

# Using the School Environment to Promote Physical Activity and Healthy Eating

Howell Wechsler, Ed.D., M.P.H.,<sup>1</sup> Randolph S. Devereaux, A.B., Margaret Davis, M.D., M.P.H., and Janet Collins, Ph.D.

*Division of Adolescent and School Health, National Center for Chronic Disease Prevention and Health Promotion, The Centers for Disease Control and Prevention, Atlanta, Georgia 30341*

**Background.** The role of the community environment in shaping dietary and physical activity behaviors has received increasing attention in recent years. Although schools are a key part of the community environment, interventions that promote physical activity and healthy eating among students through changes in the school environment have received relatively little attention.

**Method.** After reviewing the role of environmental factors in shaping health behavior, this paper describes the various aspects of the school environment that influence physical activity and nutrition behaviors. Relevant research is described and new research directions are proposed for five key environmental influences: recess periods, intramural sports and physical activity programs, physical activity facilities, foods and beverages available at school outside of the school meals program, and psychosocial support for physical activity and healthy eating.

**Results.** Recess, intramural programs, and access to school physical activity facilities outside of school hours can provide opportunities for health-enhancing physical activity. States, school districts, and schools can establish strong policies and implement creative interventions to promote healthy eating through the foods and beverages offered at school. Schools can offer psychosocial support for physical activity and healthy eating through school policies, administrative commitment, role modeling by school staff, and the use of cues and incentives.

**Conclusions.** Enough is known from theory, practice, and research to suggest that school-based environmental strategies to promote physical activity and healthy eating among young people merit implementation and ongoing refinement.

<sup>1</sup> To whom reprint requests should be addressed at Division of Adolescent and School Health, Centers for Disease Control and Prevention, 4770 Buford Highway, NE Mail Stop K-32, Atlanta, GA 30341-3717. Fax: 770-488-3112. E-mail: [haw7@cdc.gov](mailto:haw7@cdc.gov).

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## INTRODUCTION

Undesirable dietary and physical activity patterns can significantly increase the risk of young people for serious health problems [1–3]. Schools are convenient sites in which to base physical activity and nutrition interventions for young people. Although increasing attention has been focused on the influence of the community environment on dietary and physical activity behaviors [4–7], relatively little attention has been paid to studying the influence of the school environment on these behaviors.

Schools offer many opportunities for young people to practice healthy eating and to engage in physical activity. More than one-half of young people in the United States get either breakfast or lunch, and 1 in 10 get both, from a school meal program [8]. In addition to cafeteria meals, students can obtain numerous snacks at school, e.g., from vending machines, classroom parties, and concession stands. School opportunities for participation in physical activity include physical education classes, recess periods, extracurricular sports and physical activity programs, and access to school gymnasiums, playing fields, and playgrounds. Schools also have personnel who, with sufficient training and commitment, can design and deliver effective nutrition and physical activity programs, establish and enforce policies that support healthy choices, and serve as powerful role models for students.

Several literature reviews have found that well-designed and well-implemented school-based programs can improve the physical activity and eating behaviors of young people [9–13]. Schools can draw on guidelines issued by the Centers for Disease Control and Prevention (CDC) that identify policy and programmatic strategies most likely to be effective in promoting physical

activity [9] and healthy eating [10] among young people (Table 1); one of the guidelines calls for the establishment of a health-enhancing school environment.

Frustrated with theoretical models focusing exclusively on factors within the individual, such as knowledge, attitudes, and beliefs, many researchers have designed interventions based on theories that strongly emphasize the role of the environment in influencing behavior, e.g., social ecology and social cognitive theory [14–18]. Similarly, several recent review articles explored environmental rather than individual approaches to promoting cardiovascular health at the community level [4–7,19]. At the school level, initiatives to reshape the school environment have been central to many efforts to reduce adolescent use of tobacco products [20]. Despite these developments, little research has been conducted to date on the impact of school-based environmental interventions on youth physical activity and dietary behaviors or even to specify what

is meant by the school physical activity and nutrition environment.

This paper will describe the role of environmental factors in shaping health behavior, the characteristics of interventions that attempt to influence the health environment, and the theoretical foundations upon which such interventions are based. Existing research will be reviewed and new research directions proposed for five key aspects of the school physical activity and nutrition environment that have received relatively little research attention. Finally, research needed to improve our understanding of the overall school physical activity and nutrition environment will be discussed.

#### THE COMMUNITY HEALTH ENVIRONMENT AND ENVIRONMENTAL INTERVENTIONS

The health environment has been conceptualized as all factors that can affect an individual's health-related behaviors, are external to the individual, and are shared by members of the individual's community [21]. Environmental factors may be social, institutional, or physical [14]. The social environment includes such variables as social support, role modeling, persuasion, and social norms from a variety of sources, e.g., peers, family members, the mass media. The institutional environment includes rules or policies established by institutions to which individuals belong, such as governments, employers, churches, schools, stores, and clubs. The physical environment includes climate, topography, and physical structures of a community as well as the availability of relevant facilities and services.

Both social ecological theory and social cognitive theory provide insights into the role of the environment in shaping health behaviors. Social ecological theory, which posits that the environment largely controls or sets limits on the behavior that occurs within it [22], provides a philosophical underpinning for intervention strategies such as offering economic and social support for health-enhancing practices, transmitting information and life skills to support health-enhancing behaviors, and making healthful goods and services more widely available and accessible [23]. Within social cognitive theory, the key concept of reciprocal determinism holds that behaviors are influenced by personal, environmental, and behavioral factors and that these factors are dynamic and constantly interacting [24]. For example, the environment may limit or facilitate behavior, but behavior also can change the environment. Personal factors, such as beliefs, may influence behavior, but environmental factors can lead to a change in behavior, which, in turn, can induce changes in beliefs [14].

Historically, changes in the environment have played a critical role in improving public health. In fact, most of the decline in mortality in the United States during

**TABLE 1**

CDC Guidelines for School Programs to Promote Lifelong Physical Activity and Healthy Eating

1. Policy: Establish policies that promote enjoyable, lifelong physical activity, and healthy eating.
2. Environment: Provide physical and social environments that encourage and enable safe and enjoyable physical activity and healthy eating.
3. Health education curricula: Implement health education curricula from preschool through secondary school that help students develop the knowledge, attitudes, behavioral skills, and confidence needed to adopt and maintain physically active lifestyles and healthy eating behaviors.
4. Health education instruction: Provide health education through developmentally appropriate, culturally relevant, fun, participatory activities that involve social learning strategies.
5. Physical education: Implement physical education curricula and instruction that emphasize enjoyable participation in physical activity and that help students develop the knowledge, attitudes, motor skills, behavioral skills, and confidence needed to adopt and maintain physically active lifestyles.
6. Extracurricular activities: Provide extracurricular activity programs that meet the needs and interests of all students.
7. Integration of school food service and nutrition education: Coordinate school food service with nutrition education and with other components of the coordinated school health program to reinforce messages on healthy eating.
8. Training for school staff: Provide adequate preservice and ongoing in-service training for teachers, coaches, food service staff, and other school staff that impart the knowledge and skills needed to effectively promote enjoyable, lifelong physical activity and healthy eating.
9. Family and community involvement: Involve family members and the community in supporting, enabling, and reinforcing physical activity and nutrition education for young people.
10. Program evaluation: Regularly evaluate the effectiveness of school programs in promoting physical activity and healthy eating, and change the programs as appropriate to increase effectiveness.

the 20th century resulted from environmental changes, such as improvements in water and food quality, sanitation, housing, and transportation safety [16]. Environmental interventions are designed to (1) provide access to opportunities for engaging in health-enhancing behavior, while eliminating or weakening those aspects of the environment that make it easier for individuals to engage in health-compromising behavior, and (2) highlight positive role models, generate social support, and establish rewards and cues to action for engaging in health-enhancing behaviors. The ultimate goal is to shift social norms and the physical environment so that they naturally reinforce health-enhancing behaviors and discourage health-compromising behaviors. Environmental interventions often involve changes in laws, regulations, or organizational policies [5]; they also can involve mass media communication campaigns [6].

Environmental interventions have several advantages over initiatives directed at individual persons, which often emphasize personal responsibility for change. By reaching wider audiences, environmental interventions can be less costly and more efficient. In addition, unlike individual interventions, they can take advantage of passive approaches, such as changing the food preparation practices of school cafeterias, that do not require voluntary and sustained effort by targeted individuals [25]. Ideally, interventions should encompass both environmental and individual behavior change strategies. Indeed, Green and Kreuter [26] have defined health promotion as “the combination of educational and environmental supports for actions and conditions of living conducive to health.”

Several kinds of interventions that have been proposed for changing a community's physical activity and nutrition environment [4,6,7] are identified in Table 2. In addition, some authors have suggested that regulatory approaches used to control the sale of alcohol and tobacco products might be used to control the conditions under which foods of relatively low nutritional value are sold and promoted [5,27]. For example, laws or regulations could establish limits on where and when these foods could be sold (e.g., not in school during meal periods) or advertised (e.g., not on children's television shows or on billboards near schools), and advertisers could be required to include appropriate nutritional messages in all advertisements or to support counteradvertising. Elsewhere in this issue, Richter et al. [28] review various approaches to measuring the community health environment for physical activity and nutrition among youth.

### THE SCHOOL ENVIRONMENT

Broadly speaking, a school's physical activity and nutrition environment can be conceptualized as including any factor that could influence the physical activity and

nutrition behaviors of students. Thus, it would include all eight components of the CDC's coordinated school health program model: a healthy school environment, which the CDC [29] defined as “the physical and aesthetic surroundings and the psychosocial climate and culture of the school”; health education; physical education; the food service program; health services; counseling, psychological, and social services; family and community involvement; and health promotion for staff. Most school-based interventions to promote physical activity and healthy eating have focused on the three school health program components that most directly address these behaviors: health education, physical education, and the food service program [30]. These components have been frequently reviewed in the literature [9–13,31] and, consequently, will not be reviewed in this paper.

Instead, this paper adds to the understanding of school-based environmental interventions by focusing on five additional factors that can influence student physical activity and nutrition behaviors but do not fit neatly into any of the eight components of the coordinated school health program model. These factors, which have received relatively little attention either in the research literature or in program development, are: (a) recess periods, (b) intramural sports and physical activity programs, (c) facilities that support physical activity, (d) food and beverages available at school outside of the school meals program, and (e) psychosocial support for physical activity and healthy eating through policies, administrative attention, staff development and health promotion services, and audiovisual cues and incentives in the school's physical environment. By implementing effective policies and practices in each of these five areas, schools can provide substantial opportunities for students to engage in physical activity and healthy eating and help establish social norms that facilitate healthy choices. Organizations that provide technical assistance materials or services for schools interested in enhancing these aspects of their physical activity and nutrition environment are listed in Table 3.

### RECESS PERIODS

Recess, a regularly scheduled time for unstructured physical activity and play, has long been a staple of the elementary school environment in the United States. Typically, recess takes place outdoors; the length and number of recess periods vary by school and, within schools, by class [32]. The CDC's Guidelines for School and Community Programs to Promote Lifelong Physical Activity among Young People recommend that schools provide time for unstructured physical activity as a complement to, not a substitute for, physical education [9]. In 1999, the National Association of Elementary

TABLE 2

Sample Strategies for Community-Based Environmental Change Interventions to Promote Physical Activity and Healthy Eating

General strategy	Specific strategies
Provide or increase access to opportunities for physical activity	<ul style="list-style-type: none"> <li>• Construct sports and recreation spaces and facilities, such as parks, playgrounds, gymnasiums, and walking and bicycle paths.</li> <li>• Offer new sports and recreation programs or increase the hours that sports and recreation facilities are open for public use.</li> <li>• Provide regular breaks for physical activity.</li> <li>• Make physical activity more convenient by changing the physical environment (e.g., construct sidewalks, make stairways safe and attractive to use, install parking racks for bicycles and showers and locker rooms).</li> </ul>
Provide or increase access to opportunities for healthy eating	<ul style="list-style-type: none"> <li>• Make highly nutritious foods, such as fruits, vegetables, and low-fat dairy products, available.</li> <li>• Work with the food industry to develop, test, and market attractive convenience foods that are low in fat, sodium, and added sugars.</li> </ul>
Cultivate social support for and provide cues to and incentives for physical activity and healthy eating	<ul style="list-style-type: none"> <li>• Improve the food selection and preparation practices of food-serving institutions.</li> <li>• Foster social support networks through support groups, help lines, clubs, and family-oriented events.</li> <li>• Deliver persuasive messages through targeted use of mass media, particularly television, radio, newspapers, and magazines.</li> <li>• Prompt healthy choices through the strategic placement of information and reminders, such as signs next to elevators about the benefits of stair walking and nutrition information on product labels, menus, and cafeteria counters.</li> <li>• Offer economic incentives for healthy behavior, such as subsidies to reduce the costs of nutritious foods or participation in physical activity programs, prizes for participation in health promotion programs, and reductions in insurance rates for individuals with health-enhancing behaviors.</li> <li>• Establish economic disincentives, such as higher taxes on foods high in fat.</li> <li>• Offer noneconomic incentives for healthy behavior, such as public recognition.</li> </ul>

School Principals (NAESP) endorsed recess as “an important component in a child’s physical and social development” and encouraged principals to “develop and maintain appropriately supervised, unstructured free play for children during the school day” [33]. A 1991 survey conducted by the NAESP found that most of the 383 principals surveyed believed recess had educational and social value [34].

#### *Recess Duration*

A 1986 U.S. study found that students in grades 1–4 averaged 1.5 recess periods per day, with the average recess lasting 18.3 minutes [35]. More recent national data on recess are unavailable; anecdotal reports indicate that the time allocated might be decreasing [36,37]. Some large school districts, including Atlanta and Orlando, have eliminated recess altogether, reportedly due to safety concerns and a desire to increase time for academic instruction [36,37]. On the other hand, parental opposition has led to the defeat of some recent school district proposals to eliminate recess [37].

#### *Contribution to Physical Activity*

Currently, we have no data on the contribution that recess periods make to the overall physical activity levels of elementary school students. Recess promotes

physical activity, in part, by simply getting children outdoors. Studies have shown a positive correlation between the time young children spend outdoors and their levels of physical activity [38–40]. Children are not active throughout recess: observational studies at elementary schools found students engaging in physical activity for only 48–60% of recess with the remaining time spent waiting for a turn to play, playing with toys while sitting down, conversing with other students, or observing others [41–43]. Furthermore, much of the physical activity was not vigorous; one observational study found that students in grades K–3 were vigorously active for only 21% of recess [42]. Two studies found that children were significantly less active as time elapsed at elementary school recesses [41,44], while another study found that elementary school children were significantly more active when trained playground supervisors implemented a games intervention during recess than they were during standard, unstructured recesses [45]. Schools might try to facilitate increased physical activity during recess by having staff encourage students to be active; providing students with space, facilities, equipment, and supplies that can make participation in physical activity appealing to them; and providing organized physical activities for those students who want it [9,42].

**TABLE 3**

Organizations That Provide Technical Assistance Materials for Specific Environmental Components

Environmental component	Organization	Materials provided
Recess	<ul style="list-style-type: none"> <li>American Association for the Child's Right to Play (<a href="http://www.ipausa.org">www.ipausa.org</a>)</li> </ul>	<ul style="list-style-type: none"> <li>The Case for Elementary School Recess (brochure)</li> </ul>
Intramural sports programs	<ul style="list-style-type: none"> <li>National Intramural Sports Council (c/o National Association for Sport and Physical Education, 1-800-213-7193 ext. 410)</li> <li>National Intramural and Recreational Sports Association (<a href="http://www.nirsa.org">www.nirsa.org</a>)</li> </ul>	<ul style="list-style-type: none"> <li>Guidelines for School Intramural Programs (brochure)</li> <li>Manual for implementing intramural programs for grades K–12 (in press)</li> </ul>
Safety of physical activity facilities	<ul style="list-style-type: none"> <li>Children's Safety Network (<a href="http://www.edc.org/HHD/csn">www.edc.org/HHD/csn</a>)</li> <li>National Association for Sport and Physical Education (<a href="http://www.aahperd.org/naspe">www.aahperd.org/naspe</a>)</li> <li>National Playground Safety Institute at the National Recreation and Park Association (<a href="http://www.nrpa.org/playsafe/playsafe.htm">www.nrpa.org/playsafe/playsafe.htm</a>).</li> <li>U.S. Consumer Products Safety Commission (<a href="http://www.cpsc.gov">www.cpsc.gov</a>)</li> </ul>	<ul style="list-style-type: none"> <li>An assortment of materials and information about safety and injury prevention</li> </ul>
Physical activity equipment	<ul style="list-style-type: none"> <li>KaBOOM (<a href="http://www.kaboom.org">www.kaboom.org</a>)</li> <li>Operation FitKids (949-497-4526)</li> <li>Project Fit America (<a href="http://www.projectfitamerica.org">www.projectfitamerica.org</a>)</li> </ul>	<ul style="list-style-type: none"> <li>Information on programs that donate fitness, exercise, and playground equipment to schools</li> </ul>
School health councils	<ul style="list-style-type: none"> <li>American Cancer Society (800-ACS-2345)</li> </ul>	<ul style="list-style-type: none"> <li>Improving School Health: A Guide to School Health Councils (booklet)</li> <li>Brochure on starting a Nutrition Advisory Council</li> </ul>
School policies	<ul style="list-style-type: none"> <li>American School Food Service Association (<a href="http://www.asfsa.org">www.asfsa.org</a>)</li> <li>National Association of State Boards of Education (<a href="http://www.nasbe.org">www.nasbe.org</a>)</li> <li>National School Boards Association (<a href="http://www.nsb.org/schoolhealth">www.nsb.org/schoolhealth</a>) (703-838-6754)</li> </ul>	<ul style="list-style-type: none"> <li>Fit, Healthy, and Ready-to-Learn: A School Health Policy Guide</li> <li><i>School Health Resource Database</i> (and technical assistance service)</li> </ul>
Involving students in advocacy for physical activity and nutrition	<ul style="list-style-type: none"> <li>California Project LEAN (<a href="http://www.dhs.ca.gov/lean">www.dhs.ca.gov/lean</a>)</li> <li>American Cancer Society (800-ACS-2345)</li> </ul>	<ul style="list-style-type: none"> <li>Playing the Policy Game: Preparing Teen Leaders to Take Action on Healthy Eating and Physical Activity (educational kit)</li> <li>Generation Fit: Today's Generation Advocating for Good Health (educational packet)</li> <li>The School Health Index for Physical Activity and Healthy Eating: A Self-Assessment and Planning Guide</li> </ul>
Assessing and improving school physical activity and nutrition programs	<ul style="list-style-type: none"> <li>Centers for Disease Control and Prevention, Division of Adolescent and School Health (<a href="http://www.cdc.gov/nccdphp/dash">www.cdc.gov/nccdphp/dash</a>)</li> </ul>	<ul style="list-style-type: none"> <li>The School Health Index for Physical Activity and Healthy Eating: A Self-Assessment and Planning Guide</li> </ul>

*Social and Educational Benefits*

Beyond its contribution to physical activity, recess may have substantial social and educational benefits. Pellegrini and Smith [32] described recess as “practice for adult life.” In recess, students have one of their few opportunities at school to interact and develop social skills, such as negotiating and cooperating, with minimal adult interference. Students appeared to be learning important conflict resolution skills while playing during recess [46]. As for educational benefits, studies have found that fourth graders were more fidgety and concentrated less on tasks on days when they did not participate in recess [47] and the longer children sat in classrooms without a recess break, the less attentive they became [44].

*Critical Issues*

Critical issues to consider when designing recess periods include safety, the degree to which activities are structured and supervised, and timing of recess periods. Students were more likely to learn social skills when recess play was left unstructured, that is, when children were allowed to decide how to spend their time [32]. “Unstructured” should not be confused with “unsupervised.” Enough adults must be on hand to enforce safety rules and prevent aggressive, bullying behavior. School equipment and supplies used during recess must be developmentally appropriate and meet established safety standards. Schools need to work with police departments and community agencies to address safety concerns about having children play in school playgrounds in high-crime neighborhoods.

Several studies found that students ate more of their lunch food when they had recess before rather than after lunch [48–50]. Perhaps students develop a greater appetite after expending time and energy in recess or students who eat before recess rush through their meals so that they can play sooner. In light of this research, it appears that schools should schedule recess some time before lunch [49].

### *Research*

A priority for surveillance research is to obtain descriptive data on recess in U.S. elementary schools: the number of schools that provide it, length and frequency of recess periods, who supervises, when it is scheduled, and whether administrators or individual teachers decide if and when students have recess. CDC will obtain national data on some of these questions through its School Health Policies and Programs Study (SHPPS), to be conducted in Spring 2000. Additional studies are needed to identify more precisely the contributions recess can make to children's physical activity needs and to academic performance. Researchers should explore the short- and long-term effects on children of eliminating recess. In addition, quasi-experimental studies should be conducted to test the effects of different frequencies and lengths of recess periods, materials and facilities available during recess, and alternative staff approaches to managing recess, on physical activity levels, classroom behavior, and on-task performance.

### **INTRAMURAL SPORTS AND PHYSICAL ACTIVITY PROGRAMS**

Traditionally, extracurricular sports and physical activity programs have been a vehicle for promoting physical activity among students. In a 1984 national study, physical education class accounted for less than 20% of the weekly time spent in physical activity by students in grades 5–12 [51]. Participation in extracurricular sports and recreation programs might have other benefits as well. For example, adolescent participation in extracurricular activities such as school sports was negatively associated with tobacco and other drug use [52,53] and positively associated with good conduct, academic achievement, staying in school, and having good social skills [54–57].

### *Interscholastic Sports versus Intramurals*

Extracurricular opportunities to engage in physical activity may be interscholastic or intramural. Interscholastic sports programs consist of team or individual competition between different schools, and intramural programs consist of sports and recreational activities, both competitive and noncompetitive, which involve students within one school. Intramural programs have

been encouraged for students in grades K–12, but participation in interscholastic sports programs typically has been limited to the secondary school level.

At present, interscholastic sports programs are more commonly available than intramural programs. In 1994, 82% of middle/junior high schools and 94% of senior high schools offered interscholastic sports programs, but only 51% of middle/junior high schools and 38% of senior high schools offered intramurals [58]. Interscholastic sports programs tend to be highly valued by schools and their surrounding communities, and prestige accrues to those gifted athletes who win spots on team rosters. In contrast, little prestige is attached to intramural programs, which tend to receive scant attention from school administrators or the community at large.

Because they can be designed for students with a wide range of abilities, intramural programs have greater potential for improving the rates of youth participation in physical activity than do interscholastic sports. Intramural programs may be beneficial for a large group of students who have not participated much in physical activity: boys and girls who lack the skills or confidence to play interscholastic sports or who dislike competitive sports altogether. Whereas interscholastic sports emphasize competition and winning, intramurals emphasize participation and enjoyment without pressure [59]. Intramural programs can be integrated with before- or after-school programs to interface with child care and provide additional opportunities for physical activity for elementary and middle school students [60].

### *Content, Critical Characteristics, and Funding*

Typically, intramural physical activity programs focus on sports, fitness, and recreational activities. Activities can vary tremendously and might include (1) leagues and tournaments for sports such as flag football, basketball, softball, or tennis; (2) clubs for fitness and recreational activities such as weight lifting, hiking, dancing, and aerobic workouts; and (3) self-directed activities such as walking, jogging, or stretching [61].

The National Intramural Sports Council identified three critical characteristics of high-quality intramural programs: (1) students have a choice of activities; (2) every student can participate regardless of ability; and (3) students have the opportunity to be involved in the planning, organization, and administration of the program [62]. Intramurals should be considered a part of the school curriculum that provides opportunities to practice skills taught in physical education courses but must not be considered a replacement for instruction in physical education [62].

Lack of funding is probably the greatest barrier to

implementation of intramural physical activity programs. Iowa's West Des Moines School District overcame this barrier by collaborating with the local YMCA and parks and recreation department to create a secondary school intramural program that included flag football, basketball, wrestling, volleyball, street hockey, dance, fishing, and a year-round fitness club [63]. The school board paid for staff salaries, program equipment, facilities, and transportation; the YMCA and the park district helped school-based intramural directors with program development, provided trained adults to serve as supervisors, and managed program finances for each of the participating schools.

### *Research*

The CDC's SHPPS will obtain data on the proportion of elementary, middle/junior high, and senior high schools offering intramural physical activity programs and the activities offered. Currently, however, no surveillance systems provide data on the proportion of students who participate or the amount and types of physical activity in which they engage. Program planners would benefit from case studies of intramural programs in which substantial numbers of boys and girls participate, particularly those students who had previously been inactive. The case studies could document the most attractive program offerings, effective strategies for attracting students, and efficient program implementation practices. In addition, researchers should assess the effects of participating in high-quality intramural programs on students' knowledge, attitudes, and beliefs about physical activity; the total time they spend being physically active; academic performance; and conduct.

### **FACILITIES THAT SUPPORT PHYSICAL ACTIVITY**

Physical activity among young people has been positively correlated with access to convenient play spaces and facilities [40,64,65] and to sports and exercise equipment [66,67]. Correspondingly, a lack of facilities has been cited as one of the barriers to youth participation in sports and physical activity [68]. It is difficult, however, to identify a minimum set of facilities that schools should have for physical activity programs. Creative administrators and staff can develop excellent services with only modest facilities, while having state-of-the-art facilities does not ensure a quality program.

Consistent with the recognition that students should be able to choose from a variety of physical activities, having a variety of facilities appears to be important. A 1994 national survey found that more than 90% of middle/junior and senior high schools had gymnasiums and playing fields for physical education; 67%, weight rooms; about half, tracks and tennis courts; 11%, outdoor pools; and 9%, indoor pools [58]. Schools also need

to have enough equipment and supplies to allow all students to be active for most of the time they spend in physical education, at recess, and in extracurricular or intramural physical activity programs.

### *Strategies*

Increasing access to existing resources, such as school facilities and grounds, is a potential strategy for promoting physical activity. CDC's guidelines recommend that school spaces and facilities for physical activity be available to young people before, during, and after the school day, on weekends, and during summer and other vacations [9]. Increasing access may contribute to the prevention of juvenile crime [68]. A 1994 survey found that 71% of the nation's middle/junior high and senior high schools kept their physical education facilities available beyond regular school hours to all students [58]. Sixty-five percent of students in grades 4–12 surveyed in a 1996 national study said that they could use their school's physical activity facilities when school was not in session [69].

Making school facilities available to the general community during non school hours can also promote physical activity among adults while motivating communities to support the construction of school facilities that will be used primarily by young people. Clovis High School in Clovis, California, was the beneficiary of community support for tax bond initiatives in which the money collected could be spent only on physical education or fine arts facilities. In return, the school gave the community access to its wide array of facilities, including 12 lighted tennis courts, an all-weather track, a swimming pool, a diving pool, and two gymnasiums [70].

### *Safety*

A health-enhancing physical environment must be a safe environment. School physical activity spaces and facilities should meet or exceed recommended safety standards and be regularly inspected, with hazardous conditions corrected immediately [71–73]. Schools also need to work with government and community agencies to make sure that young people can be physically active in outdoor school spaces without being exposed to violence or environmental hazards. A safe outdoor environment for physical activity also should include access to cool water and adequate shade for play and rest [74].

### *Research*

SHPPS 2000 will provide information on existing facilities for physical activity at the elementary, middle/junior high, and senior high school levels. Research is still needed to assess the effects that increasing the hours in which school facilities are accessible might

have on student participation in physical activity. Case studies could help identify the type of facilities that are most likely to increase student participation in physical activity and thereby help schools make efficient use of limited construction resources. In addition, evaluation studies should be conducted to assess the benefits of (and identify best practices for) developing new types of school-based physical activity facilities, such as a school fitness center [75,76].

#### **FOODS AND BEVERAGES AVAILABLE AT SCHOOL OUTSIDE OF THE SCHOOL MEALS PROGRAM**

The U.S. Department of Agriculture has established standards requiring schools to provide meals consistent with the Dietary Guidelines for Americans, but these standards do not apply to foods and beverages sold or offered outside of the National School Lunch and the School Breakfast Programs [77,78]. Students have access to foods and beverages outside of the school meals programs through a variety of venues including cafeteria a la carte lines and snack bars, vending machines, school stores, school and classroom parties, snack time for elementary school students, concession stands at school-sponsored events, after school programs, and fund-raising activities.

Of particular concern to nutritionists are foods sold in the food service area during school meal periods, i.e., "competitive foods." According to the American Dietetic Association [79], competitive foods can decrease participation in school meals, thereby placing school food service programs in financial jeopardy; decrease intake of foods offered in school meals; and lead to the perception that school meals are only for needy children and thereby stigmatize participants.

The only federal regulations addressing competitive foods prohibit the sale of "foods of minimal nutrition value" [77]. Such foods provide, per serving, less than 5% of the U.S. recommended daily allowance of protein, vitamin A, vitamin C, niacin, riboflavin, thiamin, calcium, and iron. These foods include carbonated soft drinks, chewing gum, water ices, and certain candies made primarily from sweeteners, such as hard candy, licorice, jelly beans, and gumdrops. Foods of minimal nutritional value may be sold in the cafeteria before and after school meal periods and outside the cafeteria at any time. Thus, federal regulations do not prohibit the practice of many schools of selling carbonated soft drinks in vending machines located near but not inside the food service area throughout the school day [81]. Furthermore, they do not restrict the sale of other foods of low nutritional value such as chips, most candy bars, and noncarbonated, high-sugar drinks that are not 100% juice.

We were unable to find studies that quantified the contribution to student dietary intake made by foods

and beverages sold or offered at school outside of the school meal programs. One study, however, found that students who had access both to competitive foods from a cafeteria snack bar and to National School Lunch Program meals had significantly lower lunchtime intakes of fruits and vegetables than students whose school offered school lunch program meals only [82].

#### *Availability*

National studies conducted in 1992 [83] and 1994 [84] found that foods and beverages were widely available in American schools outside of school meals programs:

- 78% of high schools, 65% of middle schools, and 31% of elementary schools offered foods a la carte in their cafeterias [83];
- 88% of high schools [58], 61% of middle schools [58], and 14% of elementary schools [83] had food or beverage vending machines that students were allowed to use;
- 34% of high schools and 15% of middle schools permitted students to use school vending machines at any time [58], and 6% of elementary schools allowed students to use vending machines during lunch [83];
- 15% of high schools, 10% of middle schools, and 2% of elementary schools sold food through a school store or snack bar [83];
- 42% of high schools and 25% of middle schools allowed foods to be sold for fund-raising purposes during the school meal periods [84]; and
- 38% of high schools, 23% of middle schools, and 20% of elementary schools permitted students to leave the campus at lunchtime [83].

More recent information on the availability of foods and beverages outside of the school meals programs will be reported from USDA's second School Nutrition Dietary Assessment Study, which was conducted in late 1998 and is currently being analyzed, and CDC's SHPPS, to be conducted in Spring 2000. These foods and beverages appear to have become more available in recent years. Observational studies conducted in Minnesota secondary schools found more schools with stores selling food and longer hours of accessibility for school vending machines in 1998 than in 1994 [81,85]. In addition, numerous news reports in 1998 and 1999 described how specific schools or school districts had considerably increased the extent to which food and beverages were sold through vending machines [86-89].

#### *Nutritional Quality*

From a nutritional standpoint, the key issue is not the availability of foods at school outside of the school meals programs, but the nature of these foods. The most common snacks and beverages offered by cafeteria a la carte lines were baked desserts, juices, juice drinks, ice



cream, and chips [83]. The foods most often offered in school vending machines were soft drinks, chips, dessert baked goods, and candy [83]. In 1992, fruit and yogurt were offered in vending machines in less than 1% of schools [83]. A 1994 study of vending machines in 55 Minnesota high schools found that 54% of the schools with vending machines sold chips, but only 27% sold pretzels; 56% sold candy, but only 8% sold fruit [81].

Some evidence exists that the nutritional quality of beverages consumed by students at school has deteriorated in recent years. A 1998 USDA study found “a virtual revolution” in the beverages obtained by public school districts. Between the 1984–1985 and 1996–1997 school years, school purchases decreased 29% for milk but rose 181% for fruit drinks (not 100% fruit juice) and 1103% for carbonated sodas. In 1984–1985, fruit drinks and carbonated sodas comprised only 2.6% of the total volume of beverages acquired; in 1996–1997, they comprised 11.0% [90]. Milk is an integral component of school meals, but fruit drinks and carbonated sodas can only be sold by schools outside of the school meal programs.

An emerging environmental factor that may substantially increase sales of soft drinks through school vending machines is the signing of exclusive marketing contracts between soft drink bottlers and school districts. These companies are giving cash-starved school districts enormous sums of money; for example, the Colorado Springs, Colorado, school district expected to generate as much as \$11 million over the course of its 10-year exclusive contract with Coca-Cola [89]. The New York Times reported that the number of districts with exclusive marketing contracts increased from 46 (in 16 states) in April 1998 to 140 (in 26 states) in May 1999 [91]. These contracts typically include incentives linking revenue for schools to the volume of beverages sold. Some principals reported that vending machine sales account for more than 25% of their discretionary budgets [92].

### *Actions by States and School Districts*

In the absence of strong federal regulations, a number of states and school districts have established more restrictive policies. For example, the West Virginia Board of Education prohibits the sale or serving at school of chewing gum, water ices, candy bars, food or drinks containing 40% or more (by weight) sugar or other sweeteners, juice or juice products containing less than 20% real juice, and foods with more than 8 g of fat per 1-oz serving. In addition, soft drinks are prohibited at elementary and middle schools [93]. The West Virginia Department of Education provides schools with colorful booklets containing creative ideas for food treats that meet the state’s strict standards for competitive foods and can be served at school parties [94,95].

Some states prohibit the sale of foods of minimal nutritional value on school campuses until after the last lunch period, and some states and school districts prohibit the sale of soft drinks until the end of the school day [85]. California requires that half of the food items offered for sale by any organization or entity on school premises must come from the state’s list of nutritious foods [96]. The list includes dairy products, juices (at least 50% full-strength), fruits, vegetables, nuts, grain products, meats, legumes, and any foods that would qualify as one of the required food components of the school lunch meal pattern. California also sets limits on the number of times that student organizations can sell food items on campus and the number of different types of foods they can sell [97].

### *Incentives for Nutritious Choices*

Findings from two University of Minnesota studies may have implications for schools wishing to upgrade the quality of foods selected by students outside of school meal programs. The prices of low-fat snack choices in university-based vending machines [98] and of fruits and vegetables in high school cafeterias [99] were reduced by 50% for 3 weeks, and food sales at these sites were assessed before, during, and after the intervention. No educational or other activities supplemented the price cuts. The total number of snacks sold through the vending machines and the overall a la carte sales revenue in the cafeteria did not differ by experimental period. During the intervention, however, sales of low-fat snacks through the vending machines increased from 26 to 46% of all sales; in the cafeteria study, sales of fruit increased about fourfold and of carrots about twofold. After the regular prices were restored, sales of low-fat snacks, fruit, and carrots plummeted to a level not significantly different from sales during the baseline period. No information was provided about changes in profits, but a substantial price decrease would inevitably lead to a reduction in profits unless there was a major increase in sales volume.

The same University of Minnesota research team has recently completed data collection for its Changing Individuals’ Purchase of Snacks (CHIPS) study and is beginning to implement a new study entitled Trying Alternative Options in Cafeterias (TACOS) [Mary Story, University of Minnesota, personal communication, 1999]. CHIPS explored the effects on vending machine choices in schools and work sites of price reductions either alone or in combination with (a) special labeling of low-fat food choices or (b) labeling plus promotional signs. TACOS will evaluate three strategies to promote the selection of low-fat foods in secondary school a la carte lines and vending machines: (a) making more of these foods available, (b) lowering their prices, and (c) inviting a student group to promote low-fat

choices with a financial incentive based on sales volume of the targeted foods.

### *Research*

Studies are needed to establish how the availability of foods outside of the school meals programs affects both the consumption of school meals and the overall quality of students' diets. State, district, and school policies that regulate the types of foods sold or offered at school need to be evaluated to determine the extent of their implementation, the processes that should be followed to optimize implementation, and any effects such policies have on students' knowledge, attitudes, and perceptions of cultural norms about nutrition.

Strategies building on findings by University of Minnesota researchers that students will greatly increase purchases of nutritious foods if their price is reduced substantially should be tested. Considering the importance of revenues from vending machines for school budgets, dissemination will depend, in large part, upon the degree to which prices can be reduced without reducing overall profits. One approach would be for private and public agencies to subsidize highly nutritious foods and beverages; another would be to raise the prices of less nutritious snacks while decreasing the prices of nutritious items. Researchers might also work with the food industry on developing new products, packaging designs, and promotional strategies to make healthier snack choices more appealing to young people.

### **PSYCHOSOCIAL SUPPORT FOR PHYSICAL ACTIVITY AND HEALTHY EATING**

The school psychosocial environment can support health-enhancing physical activity and nutrition choices by helping to define accepted norms. Such norms are shaped in part by the types of physical activity and nutrition programs offered, but they also reflect the messages students receive from school officials and staff about the importance of the behaviors being promoted. These messages are communicated in several ways, including school policies and ongoing administrative support, role modeling by school staff, and cues and incentives established in the school setting.

### *School Policies*

Enacting school policies on physical activity and nutrition demonstrates commitment from school leadership, provides guidance and direction for school staff, and establishes accountability for action. In addition, schools can use the development of a new policy to focus attention on the importance of physical activity and nutrition programs and get key constituents involved in supporting them. Publicizing the existence of a new policy and enforcing it thereafter can help establish

what students perceive to be normative behavior. School policies are needed to support all key school physical activity and nutrition activities, as outlined in the CDC school health guidelines documents [9,10]. Elsewhere in this issue, McGraw et al. [100] review approaches to measuring the adoption and implementation of school policies to promote physical activity and healthy eating among students.

One important psychosocial factor that can be influenced by school policy but has received little research attention to date is the use of food or physical activity to reward or punish students for their behavior. CDC's school health guidelines recommend that schools discourage staff from using food to reward students. At the elementary school level, however, many teachers gave students candy as a reward for good behavior [101], and students often received discount coupons for meals at fast food restaurants as a reward for academic achievements such as reading a specified number of books [102]. Rewarding children with snack food increased their preference for those foods [103]. Indeed, the social context in which new foods are introduced to young children was one of the most powerful determinants of their food preferences [103]. Baxter [103] suggested that instead of offering candy as a reward schools might offer stickers or tokens that could be redeemed for prizes.

According to CDC guidelines [9], schools should not punish students for misbehavior by giving them a physical activity task, such as running laps or doing push-ups, because this "risks creating negative associations with physical activity in the minds of young people." Yet, this is reported to be a widespread practice in physical education and sports programs [104]. Instead of using physical activity as a punishment, physical education teachers and coaches can use a variety of disciplinary strategies, including time-outs, behavior contracts, letters to parents, and contacting the principal [105].

### *Ongoing Administrative Support*

School administrators can provide psychosocial support by demonstrating their commitment to physical activity and nutrition programs through simple gestures such as periodically attending lunch periods in the cafeteria or recess periods in the schoolyard, honoring students in the intramural program with awards or recognizing them on the public address system, and regularly including news about physical activity and nutrition programs in the school newsletter and in presentations at parent or staff meetings. This commitment to physical activity and nutrition can be institutionalized by the development and active involvement in school management of a school health council (SHC).

A SHC has been defined as an "advisory group of

individuals who represent segments of the community to collectively provide advice to the school system on aspects of the school health program" [106]. SHC activities can include program and fiscal planning, advocacy, liaison with district and state agencies, managing health promotion activities, and providing accountability and quality control. Ideally, a SHC should include all constituencies affected by the school health program, including administrators, classroom teachers, physical education teachers, other staff, students, parents and guardians, food service directors, school health care providers, community-based health care providers, school counselors, and community-based youth service providers.

A 1994 national survey found that 34% of school districts and 19% of secondary schools had SHCs [107]. Constituencies most commonly represented were teachers, administrators, school nurses, and counselors; more than half of the SHCs had representation from all of these groups. Less than one-third included students, and only 8% had food service personnel as members [58]. Some schools have committees or councils designed specifically to provide guidance for the school food service program [108].

### *Role Modeling by School Staff*

One of the most important ways that the psychosocial environment influences the development of norms is through role modeling. Because they spend a great deal of time with students and have considerable influence over them, school staff members can be powerful role models. Clearly, schools cannot dictate the personal behaviors of their staff members, but they can make it easier for staff to become physical activity and nutrition role models by sponsoring school-site health promotion programs for them. As Allegrante wrote, "Teachers who become interested in their own health tend to take an interest in the health of students and to serve as healthy role models. Such teachers also usually understand the health needs of students and are more effective teachers of health" [109].

Participation in school health promotion programs for staff reduced absenteeism, raised morale, increased participation in vigorous activity, facilitated weight loss, lowered blood pressure, and improved stress management skills [110,111]. Models developed for school staff health promotion include both on-site services and off-site team-building conferences [109].

The effects of health promotion activities for staff on the quality of health education instruction they provide or on students' physical activity and nutrition behaviors have not received much research attention. In the only relevant study we could find [112,113], 32 schools delivered a 24-session curriculum for fourth and fifth graders designed to increase their consumption of fruits and

vegetables; teachers at half of the schools received a wellness program that included 54 health promotion workshops over 2 years along with several school-wide health activities. The staff wellness program had no appreciable effects on teacher motivation or efficacy to change student behavior, the fidelity with which teachers implemented the curriculum, or student fruit and vegetable intake, nor did it appreciably affect the teachers' consumption of fruits and vegetables. However, teachers in the intervention group attended, on average, only 6 of the program's 54 health workshops, and the researchers concluded that this was a likely explanation for the lack of effects.

### *Cues*

In commercial marketing, cues and incentives are widely used to trigger the purchase of specific products [114]; for health promotion they can be used to establish a psychosocial environment that promotes and reinforces physical activity and healthy eating choices. Cues are stimuli that can suggest the performance of new behaviors or remind individuals to take actions by reinforcing previously learned behaviors and attitudes [14]. For physical activity and food choices, the most commonly used cues are signs and displays at the point of final sale; in marketing, these reminders are called point-of-choice advertising.

Environmental cues are more widely used to promote healthy eating than physical activity. Point-of-choice interventions at grocery stores, supermarkets, restaurants, and cafeterias have included posters, brochures, table tents, shelf labels, displays, heart-healthy symbols on menus, buttons on waiters, and taste demonstrations [6]. In controlled studies, these interventions demonstrated positive effects on the selection of more nutritious foods, but the effects varied in magnitude, duration, and consistency [6]. However, Hoerr and Loudon [115] found that posting nutrition information in bar graph form on university vending machines did not increase sales of nutrient-dense snacks. In the only two studies we found involving cues for physical activity reminders, posting signs near escalators in public facilities to encourage people to use stairs significantly increased the number of stair users [116,117].

In the elementary and secondary school settings, audiovisual nutrition cues have been included in multi-component interventions that have successfully promoted healthy eating choices, but the independent effect of the cues has not been assessed. For example, the Child and Adolescent Trial for Adolescent Health, which reduced student fat intake [118], included promotional materials as well as classroom instruction and modifications in food service menu planning, food purchasing, and food preparation practices, but the independent effect of the promotional materials was not

assessed. These materials included a variety of cues to action, such as table tents on the serving line to promote healthier menu choices, nutrition information and fun activities added to the backs of cafeteria menus distributed to students, and bulletin boards with nutrition information [119]. Multicomponent interventions that led to increases in student consumption of fruits and vegetables [17,120] and of low-fat milk [121] also used cues such as colorful displays in cafeterias, posters in school hallways, taste testings, announcements over the school public address system, and tip sheets distributed to students and their families.

### *Incentives*

Incentives are rewards to motivate a desired performance [114]. They are often used to motivate individuals to try a specific product or behavior, in the hope that they will become more favorably disposed toward it [114]. Common incentives include discount coupons, gifts, and contest prizes. An extensive review of nutrition education for adults found that point-of-choice interventions in grocery stores and restaurants are more effective when used with incentives [122].

In school-based interventions, gifts and prizes have been used as incentives for adopting health-enhancing behaviors. For example, the Sports, Play, and Active Recreation for Kids intervention featured the delivery of an innovative physical education curriculum, a classroom-based self-management curriculum, parent involvement activities, and prizes such as pencils and sports water bottles awarded to students for meeting weekly activity goals; these prizes were phased out as students learned to use self-reward [123]. This intervention had no effects on physical activity outside of school, but it significantly increased student physical activity during physical education class. The independent effect of the prizes was not assessed. In an intervention to promote the selection of low-fat milk in elementary school cafeterias [121], students received gifts, such as pencils and refrigerator magnets that featured the project's slogan, and participated in a contest to solve a crossword puzzle about low-fat milk in which those who solved the puzzle were included in a drawing to win T-shirts featuring the project slogan. The intervention also included a 45-minute educational session in the school auditorium, two taste tests at which students received low-fat milk and cookies, posters displayed throughout the school, a three-dimensional cut-out poster placed right above the cafeteria milk coolers, and easy-to-read flyers distributed to students and parents. This intervention, which involved no classroom instructional activities, increased low-fat milk's share of total milk consumption from 25 to 57%.

### *Countering Cues and Incentives for the Consumption of Less Nutritious Foods*

Environmental cues and incentives also are being used extensively in school settings to promote foods and beverages high in fat and sugar. More schools are selling in-school space to corporations to advertise products such as fast food meals, soft drinks, potato chips, and candy [102]. Advertisements for high-fat, high-sugar products can be found on school walls, scoreboards, and buses; in student publications and food service menu brochures; and on book covers distributed free of charge to students. In addition, at some 12,000 schools, students watch the 12-minute Channel One daily newscast that includes 2 minutes of advertising, some of it for fast food restaurants, soft drinks, and candy. In return for providing a captive audience, schools received free televisions and VCRs [102]. Moreover, commercial interests such as candy manufacturers and commodity organizations have produced glossy "educational" materials distributed free to teachers that contain information described by Consumers Union Educational Services [102] as biased and self-serving. Food companies also have sponsored blatantly promotional contests with cash awards to schools. For example, a cookie manufacturer sponsored a contest to see which school could come up with the most ingenious way to verify that consumers would find 1000 chocolate chips in a bag of its cookies [124].

Some school districts have developed policies to prevent food manufacturers from dominating the school nutrition environment. For example, in 1998 the Berkeley (CA) school board banned corporate logos from school walls and outdoor scoreboards [125], and in 1999 the San Francisco school board banned textbooks that unnecessarily mention brand names and ruled that no student could be required to wear a corporate logo for any school activity [126]. These actions were consistent with the 1995 recommendation of Consumers Union Educational Services [102] that schools become ad-free zones where young people can learn without commercial influences and pressures.

### *Research*

SHPPS 2000 will obtain national data on school policies related to the use of food to reward or physical activity to punish students, SHCs and district health councils, the number of schools that provide physical activity and nutrition promotion programs to staff through school health promotion programs, and some information on the extent to which cues and incentives are used in schools either by commercial interests to sell foods and beverages or in health promotion interventions to promote physical activity and healthy eating.

Additional studies are needed to assess the extent to

which school staff use food as a reward and physical activity as a punishment and the effects of these practices on students' attitudes, beliefs, and behavior; to document the accomplishments of SHCs and identify the processes associated with developing and maintaining effective health councils; to assess staff participation in health promotion programs and test strategies to increase staff participation; to determine the effects of well-attended staff health promotion programs on health education teaching practices and on students' knowledge, attitudes, and behaviors; and to assess the effects of cues and incentives on student physical activity and nutrition behaviors and identify the specific types and combinations of cues and incentives that have the greatest impact.

### DISCUSSION

Interventions to modify the environmental factors that influence behavior have become integral to health promotion theory and practice. However, one factor that complicates any discussion of environmental interventions is the very inclusive definition of the concept: almost any intervention could be viewed as affecting the environment in some way. In the school setting, for example, any health promotion activity involving one or more of the eight components of a coordinated school health program could be considered an environmental intervention. Thus, an explicit delineation of specific environmental factors that should be targeted for intervention in a specific setting is needed to make environmental interventions a meaningful construct.

The most widely studied, and perhaps the most powerful, factors in the school environment that influence student physical activity and nutrition behaviors are the school's programs in health education, physical education, and food service. Great progress has been made in recent years in developing and rigorously testing innovative health education and physical education curricula and instructional practices, food service menu plans, and food preparation practices. Still, much remains to be done to further improve these services and refine strategies for disseminating innovative practices.

In this paper, we chose to examine other school-based environmental influences that have received little research attention. None of these influences—recess, intramural programs, physical activity facilities, foods available on campus outside of the school meals programs, and psychosocial support for physical activity and healthy eating—are included in the eight components of CDC's coordinated school health program model, nor do any of the five fit neatly into any of the components. Not surprisingly, these influences are often neglected in discussions of school health priorities.

Interventions involving just one of these influences are not likely to have strong, independent effects on

student behaviors. For example, colorful signs encouraging healthy eating choices in the cafeteria (an example of psychosocial support) are not likely to lead to behavior change by themselves, but they may contribute to behavior change if integrated with other environmental changes. The various factors that comprise the school physical activity and nutrition environment are more likely to influence student behavior in a positive direction when they promote the same health messages and give students numerous, diverse opportunities to practice health-enhancing behaviors through a variety of channels. Thus, a top priority for research should be the assessment of the effects of a school environment that includes high-quality recess periods, intramural programs, physical activity facilities, competitive food policies, and psychosocial support for physical activity and healthy eating as well as high-quality health education, physical education, and food service programs. Researchers should also assess the effects of systematically varying individual components within a larger comprehensive intervention.

Another area for research is the influence of the socioeconomic status (SES) of the area in which a school is located on the school physical activity and nutrition environment. SES is a profoundly important determinant of individual and public health, with the largest burden of morbidity and mortality associated with lower SES [127,128]. Conceivably, the environmental interventions discussed in this paper might be less often and less intensively implemented in low-income school districts, where there is a relatively low tax base and thus fewer resources for capital improvements, supplementary teachers, enrichment activities, supplies, and fund-raising activities. Research questions include the following: (1) Are physical activity facilities less available in low-income school districts? (2) Are health-enhancing policies less often in place and less often implemented and enforced in low-income areas? (3) Are the opportunities for healthy eating and physical activity described in this paper less available to poor children than to affluent ones? (4) Can successful environmental interventions be generalized across schools in communities with different SES levels? CDC's SHPPS 2000 will include SES data and allow for analysis of some of these issues at the national level.

Regardless of the SES of the area in which schools are located, it is unrealistic to expect them to produce major improvements in student eating and physical activity behaviors without the support of families and other important community-based constituencies. Food stores, restaurants, the food and fitness industries, community-based programs, religious institutions, government agencies, and the mass media must also contribute to changing a culture that pushes children toward sedentary lifestyles and unhealthy eating patterns. However, schools are an important part of the

larger community and have potential for influencing families and the community at large [129]. Thus, researchers need to explore ways to integrate changes in the school physical activity and nutrition environment with changes in the corresponding environment of the community. One example would be the National Walk Our Children to School Day (<http://claire.hsrc.unc.edu/publicaware/walk>), an annual event started in 1997 by the Partnership for a Walkable America to raise awareness about the health and social benefits of walking, the importance of pedestrian safety, and the need for community environmental changes, such as more crosswalks, sidewalks, and school crossing guards.

One of the greatest challenges for those concerned with school-based environmental interventions is to develop strategies for dissemination. Schmid and colleagues [5] stressed the importance of ensuring informed public participation in the development of policy and environmental changes and recommended that, when possible, environmental changes be introduced and championed by members of the affected community. They noted, for example, that policies to prohibit the sale of soft drinks and candy at schools are more likely to be accepted if they are proposed by parents rather than mandated by government [5]. Glanz and Mullis [130] recommended starting with small initiatives that are likely to be successful. In this article, we have stressed the importance of conducting case studies of environmental interventions to help improve our understanding of the processes by which innovative practices are implemented. Studies are also needed to document the processes that ensure the long-term maintenance of these practices and to quantify the cost-effectiveness of specific environmental interventions.

Efforts to promote improvements in the school physical activity and nutrition environment would benefit from a two-pronged approach that seeks policy mandates from education agencies, school boards, and superintendents while working to generate grass-roots support from those who will ultimately implement policies and programs at the school level. Having a policy-making body mandate time for recess, issue regulations on competitive foods, or provide funding for intramural programs is an efficient way to widely disseminate health-enhancing environmental changes. However, with the American educational system placing greater emphasis on local control, it has become increasingly difficult to get policy mandates adopted at the state and even at the district level. Furthermore, even if policies are put in place, obtaining school-level support for environmental changes will be needed to ensure their implementation and maintenance.

Gaining support for environmental changes from school-level administrators, teachers, parents, and students will require creative but practical approaches. Advocates for environmental change must understand

the viewpoints of potential opponents. For example, on the competitive foods issue, advocates must appreciate the temptation to raise funds for important educational activities through sales of high-sugar or high-fat foods. In a sense, the community is getting industry to pay for public education, but at what cost? While educating the community about the inappropriateness of this practice, advocates for health-enhancing policies also need to offer suggestions for how schools can make up financial losses incurred by changes in competitive food sales practices or at least keep those losses to a minimum. Advocates also need to keep in mind the importance of involving students in making the case for environmental change. Young people can develop creative ideas for influencing others, and their testimony at policy-making meetings can be powerful [131, 132].

In conclusion, enough is known from theory, practice, and research to suggest that school-based environmental strategies to promote physical activity and healthy eating among young people merit implementation and ongoing refinement. Although further empirical data are needed, we believe that the environmental components reviewed in this paper can, individually and collectively, make important contributions to the promotion of student health. There is no doubt that schools are heavily burdened by the need to address many difficult educational and social challenges. However, establishing a school environment that helps young people adopt and maintain lifelong, healthy habits deserves a place on the American educational agenda.

## REFERENCES

1. U.S. Department of Health and Human Services (USDHHS). Physical activity and health: a report of the Surgeon General. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.
2. U.S. Public Health Service. The Surgeon General's report on nutrition and health. Washington: U.S. Department of Health and Human Services, Public Health Service, 1988. [DHHS Publication No. (PHS) 88-50210]
3. U.S. Public Health Service. Healthy People 2000: national health promotion and disease prevention objectives. Full report, with commentary. Washington: U.S. Department of Health and Human Services, Public Health Service, 1991. [DHHS Publication No. (PHS) 91-50212]
4. Sallis JF, Bauman A, Pratt M. Environmental and policy interventions to promote physical activity. *Am J Prev Med* 1998; 15:379-97.
5. Schmid TL, Pratt M, Howze E. Policy as intervention: environmental and policy approaches to the prevention of cardiovascular disease. *Am J Public Health* 1995; 85:1207-11.
6. Glanz K, Lankenau B, Foerster S, Temple S, Mullis R, Schmid T. Environmental and policy approaches to cardiovascular disease prevention through nutrition: opportunities for state and local action. *Health Educ Q* 1995;22:512-27.

7. King AC, Jeffery RW, Fridinger F, Dusenbury L, Provence S, Hedlund SA, et al. Environmental and policy approaches to cardiovascular disease prevention through physical activity: issues and opportunities. *Health Educ Q* 1995;22:499–511.
8. Dwyer J. The school nutrition dietary assessment study. *Am J Clin Nutr* 1995;61(1 suppl):173S–7S.
9. Centers for Disease Control and Prevention. Guidelines for school and community programs to promote lifelong physical activity among young people. *MMWR* 1997;46 (No. RR-6).
10. Centers for Disease Control and Prevention. Guidelines for school health programs to promote lifelong healthy eating. *MMWR* 1996;45 (No. RR-9).
11. Contento I, Balch GI, Bronner YL, Paige DM, Gross SM, Bisignani L, et al. Nutrition education for school-aged children. *J Nutr Educ* 1995;27:298–311.
12. Resnicow K, Robinson TN. School-based cardiovascular disease prevention studies: review and synthesis. *Ann Epidemiol* 1997;7:S14–31.
13. Stone EJ, McKenzie TL, Welk GJ, Booth ML. Effects of physical activity interventions in youth: review and synthesis. *Am J Prev Med* 1998;15:298–315.
14. Baranowski T. Reciprocal determinism at the stages of behavior change: an integration of community, personal and behavioral perspectives. *Int Q Comm Health Educ* 1989–1990;10:297–327.
15. Killen JD, Robinson TN. School-based research on health behavior change: the Stanford Adolescent Heart Health Program as a model for cardiovascular disease risk reduction. In: Rothdopf E, editor. *Review of research in education*. Vol. 15. Washington: AERA, 1989:171–200.
16. McLeroy KR, Bibeau D, Steckler A, Glanz K. An ecological perspective on health promotion programs. *Health Educ Q* 1988;15:351–77.
17. Nicklas TA, Johnson CC, Myers L, Farris RP, Cunningham A. Outcomes of a high school program to increase fruit and vegetable consumption: Gimme 5—a fresh nutrition concept for students. *J Sch Health* 1998;68:248–53.
18. Sallis JF, Owen N. Ecological models. In: Glanz K, Lewis FM, Rimer BK, editors. *Health behavior and health education: theory, research, and practice* (2nd ed). San Francisco: Jossey-Bass, 1997:403–24.
19. Brownson RC, Koffman DM, Novotny TE, Hughes RG, Eriksen MP. Environmental and policy interventions to control tobacco use and prevent cardiovascular disease. *Health Educ Q* 1995;22:478–98.
20. Centers for Disease Control and Prevention. Guidelines for school health programs to prevent tobacco use and addiction. *MMWR* 1994;43 (No. RR-2).
21. Baranowski T, Perry CL, Parcel GS. How individuals, environments and health behavior interact: social cognitive theory. In: Glanz K, Lewis FM, Rimer B, editors. *Health behavior and health education: theory, research, and practice* (2nd edition). San Francisco: Jossey-Bass, 1996:246–79.
22. Green LW, Richard L, Potvin L. Ecological foundations of health promotion. *Am J Health Promot* 1996;10:270–81.
23. Breslow L. Social ecological strategies for promoting healthy lifestyles. *Am J Health Promot* 1996;10:253–7.
24. Bandura A. *Social foundations of thought and action: a social cognitive theory*. Englewood Cliffs (NJ): Prentice Hall, 1986.
25. Stokols D. Translating social ecological theory into guidelines for community health promotion. *Am J Health Promot* 1996;10:282–98.
26. Green LW, Kreuter MW. *Health promotion planning: an educational and ecological approach* (3rd ed). Mountain View (CA): Mayfield, 1999.
27. Jeffery RW, Forster JL. Obesity as a public health problem. In: Johnson WG, editor. *Advances in eating disorders: treating and preventing obesity*. Greenwich (CT): JAI Press, 1987:253–71.
28. Richter KP, Harris KJ, Paine-Andrews A, Fawcett SB, Schmid TL, Lankenau BH, et al. Measuring the health environment for physical activity and nutrition among youth: A review of the literature and applications for community initiatives. *Prev Med* 2000;31:S98–S111.
29. Centers for Disease Control and Prevention. A coordinated school health program. The CDC eight component model of school health programs. Accessed on the world wide web at <http://www.cdc.gov/nccdphp/dash/cshpdef.htm> on July 23, 1999.
30. Marx E, Wooley SF, Northrop D, editors. *Health is academic: a guide to coordinated school health programs*. New York: Teachers College Press, 1998.
31. Lytle LA, Kelder SH, Snyder MP. A review of school food service research. *School Food Service Res Rev* 1992;16(1):7–14.
32. Pellegrini AD, Smith PK. School recess: implications for education and development. *Rev Educ Res* 1993;63:51–67.
33. National Association of Elementary School Principals. 1999–2000 adopted platform. Alexandria (VA), 1999.
34. NAESP Communicator. All work and no play. *NAESP Commun* January 1999;22(5):1.
35. Ross JG, Pate RR, Corbin CB, Delpy LA, Gold RS. What is going on in the elementary physical education program? The national children and youth fitness study. *JOPERD* 1987;58(6):78–84.
36. Johnson D: Trend toward no-recess policy is accelerating at nation's schools. *The New York Times*, 1998 Apr 7.
37. *Education Daily*. More schools are giving kids a break from recess. Alexandria (VA): Aspen, Dec 31, 1998, 1,5,6.
38. Baranowski T, Thompson WO, DuRant R, Baranowski J, Puhl J. Observations on physical activity in physical locations: age, gender, ethnicity, and month effects. *Res Q Exerc Sport* 1993;64:127–33.
39. Klesges RC, Eck LH, Hanson CL, Haddock CK, Klesges LM. Effects of obesity, social interactions, and physical environment on physical activity in preschoolers. *Health Psychol* 1990;9:435–49.
40. Sallis JF, Nader PR, Broyles SL, Berry CC, Elder JP, McKenzie TL, et al. Correlates of physical activity at home in Mexican-American and Anglo-American pre-school children. *Health Psychol* 1993;12:390–8.
41. McKenzie TL, Sallis JF, Elder JP, Berry CC, Hoy PL, Nader PR, et al. Physical activity levels and prompts in young children at recess: a two-year study of a bi-ethnic sample. *Res Q Exerc Sport* 1997;68:195–202.
42. Kraft RE. Children at play: behavior of children at recess. *JOPERD* 1989;60(4):21–4.
43. Hovell MF, Bursick JH, Sharkey R, McClure J. An evaluation of elementary students' voluntary physical activity during recess. *Res Q Exerc Sport* 1978;49:460–74.
44. Pellegrini AD, Davis PD. Relations between children's playground and classroom behaviour. *Br J Educ Psychol* 1993;63:88–95.
45. Connolly P, McKenzie TL. Effects of a games intervention on the physical activity levels of children at recess. *Res Q Exerc Sport* 1995;66(suppl):A60.
46. Sluckin A. *Growing up in the playground: the social development of children*. London: Routledge & Kegan Paul, 1981.
47. Jarrett OS, Maxwell DM, Dickerson C, Hoge P, Davies G, Yetley A. Impact of recess on classroom behavior: group effects and individual differences. *J Educ Res* 1998;92:121–6.

48. Getlinger MJ, Laughlin VT, Bell E, Akre C, Arjmandi BH. Food waste is reduced when elementary-school children have recess before lunch. *J Am Diet Assoc* 1996;96:906-8.
49. Ruppenthal B, Hogue W. Playground and plate waste. *Sch Foodserv J* 1977;31:66-70.
50. Smith TR. Play first, eat last. *Sch Foodserv J* 1980;34:54-5.
51. Ross JG, Dotson CO, Gilbert GG, Katz SJ. After physical education . . . physical activity outside of school physical education programs. *JOPERD*, 1985;56(1):77-81.
52. Shilts L. The relationship of early adolescent substance use to extracurricular activities, peer influence, and personal attitudes. *Adolescence* 1991;26:613-7.
53. Escobedo LG, Marcus SE, Holtzman E, Giovino GA. Sports participation, age at smoking initiation, and the risk of smoking among US high school students. *JAMA* 1993;269:1391-5.
54. Poinsett A. The role of sports in youth development. Report of a meeting convened by Carnegie Corporation of New York, March 18, 1996, New York (NY): Carnegie Corp., 1997.
55. Jeziorski RM. The importance of school sports in American education and socialization. Lanham (MD): University Press of America, 1994.
56. Women's Sport Foundation. The women's sports foundation report: minorities in sports. New York: Women's Sports Foundation, 1989.
57. Ewing ME, Seefeldt V, Brown TP. Role of organized sport in the education and health of American children and youth. East Lansing (MI): Institute for the Study of Youth Sports, Michigan State Univ, 1996.
58. Centers for Disease Control and Prevention. Unpublished data, School Health Policies and Programs Study, 1994. Atlanta (GA): CDC, 1999.
59. Stein EL. Starting intramural programs in elementary/secondary schools. *JOPERD* 1983;54(2):19.
60. Seppanen PS, Love JM, deVries DK, Bernstein L, Seligson M, Marx F, et al. National study of before and after school programs. Final report to the Office of Policy and Planning, U.S. Department of Education. Portsmouth (NH): RMC Research Corp, 1993.
61. Carlton P, Stinson R. Achieving educational goals through intramurals. *JOPERD* 1983;54(2):23-31.
62. National Intramural Sports Council (NISC). Guidelines for school intramural programs. Reston (VA): NISC, 1995.
63. Sammann P. Stilwell Junior High intramural program. In: Active youth: ideas for implementing CDC physical activity promotion guidelines. Champaign (IL): Human Kinetics, 1998:131-5.
64. Zakarian JM, Hovell MF, Hofstetter CR, Sallis JF, Keating KJ. Correlates of vigorous exercise in a predominantly low SES and minority high school population. *Prev Med* 1994;23:314-21.
65. Garcia AW, Norton Broda MA, Frenn M, Coviak C, Pender NJ, Ronis DL. Gender and developmental differences in exercise beliefs among youth and prediction of their exercise behavior. *J Sch Health* 1995;65:213-9.
66. Stucky-Ropp RC, DiLorenzo TM. Determinants of exercise in children. *Prev Med* 1993;22:880-9.
67. Butcher J. Longitudinal analysis of adolescent girls' participation in physical activity. *Sociol Sport J* 1985;2:130-43.
68. Carnegie Council on Adolescent Development. A matter of time: risk and opportunity in the out-of-school hours. Recommendations for strengthening community programs for youth. New York: Carnegie Corporation of New York, 1994.
69. International Life Sciences Institute (ILSI). Physical activity message for parents from new survey: no more excuses. Washington. Press release, 1997 July 1.
70. Sammann P. Clovis High School program. In: Active youth: ideas for implementing CDC physical activity promotion guidelines. Champaign (IL): Human Kinetics, 1998:39-43.
71. Committee on Injury and Poison Prevention, American Academy of Pediatrics. Injury prevention and control for children and youth. Elk Grove Village (IL): American Academy of Pediatrics, 1997.
72. Hergenroeder AC. Prevention of sports injuries. *Pediatrics* 1998;101:1057-63.
73. U.S. Consumer Product Safety Commission (USCPSC). Handbook for public playground safety. Washington: U.S. Govt. Printing Office, 1997. [USCPSC Publication No. 325.]
74. Dymment PG, editor. Sports medicine: health care for young athletes. 2nd ed. Elk Grove Village (IL): American Academy of Pediatrics, 1991.
75. Sammann P. Herbert Hoover High School Fitness Center. In: Active youth: ideas for implementing CDC physical activity promotion guidelines. Champaign (IL): Human Kinetics, 1998: 65-9.
76. Sammann P. Forrest High Campus SELF Center. In: Active youth: ideas for implementing CDC physical activity promotion guidelines. Champaign (IL): Human Kinetics, 1998:61-4.
77. U.S. Department of Agriculture. National school lunch program and school breakfast program nutrition objectives for school meals (7CFR 210.220). *Fed Reg* June 10, 1994:30218-51.
78. U.S. Department of Agriculture. National school lunch program and school breakfast program: compliance with the Dietary Guidelines for Americans and food-based menu systems. Washington: Food and Consumer Service, 1995.
79. American Dietetic Association. Position of the American Dietetic Association: competitive foods in schools. *J Am Diet Assoc* 1991;91:1123-5.
80. Deleted in proof.
81. Story M, Hayes M, Kalina B. Availability of foods in high schools: is there cause for concern? *J Am Diet Assoc* 1996;96:123-6.
82. Eagan J, Cullen KW, Baranowski T. The effect of competitive foods on children's lunch fruit and vegetable intake. Unpublished manuscript, Department of Behavioral Science, Univ. of Texas M.D. Anderson Cancer Center. Houston (TX), 1999.
83. Burghardt J, Gordon A, Chapman N, Gleason P, Fraker T. The school nutrition dietary assessment study: school food service, meals offered, and dietary intakes. Contract No. 53-3198-016. Sponsored by the U.S. Department of Agriculture, Food and Nutrition Service, Office of Analysis and Evaluation. Princeton (NJ): Mathematica, 1993.
84. Pateman BC, McKinney P, Kann L, Small ML, Warren CW, Collins JL. School food service. *J Sch Health* 1995;65:327-32.
85. Story M, Neumark-Sztainer D. Competitive foods in schools: issues, trends, and future directions. *Top Clin Nutr* 1999;15(1):37-46.
86. Vail K. Insert coins in slot: school vending machines generate funds—and controversy. *Am Sch Board J* 1999 (Feb):28-33.
87. Walsh M. Schools are latest front in cola wars. *Educ Week*, April 8, 1998:1,15.
88. Sanchez R. A corporate seat in public classrooms: marketing efforts bring revenue, opposition. *Washington Post*, 1998 March 10; Sect. A:1&A:6.
89. Kaufman M. Pop culture: health advocates sound alarm as schools strike deals with Coke and Pepsi. *The Washington Post* 1999 March 23; Health Sect.
90. Daft L, Arcos A, Hallawell A, Root C, Westfall DW. School food purchase study: final report. Contract No.:53-3198-5-024. Sponsored by U.S. Department of Agriculture, Food and Nutrition



- Service, Office of Analysis and Evaluation. Alexandria (VA): POMAR International, 1998.
91. Hays CL. Today's lesson: soda rights. Consultant helps schools sell themselves to vendors. *The New York Times* 1999 May 21; Sect. Business Day.
  92. NASSP Newsleader. Soda and snack sales provide boost for curricular budgets. *NASSP Newsleader*, February 1999:7.
  93. Stuhldreher WL, Koehler AN, Harrison MK, Deel H. The West Virginia standards for school nutrition. *J Child Nutr Management* 1998;22:79–86.
  94. West Virginia Board of Education. Let's celebrate: a world of healthy food. 2nd ed. Charleston (WV): West Virginia Board of Education, Office of Child Nutrition, 1997.
  95. West Virginia Board of Education. Let's party: party ideas for school and home. 2nd ed. Charleston (WV), 1993.
  96. California Education Code, Sect. 39876.
  97. California Code of Regulations, Title 5, Sect. 15500 and 15501.
  98. French SA, Jeffery RW, Story M, Hannan P, Snyder MP. A pricing strategy to promote low-fat snack choices through vending machines. *Am J Public Health* 1997;87:849–51.
  99. French SA, Story M, Jeffery RW, Snyder P, Eisenberg M, Sidebottom A, et al. Pricing strategy to promote fruit and vegetable purchase in high school cafeterias. *J Am Diet Assoc* 1997; 97:1008–10.
  100. McGraw SA, Sellers D, Stone E, Resnicow KA, Kuester S, Fridinger F, et al. Measuring implementation of school programs and policies to promote healthy eating and physical activity among youth. *Prev Med* 2000;31:S86–S97.
  101. Wolfe WS, Campbell CC. Nutritional health of school-aged children in upstate New York: what are the problems and what can schools do? Ithaca (NY): Cornell Univ, Division of Nutritional Sciences, 1991.
  102. Consumers Union Education Services. Captive kids: commercial pressures on kids at school. Yonkers (NY): Consumers Union of United States, 1995.
  103. Baxter SD. Are elementary schools teaching children to prefer candy but not vegetables? *J Sch Health* 1998;68:111–3.
  104. Wilson S, Dale G. Everybody on the line: the reality of punishment in physical education and sport. Presentation made at the national convention of the American Alliance for Health, Physical Education, Recreation and Dance, Boston (MA), April 1999.
  105. Graham G, Holt/Hale SA, Parker M. Children moving: a reflective approach to teaching physical education. 4th edition. Mountain View (CA): Mayfield, 1998.
  106. American Cancer Society. Improving school health: a guide to school health councils. Atlanta (GA), 1998.
  107. Collins JL, Small ML, Kann L, Pateman BC, Gold RS, Kolbe LJ. School health education. *J Sch Health* 1995;65:302–11.
  108. American School Food Service Association. Do you have a NAC for nutrition education? Alexandria (VA): ASFSA, 1999.
  109. Allegrante JP. School site health promotion for staff. In: Marx E, Wooley SF, Northrop D, editors. *Health is academic: a guide to coordinated school health programs*. New York: Teacher College Press, 1998:224–43.
  110. Blair SN, Collingwood TC, Reynolds R, Smith M, Hagen RD, Sterling CL. Health promotion for educators: impact on health behaviors, satisfaction, and general well-being. *Am J Public Health* 1984;74:147–9.
  111. Allegrante JP, Michela JL. Impact of a school-based workplace health promotion program on morale of inner-city teachers. *J Sch Health* 1987;57:409–11.
  112. Baranowski T, Hearn MD, Baranowski JC, Lin LS, Doyle C, Wahlay N, et al. Teach Well: the relation of teacher wellness to elementary student health and behavior outcomes: baseline subgroup comparisons. *J Health Educ* 1995;26 (suppl 2):1–11.
  113. Resnicow K, Davis M, Smith M, Baranowski T, Lin LS, Baranowski J, et al. Results of the Teachwell Worksite Wellness Program. *Am J Public Health* 1998;88:250–7.
  114. Andraesen AR. Marketing social change: changing behavior to promote health, social development, and the environment. San Francisco: Jossey-Bass, 1995.
  115. Hoerr SM, Loudon VA. Can nutrition information increase sales of healthful vended snacks? *J Sch Health* 1993;63:386–90.
  116. Blamey A, Mutrie N, Aitchison T. Health promotion by encouraged use of stairs. *Br Med J* 1995;311:289–90.
  117. Brownell KD, Stunkard AJ, Albaum JM. Evaluation and modification of exercise patterns in the natural environment. *Am J Psychiatry* 1980;137:1540–5.
  118. Luepker RV, Perry CL, McKinlay SM, Nader PR, Parcel GS, Stone EJ, et al. Outcomes of a field trial to improve children's dietary patterns and physical activity: the Child and Adolescent Trial for Cardiovascular Health (CATCH). *JAMA* 1996;275: 768–76.
  119. Nicklas TA, Stone E, Montgomery D, Snyder P, Zive M, Ebzery MK, et al. Meeting the dietary goals for school meals by the year 2000: the CATCH Eat Smart School Nutrition Program. *J Health Educ* 1994;25:299–307.
  120. Perry CL, Bishop DB, Taylor G, Murray DM, Mays RW, Dudovitz BS, et al. Changing fruit and vegetable consumption among children: the 5-a-Day Power Plus Program in St. Paul, Minnesota. *Am J Public Health* 1998;88:603–9.
  121. Wechsler H, Basch CE, Zybert P, Shea S. Promoting the selection of low-fat milk in elementary school cafeterias in an inner-city Latino community: evaluation of an intervention. *Am J Public Health* 1998;88:427–33.
  122. Contento I, Balch GI, Bronner YL, Paige DM, Gross SM, Bisignani L, et al. Nutrition education for adults. *J Nutr Educ* 1995;27:312–28.
  123. Sallis JF, McKenzie TL, Alcaraz JE, Kolody B, Faucette N, Hovell MF. The effects of a 2-year physical education program (SPARK) on physical activity and fitness in elementary school students. *Am J Public Health* 1997;87:1328–34.
  124. Molnar A. Sponsored schools and commercialized classrooms. Milwaukee (WI): Center for the Analysis of Commercialism in Education, School of Education, University of Wisconsin-Milwaukee, 1998.
  125. Seymour L. "AA" is for ad as firms gain hold on campus. *Los Angeles Times*, 1998 Nov 23; Sect. A:1.
  126. Seyfer J. San Francisco school board approves "Commercial-Free Schools Act." Associated Press, 1999 June 24.
  127. Feinstein JS. The relationship between socioeconomic status and health: a review of the literature. *Milbank Mem Fund Q* 1993;71:279–322.
  128. Marmot MG, Kogevinas M, Elston MS. Social/economic status and disease. *Ann Rev Public Health* 1987;8:111–35.
  129. Story M, Neumark-Sztainer D. School-based nutrition education programs and services for adolescents. *Adolesc Med* 1996;7:287–302.
  130. Glanz K, Mullis RM. Environmental interventions to promote healthy eating: a review of models, programs, and evidence. *Health Educ Q* 1988;15:395–415.
  131. California Project LEAN. *Playing the policy game: preparing teen leaders to take action on healthy eating and physical activity*. Sacramento (CA): California Project LEAN, 1999.
  132. American Cancer Society. *Generation fit action packet: today's generation advocating for good health*. Atlanta (GA), 1999.