The US federal mandate for school lunch and breakfast programs limits researchers' capacity to randomly allocate schoolchildren to an appropriate comparison group, thereby limited US studies to quasiexperimental designs. Although limited in generalizability to US children because of different caloric demands of walking long distances to school, a randomized trial conducted on the effects of a 1-year breakfast program in Jamaica among primary schoolchildren has demonstrated positive effects on grades, achievement test scores, and attendance.[34]

Ialongo et al[31] provided compelling evidence of the positive impact of a 5-year school-based intervention using a quasiexperimental randomized block design to examine sixth-grade student classroom behavior, mental health service utilization, and school suspension. The classroom-centered intervention (CC) focused on enhancing first-grade teachers' management of child aggression, shyness, and disruption of on-task behavior, and enhanced curricula to improve students' critical thinking, composition, and listening and comprehension skills. The family-school partnership intervention (FSP) enhanced parent-teacher communication and provided parents with effective teaching and child behavior management strategies through teacher training, weekly home-school learning and communication activities, and parent workshops led by the first-grade teachers and the school psychologist or social worker. Compared with controls, sixth-grade students assigned to the CC intervention were significantly less likely to be diagnosed with lifetime conduct disorder, to have been suspended from school, and to have been identified as needing mental health services or to have been identified by parents as receiving mental health services. Both the CC and FSP child participants showed lower levels of teacher-rated conduct disorder-related behavior. In the FSP intervention group, girls were significantly less likely to have been suspended from school than their sixth-grade peers.

Two studies using a quasiexperimental design suggest that social skills training for students in elementary or high school and a teacher training component were associated with improved achievement. Elias et al[22] found at 6-year follow-up evaluation that grade 9-11 students who had received social skills training in grades 4-5 showed significantly improved school attendance, and higher general scores on the standardized achievement test compared with controls. Further, those among the group receiving the highest level of training exceeded controls for standardized language arts and math scores. Eggert et al[23] found that 10 months after students in grades 9-12 who were at risk for failure learned social skills in a 5-month Personal Growth course that included a teacher training component, the intervention students showed significant increases in GPA, school bonding, and perception of school performance compared with controls.

Although few school-based health clinic studies examined academic achievement outcomes, McCord et al[21] provided evidence supporting significant associations between clinic use by students in grades 6-12, reduced absenteeism, and school graduation or grade promotion, particularly among African American male students who were 3 times more likely to stay in school than their peers who did not use the clinic. Gall et al[26] found that among 13- to 18-year-old public high school students, 2 months after they received school-based mental health and counseling services, absenteeism decreased by 50% and tardiness decreased by 25%. Students referred for mental health services significantly decreased absence from school by two thirds of a day while those not referred increased both absenteeism and tardiness. Only 1 study by Blair et al[30] reported significant improvements in self-reported health status and reduced absenteeism among school employees participating in the personalized aerobics lifestyle system program, an intensive 10-week intervention of health education,

peer support, behavior management, and supervised exercise sessions held 1 day per week after school.

DISCUSSION

The strongest evidence from scientifically rigorous evaluations exists for a positive effect on some academic outcomes from school health programs for asthmatic children that incorporate health education and parental involvement. Strong evidence also exists for a lack of negative effects of physical education programs on academic outcomes. Limited evidence from scientifically rigorous evaluations support the effect of nutrition services, health services, and mental health programs, and no scientifically rigorous evidence is found in the literature to support the effect of staff health promotion programs or school environment interventions on academic outcomes. In light of the economic and scientific challenges of implementing stringent research designs with adequate sample sizes in the school setting, it is noteworthy and encouraging that strong evidence exists for the effect of school health programs on academic outcomes.

For this review, we have considered strong evidence to be supplied by a randomized controlled trial of an intervention that clearly incorporates components of the coordinated school health model and measures academic outcomes. To reduce threats to the validity of the research trial contributed by contamination between conditions and to account for the variability in measures contributed by school-level consistencies, randomized controlled trials of school interventions are best conducted with schools as the unit of analysis.[35] For adequate power to detect a difference due to intervention for many outcome measures in such a group randomized trial, minimum sample size for a research design with school as the unit of analysis is recommended to be 20 schools, with a more optimal sample size approaching 100 schools,[36] an expensive proposition. Another threat to validity of school-based randomized trials is inherent in the fidelity of the implementation of the intervention in the treatment school with no implementation of the tested intervention (or similar one) in the control schools for the duration of the evaluation. Although many school administrators welcome the opportunity to implement programs designed to enhance their students' success, few administrators are pleased to ''withhold'' such programs for the purposes of research, and there have been instances where school administrators have implemented programs similar to the treatment program to give their students optimal opportunities for success.[37] In some instances, for example, with school food service, school health services, or mental health services, creating a no-treatment control condition may be against federal, state, or local policy. Careful process evaluation is critical to measure the fidelity of program implementation and maintenance of an adequate control condition. Funding agencies also have to be willing to fund school programs for extended periods sufficient for planning (1 year), implementation (1-3 years), data collection, and follow-up (1-3 years). The strongest evidence discovered in this review is the result of projects that have a history of many years of planning, careful implementation, and extended follow-up periods supported by ample grant funding.

The programs that incorporate social skills training in a health education component along with parent training, teacher training, and school-wide climate change have demonstrated evidence for improving academic outcomes.[20,29,38] These programs were designed to impact academic outcomes and, therefore, measured academic outcomes. Many school health programs have been implemented successfully and demonstrated success in improving the outcome variables of interest: increased physical activity and improved nutrition,[39] decreased substance use,[40] decreased aggression,[41] and decreased risky sexual behavior.[42] Unfortunately, for this review, outcome variables of interest for these programs have not included academic outcomes. In the future, school health programs need to be evaluated on their influence on academic performance variables to build the literature supporting school health programs for enhancing academic outcomes. However, in the interim, there is evidence that implementing school health programming incorporating social skills training in health education, breakfast programs, physical education, mental health services, health services, and parental and community involvement will improve students' chances for academic success. Further research needs to be conducted on staff health promotion and the physical aspects of the school environment to indicate promising directions for these school health components.

CONCLUSIONS

Through this process, the reviewers have critically evaluated the evidence to support school health practices as they relate to improved student academic performance. The final list of evidence-based programs that impact academic performance is very small for some of the elements of CSHP but defensible. This process will permit us to generate a specific list of future research needs to share with our colleagues interested in the field of school health and academic achievement.

REFERENCES

1. Feinstein L. *Quantitative Estimates of the Social Benefits of Learning, 2: Health (Depression and Obesity)*. London: Centre for

Research on the Wider Benefits of Learning; 2002. Wider Benefits of Learning Research Report no. 6.
2. Schoenbaum M, Waidmann T. Race, socioeconomic status and health: accounting for race differences in health in the U.S. elderly. *J Gerontol*. 1997;52:61-73.
3. Lleras-Muney A. *The Relationship Between Education and Adult Mortality in the United States*. Princeton, NJ: National Bureau of Economic Research; 2002. NBER Working Paper no. w8986.
4. Kolbe LJ. Education reform and the goals of modern school health programs. *Educ Stand*. 2002(3);4-11.
5. Ross CE, Wu C-LRA. Education, age, and the cumulative advantage in health. *J Health Soc Behav*. 1996;37(1):104-120.
6. Crum RM, Ensminger ME, Ro MJ, McCord J. The association of educational achievement and school dropout with risk of alcoholism: a twenty-five-year prospective study of inner-city children. *J Stud Alcohol*. 1998;59:318-326.
7. Kessler RC, Foster CL, Saunders WB, Stang PE. Social consequences of psychiatric disorders, I: education attainment. *Am J Psychiatry*. 1995;152(7):1026-1032.
8. Miller DS, Miller TQ. A test of socioeconomic status as a predictor of initial marijuana use. *Addict Behav*. 1997;22(4):479-489.
9. Grossman M, Kaestner R. Effects of education on health. In: Berhman JR, Stacey N, eds. *The Social Benefits of Education*. Ann Arbor: University of Michigan Press; 1997.
10. Nayga RM Jr. Schooling, health knowledge and obesity. *Appl Econ*. 2000;32(7):815-822.
11. Schorr LB. Children, families and the cycle of disadvantage. *Can J Psychiatry*. 1991;36(6):437-441.
12. McKenzie FD, Richmond JB. Linking health and learning: an overview of coordinated school health programs. In: Marx E, Wooley SF, Northrup D, eds. *Health is Academic: A Guide to Coordinated School Health Programs*. New York, NY: Teachers College Press; 1998:1-14.
13. Briss PA, Zaza S, Pappaioanou M, et al. Developing an evidence-based Guide to Community Preventive Services—methods. *Am J Prev Med*. 2000;18(suppl 1):35-43.
14. Zaza S, Wright-de Aguero L, Briss PA, et al. Task force on community preventive services. Data collection instrument and procedure for systematic reviews in the Guide to Preventive Services. *Am J Prev Med*. 2000;18:44-74.
15. Evans D, Clark NM, Feldman CH, et al. A school health education program for children with asthma aged 8-11 years. *Health Educ Q*. 1987;14(3):267-279.
16. Clark NM, Brown R, Joseph CL, Anderson EW, Liu M, Valerio MA. Effects of a comprehensive school-based asthma program on symptoms, parent management, grades, and absenteeism. *Chest*. 2004;125(5):1674-1679.
17. Sallis JF, McKenzie TL, Kolody B, Lewis M, Marshall S, Rosengard P. Effects of health-related physical education on academic achievement: project SPARK. *Res Q Exerc Sport*. 1999;70(2):127-134.
18. Dwyer T, Coonan WE, Worsley LA, Leitch DR. An assessment of the effects of two physical activity programs on coronary heart disease risk factors in primary school children. *Community Health Stud*. 1979;3:196-202.
19. O'Donnell J, Hawkins JD, Catalano RF, Abbott RD, Day LE. Preventing school failure, drug use, and delinquency among low-income children: long-term intervention in elementary school. *Am J Orthopsychiatry*. 1995;65(1):87-100.
20. Hawkins JD, Catalano RF, Kosterman R, Abbott R, Hill KG. Preventing adolescent health-risk behaviors by strengthening protection during childhood. *Arch Pediatr Adolesc Med*. 1999; 153(3):226-234.
21. McCord MT, Klein JD, Foy JM, Fothergill K. School-based clinic use and school performance. *J Adolesc Health*. 1993;14(2):91-98.
22. Elias MJ, Gara MA, Schuyler TF, Branden-Muller LR, Sayette MA. The promotion of social competence: longitudinal study of a preventive school-based program. *Am J Orthopsychiatry*. 1991;61(3):409-417.
23. Eggert LL, Thompson EA, Herting JR, Nicholas LJ, Dicker BG. Preventing adolescent drug abuse and high school dropout through an intensive school-based social network development program. *Am J Health Promot*. 1994;8(3):202-215.
24. Meyers AF, Sampson AE, Weitzman M, Rogers BL, Kayne H. School breakfast program and school performance. *Am J Dis Child*. 1989;143(10):1234-1239.
25. Murphy JM, Pagano ME, Nachmani J, Sperling P, Kane S, Kleinman RE. The relationship of school breakfast to psychosocial and academic functioning: cross-sectional and longitudinal observations in an inner-city school sample. *Arch Pediatr Adolesc Med*. 1998;152(9):899-907.
26. Gall G, Pagano ME, Desmond MS, Perrin JM, Murphy JM. Utility of psychosocial screening at a school-based health center. *J Sch Health*. 2000;70(7):292-298.
27. Felner RD, Brand S, Adan AM, et al. *Restructuring the ecology of the school as an approach to prevention during school transitions: longitudinal follow-ups and extensions of the school transitional environment project (STEP)*. *Prev Hum Serv*. 1993;10(2):103-136.
28. Felner RD, Jackson AW, Kasak D, Mulhall P, Brand S, Flowers N. *The impact of school reform for the middle years*. *Phi Delta Kappan*. 1997:528-532, 541-550.
29. Flay B, Allred CG, Ordway C. Effects of the Positive Action Program on achievement and discipline: two matched-control comparisons. *Prev Sci*. 2001;2(2):71-89.
30. Blair SN, Tritsch L, Kutsch S. Worksite health promotion for school faculty and staff. *J Sch Health*. 1987;57(10):469-473.
31. Ialongo N, Poduska J, Werthamer L, Kellam S. The distal impact of two first-grade preventive interventions on conduct problems and disorder in early adolescence. *J Emot Behav Disord*. 2001;9(3):146-160.
32. Hawkins JD, Kosterman R, Catalano RF, Hill KG, Abbott RD. Promoting positive adult functioning through social development intervention in childhood: long-term effects from the Seattle Social Development Project. *Arch Pediatr Adolesc Med*. 2005;159(1):25-31.
33. Kleinman RE, Hall S, Green H, et al. Diet, breakfast, and academic performance in children. *Ann Nutr Metab*. 2002;46(suppl 1): 24-30.
34. Powell CA, Walker SP, Chang SM, Grantham-McGregor SM. Nutrition and education: a randomized trial of the effects of breakfast in rural primary school children. *Am J Clin Nutr*. 1998;68(4):873-879.
35. Flay BR, Biglan A, Boruch RF, et al. Standards of evidence: criteria for efficacy, effectiveness and dissemination. *Prev Sci*. 2005;6(3):151-175.
36. Murray D. *Design and Analysis of Group-Randomized Trials*. New York, NY: Oxford; 1998.
37. Orpinas P, Kelder S, Frankowski R, Murray N, Zhang Q, McAlister A. Outcome evaluation of a multi-component violence-prevention program for middle schools: the Students for Peace project. *Health Educ Res*. 2000;15(1):45-58.
38. Flay BR, Allred CG. Long-term effects of the Positive Action program. *Am J Health Behav*. 2003;27(suppl 1):S6-S21.
39. Luepker RV, Perry CL, McKinlay SM, et al. Outcomes of a field trial to improve children's dietary patterns and physical activity: the child and adolescent trial for cardiovascular health. *J Am Med Assoc*. 1996;275(10):768-776.
40. Botvin GJ, Griffin KW, Diaz T, Ifill-Williams M. Preventing binge drinking during ealy adolescence: one- and two- year follow-up of a school-based preventive intervention. *Psychol Addict Behav*. 2001;15(4):360-365.
41. Foshee VA, Bauman KE, Greene WF, Koch GG, Linder GF, MacDougall JE. The safe dates program: 1-year follow-up results. *Am J Public Health*. 2000;90(10):1619-1622.
42. Coyle K, Basen-Engquist K, Kirby D, et al. Safer choices: reducing teen pregnancy, HIV, and STDs. *Public Health Rep*. 2001;116(suppl 1):82-93.