

Cardiovascular Health Promotion in the Schools A Statement for Health and Education Professionals and Child Health Advocates From the Committee on Atherosclerosis, Hypertension, and Obesity in Youth (AHOY) of the Council on Cardiovascular Disease in the Young, American Heart Association

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Cardiovascular disease (CVD) is a major cause of morbidity and premature mortality in men and women in the United States, most of the industrialized world, and many developing countries.¹ Primary prevention of CVD beginning in early childhood is supported by extensive evidence culled from epidemiological, clinical, and laboratory studies.²⁻¹⁶ Taken together, these data provided the impetus for the American Heart Association (AHA) Guidelines for Primary Prevention of Atherosclerotic Cardiovascular Disease Beginning in Childhood¹⁷ and support the need for population-based approaches to cardiovascular health promotion and risk reduction. Specifically, the population-based approach, which is aimed at modifying the food and physical activity environments of children, is an important concomitant to the high-risk approach because without the proper environment, the high-risk strategy cannot be optimally implemented. School health programs initiated in preschool and extending through high school have the potential to influence the cardiovascular health of the majority of US children and youth. Toward this goal, this statement is intended for health and education professionals, child health advocates, policymakers, and community leaders who are interested in optimizing the school environment as an integral part of population-based strategies designed to promote cardiovascular health for all US children and youth and reduce the risk and public health burden of CVD.

Background and Rationale

Several lines of evidence underscore the importance of primary prevention of CVD beginning in childhood and the need for population-based approaches to cardiovascular health promotion and risk reduction. Autopsy studies (after

the unexpected deaths of children and youth)²⁻⁵ document significant positive associations between established risk factors and the presence and extent of atherosclerotic lesions in the aorta and coronary arteries of children and youth. Specifically, data from the Bogalusa Heart Study^{3,4} and the Pathobiological Determinants of Atherosclerosis in Youth (PDAY)^{2,5} study link potentially modifiable risk factors, including atherogenic lipids and lipoproteins, systolic and diastolic blood pressures, obesity (body mass index [BMI]), and cigarette smoking, to the development and progression of atherosclerotic processes. Recent data from the Bogalusa Heart Study⁷ and Finland⁸ reaffirm the link between risk-factor exposures in childhood and adolescence and preclinical atherosclerosis in adulthood. In addition, longitudinal studies demonstrate the tracking (ie, maintenance of percentile rank over time) of risk factors and CVD-related health behaviors from childhood to young adulthood.^{10,11,18} Finally, the results of several randomized controlled trials conducted in clinical, home, and school settings demonstrate the feasibility, safety, and efficacy of modifying risk factors in children and youth.¹⁹⁻²⁴

Epidemiological studies, including the Third National Nutrition Examination Survey (NHANES III), provide nationally representative data on the prevalence and trends of risk factors, including CVD-related health behaviors.¹²⁻¹⁶ Useful in informing and guiding public health strategies, these data support the need for more effective population-based approaches to cardiovascular health in children and youth. A particularly disturbing trend, observed in NHANES and other national surveys, is the dramatic increase in the prevalence of overweight and obesity in children and youth.¹³ Recent data (1999-2000) from NHANES indicate that 15.5% of 6- to

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19-year-olds and 10.4% of 2- to 5-year-olds are overweight (BMI \geq 95th age-specific percentile).¹⁴ The prevalence of overweight among non-Hispanic black (23.6%) and Mexican-American (23.4%) adolescents increased >10 percentage points between NHANES III (1988–1994) and the most recent survey (1999–2000).¹⁴ This trend is of particular concern because obesity clusters with other major CVD risk factors, including hypertension, dyslipidemia, and type 2 diabetes mellitus.^{15,25,26} The results of several recent clinical studies documented increases in the prevalence of obesity-induced diabetes mellitus in children and adolescents, particularly among minority youth.^{25,26} National surveys indicate that patterns of dietary intake and physical activity for the majority of children and youth are not meeting current recommendations. Dietary fat intake has decreased over the past 2 decades from 36.3% to 34% of total food energy intake (EI); however, saturated fat intake (12% to 13% of EI) exceeds current recommendations.²⁷ Paralleling the NHANES prevalence and trend data for overweight, minority youth (black and Mexican American) have significantly higher saturated fat intakes than their white counterparts.^{12,27} National data on intake of 3-year-olds (surveyed in the 1995 Continuing Survey of Food Intakes by Individuals [CSFII]²⁸) also suggest that preschool children are exceeding the recommendations for saturated fat intake. Recently, the US Department of Agriculture (USDA) compared the macronutrient and micronutrient contents of menus for young children who participated in the Child and Adult Care Food Program (CACFP) with nutrient standards.²⁹ The *Dietary Guidelines for Americans* recommendations were used as the standard for percentage of energy from total fat and saturated fat.³⁰ An analysis of CACFP menus from these preschool day care programs indicated that the total fat and saturated fat content of the children's lunches exceeded the levels recommended in these guidelines.²⁹ In addition, 2001 data from the national Youth Risk Behavior Surveillance (YRBS) indicated that almost 80% of schoolchildren do not consume the recommended 5 or more servings of fruits and vegetables per day.³¹

Physical activity data from the YRBS indicated that the proportion of students who attend physical education (PE) classes daily decreased from 41.6% in 1991 to 29.1% in 1999.³¹ Of the students who reported attending PE classes, only about one third reported that they actually exercise 20 minutes or more during PE class. In addition, daily attendance in PE classes and participation in recreational/leisure-time physical activity decreased substantially from grades 9 through 12. This pattern of change was more pronounced among girls. For example, in the 2001 YRBS survey the rate of participation by girls in sufficient vigorous physical activity was 67% in grade 9 and 45% in grade 12.³¹ Similarly, data from the longitudinal National Heart, Lung, and Blood Institute (NHLBI) Growth and Health Study indicated precipitous declines in leisure-time physical activity throughout adolescence among both black and white girls.³² By age 18 or 19, 56% of black girls and 31% of white girls reported no habitual recreational activity. Noteworthy predictors of declines in physical activity included lower levels of parental education, higher BMI, pregnancy (black girls only), and cigarette smoking (white girls only).³²

Prevalence and trend data for cigarette smoking among US children and youth also provide cause for concern.^{12,31} In 2001, 28.5% of high school students were current cigarette smokers, compared with 27.5% in 1991.³¹ Data from NHANES III and the Centers for Disease Control and Prevention indicated racial/ethnic differences in the rates of smoking among high school students, particularly among girls; white girls smoke at higher rates than their black or Hispanic counterparts.^{12,31}

Collectively, available evidence, including CVD risk factor prevalence and trend data, emphasizes the need for both individual/high-risk and population-based approaches to the primary prevention of CVD beginning in childhood. By definition, public health or population-based approaches are designed to shift the entire distribution of risk factors within the population to more desirable levels. The AHA's *Guide for Improving Cardiovascular Health at the Community Level*³³ outlines a comprehensive list of goals, strategies, and recommendations that exemplify the population-based approach. As such, they are intended for and are applicable on a community-wide basis, and they identify relevant community-based structures (including schools) as central and essential components of population-based strategies. The rationale for school-based heart health education and related preventive interventions is compelling. One third of the Year 2010 health objectives for the nation can be significantly influenced by school health programs, a fact that highlights the key role of schools in achieving national health objectives.³⁴ Through schools, virtually all of our nation's youth can be reached, and through youth, both parents and teachers may be reached as well. Schools provide many opportunities for shaping dietary and physical activity behaviors, which influence CVD risk factors such as blood lipids, blood pressure, and adiposity. School policies and health education initiatives also influence the adoption of cigarette smoking in youth, another major risk factor for CVD. School-based programs are unique in that they have the ability to provide and sustain stable and effective educational initiatives within existing institutional structures.

School-Based Cardiovascular Health Promotion/Risk Reduction Research

Since the late 1970s, numerous school-based health promotion interventions have been developed and tested: Some exclusively addressed heart health, and others addressed risk factors for CVD through a more comprehensive approach. Many of the earlier first-generation studies were primarily didactic and focused on positively influencing health knowledge, attitudes, and self-reported behavior. By the mid-1980s, school-based research focused on theoretically derived behavioral interventions and incorporated the assessment and measurement of physiological risk factors for CVD as primary end points/outcomes.³⁵ The results of these second-generation trials (reviewed, critiqued, and synthesized by Resnicow and Robinson³⁵) demonstrated the potential of school-based interventions for improving the CVD risk status of children and youth and informed the third generation of research that extended beyond the classroom, with interventions focused on the broader school environment, including

Overview of School-Based Research

Project	Sample	Research Design	Intervention Components	Outcomes Measured	Comments
Know Your Body (KYB 1) ⁵⁰ Bronx, NY; Westchester, NY	4th grade (age 9.1 y) 3388 students; 37 schools	Cross-sectional cohort-study; random assignment of schools within districts Measurements at baseline and 1, 2, 3, and 5 y	Based on health belief model, SCT Teacher-delivered health education program focused on nutrition, physical fitness, and smoking prevention. Curriculum emphasized information/knowledge, motivation, and behavioral skills training.	CVD risk factor knowledge; total fat; total/HDL cholesterol; systolic/diastolic blood pressure; indices of obesity; pulse rate	KYB was among the first theory-driven school-based CVD prevention programs for elementary school children. Results differed by schools (Bronx/Westchester) and over time. At 5-y data point, net reduction in total cholesterol was 5.1% mean decrease in Westchester ($P<0.05$), 2.9% in Bronx (not significant). No significant changes in other risk factors were observed.
Know Your Body (KYB 2) ^{51,52} Washington, DC	4th–6th grades (age 10.5 y) 1041 students; 9 schools	Randomized block (by SES) Measurements at baseline and 2 y	Based on SCT, PRECEDE-PROCEED Teacher-delivered health education program focused on nutrition, physical fitness, and smoking prevention. Curriculum emphasized information/knowledge, motivation, behavioral skills training, and heart health information for parents.	CVD risk factor knowledge; total fat; saturated fat and cholesterol; systolic and diastolic blood pressure; total/HDL cholesterol; indices of obesity	KYB 2 was designed to extend KYB 1 to black children in Washington, DC, elementary schools. Attrition was significant, with 35% of students measured at 2 y after intervention. Significant positive results were observed for systolic and diastolic blood pressure, HDL cholesterol, serum thiocyanate, and attitude toward smoking.
Child and Adolescent Trial for Cardiovascular Health (CATCH) ²¹	3rd–5th grades (age 8 y [mean] at baseline) 5105 students; 96 schools (56 intervention)	Randomized, controlled field trial conducted at 4 sites: California, Louisiana, Minnesota, and Texas	Based on SCT Multicomponent interventions targeted school environment, including food services and PE classroom curricula. Individual behavioral interventions focused on nutrition, physical fitness, and smoking prevention. Home-based family component offered in 50% of intervention schools complemented school-based curricula.	Primary end points at school level were changes in fat content of food lunch offerings, amount of MVPA in PE programs. Individual student-level end points included serum cholesterol change (primary), psychosocial factors; recall measures of eating, physical activity patterns, and other physiological CVD risk factors.	CATCH is particularly noteworthy as the first multicenter school-based research to use the fundamental methodology of clinical trials, including random assignment of schools to treatment condition, rigorous quality-control procedures, and extensive process evaluation. CATCH intervention was able to modify fat content of school lunches, increase MVPA in PE, and improve eating/physical activity behaviors in children during the course of 3 school years.
Cardiovascular Health in Children Study I (CHIC I) ²²	3rd, 4th grades (age 8–11 y at baseline) 1274 students; 12 schools	Randomized, controlled field trial; stratified by geographic region and urban/rural setting	Based on Bruhn & Parcel Development of Positive Health Behavior model Multicomponent intervention was delivered by classroom and PE teachers using AHA Lower and Upper Elementary School Site Program Kits (16 sessions over 8 wk). Content emphasized nutrition, physical activity, and smoking prevention. Investigators developed an aerobic activity intervention (24 sessions over 8 wk).	School-level analyses focused on total cholesterol, systolic and diastolic blood pressure, indices of adiposity/obesity, and aerobic power. Self-report: knowledge, physical activity Individual -level analyses focused on same outcomes.	Children in CHIC I intervention group had significantly greater knowledge and a significant increase in self-reported physical activity than children in control group. Trends for intervention group included reduction in total cholesterol (-5.27 mg/dL), increase in aerobic power, reduction in body fat, and smaller rise in diastolic blood pressure.
Cardiovascular Health in Children Study II (CHIC II) ⁵³	Middle school-aged youth (age 11–14 y) 1140 students; 5 rural schools	Randomized, controlled trial; 2×2 factorial design with 3 treatment groups and 1 control	Investigator (PE specialist) developed interventions: exercise only; education only; or exercise and education. Exercise program (3 d/wk, 8 wk) consisted of 5-min warm-up, 20–30 min aerobic activities, 5-min cool-down. Knowledge program (2 sessions/wk, 8 wk) was taught by regular classroom teacher and consisted of exercise, nutrition, smoking, and health information.	Indices of adiposity (BMI, triceps skinfolds), systolic and diastolic blood pressure, PV_{O_2} max	Systolic and diastolic blood pressure increased more in control group than in intervention groups. BMI did not change significantly. Sum of skinfolds increased less in participants in exercise intervention groups than in control groups. Small increase in PV_{O_2} max of combined exercise-education group was significantly greater than in education group only.

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Project	Sample	Research Design	Intervention Components	Outcomes Measured	Comments
Go for Health ^{54,55}	3rd, 4th grades 1156 students; 4 schools	Cross-sectional cohort study with pretest/posttest control group	Based on SCT Study focused on classroom-based health education/PE (physical activity skill/fitness development) and changes in food service.	Duration of MVPA during PE, total energy consumed, total/saturated fat intake, salt/sodium intake	Go for Health Study demonstrated that training PE teachers and encouraging their physical activity led to substantial increases in children's physical activity; after 2 y in program, children were active for 40% of PE class time, compared with 10% in control schools.
Heart Smart Program ^{56,57}	4th, 5th grades 556 students; 4 schools	Random assignment of schools Postintervention analyses focused on individual students	Based on SCT, PRECEDE-PROCEED model Interventions targeted individual student and school environment. Health education curriculum focused on cardiovascular physiology, eating/exercise behavior, and coping skills. PE program (Superkids-Superfit) emphasized aerobic conditioning, personalized fitness; cardiovascular risk factor screening: lipid profile, blood pressure, and indices of adiposity. Food service modification was designed to reduce sodium and sugar by 50% and fat by 30%. Incorporated school health advisory, health fairs, fun runs	Knowledge, fitness, lipids/lipoproteins, systolic/diastolic blood pressure, BMI	Screening program participants had greater improvements in health knowledge than nonparticipants. School lunch choices were successfully altered; improvements in run/walk performance were related in predicted directions to overall cardiovascular risk profile. Increases in HDL cholesterol observed in intervention schools.
Planet Health ⁵⁸	6th–8th grades 1295 students; 10 schools (5 intervention)	Randomized, controlled field trial with random assignment of schools (matched by ethnic composition, town) Measurements at baseline and 2nd school year after baseline	Based on SCT, behavioral choice theory Multicomponent intervention (16 sessions/y, 2 school y) was delivered by classroom teachers and PE. Program components were designed to reduce prevalence of obesity and focused on reducing TV/fat intake, increasing physical activity, and increasing fruit and vegetable consumption.	Primary end point: adiposity/obesity index based on BMI and triceps skinfold. Secondary end points: self-reports on TV viewing, fat/saturated fat/fruit/vegetable intake, and physical activity	Prevalence of obesity among girls in intervention schools decreased significantly (boys, not significant). Reductions were seen in TV viewing (boys and girls). TV viewing predicted obesity change and mediated intervention effect.
Sports, Play, and Active Recreation for Kids (SPARK) ⁵⁹	4th, 5th grades 955 students; 7 schools	Cohort study with 2 intervention variations: specialist and teacher delivered	Emphasis on self-monitoring SCT intervention components were designed to increase physical activity during PE classes and beyond school environment. Interventions: PE 1: 10 fitness sessions; PE 2: 9 behavioral skill training sessions	Physical activity during PE classes (frequency and quality) and outside-of-school physical activity	Observed physical activity during PE classes increased significantly with PE specialists (40.2 min/wk), trained teachers (32.7 min/wk), controls (17.8 min/wk). Follow-up of SPARK schools 1.5 y after intervention termination indicated health-related PE programs can have long-term effects on teachers and students; students of trained teachers continued to be 88% as active in PE classes as during main study.
Stanford Adolescent Heart Health Program ^{60,61}	10th grade (age 14–16 y) 1130 students; 4 schools	Randomized block (by ethnic distribution, school size) Measurements at baseline and 4 months (2 months after intervention)	Based on SCT, social inoculation theory Program (20 sessions, 7-wk interval, 50 min/session) focused on physical activity, nutrition, and smoking prevention. Information and resistance skills were emphasized and incorporated into PE curriculum.	CVD risk factor knowledge, physical activity, diet, smoking behavior, systolic and diastolic blood pressure, indices of adiposity (BMI, skinfolds), heart rate	This was one of the first controlled trials designed to create, implement, and test a school-based multiple risk factor reduction program for high school students. Results generally supported school-based primary prevention education: Knowledge of CVD risk factors and self-report of exercise increased significantly; regular exercisers had significantly lower resting heart rates; quit rate for experimental smokers (intervention vs control group) was significant; and indices of obesity decreased significantly in girls.

SCT indicates social-cognitive theory.

food service, physical activity programs and facilities, and school policies that affect health-related behaviors. Extension into after-school and community programs and linkages with community agencies also were emphasized.

The Child and Adolescent Trial for Cardiovascular Health (CATCH) exemplifies the third generation of school-based research.^{21,36–39} Specifically, CATCH was the largest randomized controlled field trial designed to evaluate the effects of theoretically derived multicomponent (individual-, school-, and family-based) interventions on risk factors for CVD in elementary school children. Included in this multisite trial were 96 schools (56 intervention, 40 control) from 4 geographic areas (California, Louisiana, Minnesota, and Texas). The sample at baseline included third-grade students from ethnically diverse backgrounds. The CATCH intervention consisted of school-based (classroom curricula, food service, PE) and family-based (home curricula) components. Primary end points/outcomes at the school level were changes in the fat content of food service lunch offerings and the amount of moderate-to-vigorous physical activity (MVPA) in PE. At the individual-student level, serum cholesterol change was the primary end point; psychosocial factors, recall measures of eating and physical activity behaviors, and other physiological measures were secondary end points.^{21,36–38} Three-year outcomes indicated that CATCH interventions were able to modify the fat content of school lunches, increase MVPA, and improve eating and physical activity behaviors.²¹ Specifically, the total fat content of school lunch menus decreased significantly more in intervention schools (from 38.7% to 31.9%) than in control schools (from 38.9% to 36.2%). Similarly, the CATCH intervention decreased the saturated fat content of school lunch menus from 14.8% to 12.0%; that for control schools decreased from 15.1% to 13.7%. Concomitantly, the CATCH PE intervention resulted in a significant increase in the percentage of MVPA during PE class—from 37% to 52%—with students in the intervention schools also demonstrating greater energy expenditure than did their control school counterparts. No significant between-group (intervention–control school) differences in serum cholesterol or other physiological measures were observed.²¹ A follow-up of 73% (n=3714) of the CATCH cohort was conducted to assess differences maintained through the eighth grade in diet, physical activity, and related health indicators, including physiological measures of CVD risk.³⁹ Intervention students maintained a higher self-reported daily MVPA than did controls; however, between-group differences declined over time (from 13.6 minutes in the fifth grade to 8.8 minutes in the eighth grade). The between-group differential in self-reported daily EI from fat was maintained. Consistent with 3-year outcomes,²¹ no significant between-group differences were observed in any of the physiological indicators of CVD risk, including serum cholesterol, blood pressure, and BMI.³⁹

Collectively, the CATCH results and the data generated from other recent research support the potential role of schools (as defined in the AHA's *Guide for Improving Cardiovascular Health at the Community Level*³³) as key structures for population-based behavioral change interventions. Illustrating the importance of multicomponent interven-

tions, including environmental and individual-level strategies, CATCH has been used as a model for guiding and informing other programs, including the Healthy Start project (discussed below) for preschoolers. Results from CATCH and other third-generation school-based studies suggest that effective behavioral change strategies with children and youth must extend beyond the individual level and target environments in which health behaviors develop and are influenced. The effectiveness of CATCH in altering eating and physical activity behaviors has been attributed in part to involving school environmental changes as intervention elements. Behavioral differences narrowed in magnitude but persisted for 3 years after intervention, pointing to the need for follow-up that reinforces interventions at both the school and individual levels.³⁹ Recent results from CATCH-ON,^{40–42} which was designed to assess the sustainability of CATCH, reaffirm this need as they emphasize the school-level infrastructures and the school and environmental policies necessary to maintain CVD-related health behaviors, including the recommended levels of physical activity in PE classes and the macronutrient content of school lunch programs.^{40–42}

Preschool Cardiovascular Health Promotion/Risk Reduction Research

Paralleling the third generation of school-based cardiovascular health–promotion/risk-reduction research was the emergence of preschool-based research and heart health education initiatives. Contemporary preschool heart health programs are based on the premise that for children to be able to take care of themselves, they need to know what to do to keep themselves healthy (knowledge), need to believe that healthy living is really important to them (good attitudes), and need the opportunity to practice good health behavior, not just talk about it (actions and behavior). The ultimate goal is to enable young children to make healthy lifestyle choices and develop good health behaviors in the first place, rather than learn bad habits that need to be undone later.⁴³ Toward that goal and building on lessons learned from CATCH and other third-generation school-based studies, research and demonstration projects (completed and in progress) that target preschool populations illustrate the importance of efforts focused on the individual child and relevant preschool and social and environmental factors.^{44–49}

Healthy Start, an example of a preschool-based demonstration and education research project, was initiated in the mid-1990s with funding from NHLBI-NIH (National Institutes of Health) and was modeled in part on CATCH.^{44–47} The project was designed to evaluate the impact of a multicomponent preschool cardiovascular health intervention, including the modification of meals and snacks served by the school food service, in a largely minority Head Start preschool population. Specific aims were reducing the total and saturated fat content of preschool meals and snacks, increasing nutrition knowledge, and reducing total serum cholesterol. Nine Head Start centers in upstate New York were assigned to either food service modification or control conditions. Half of the centers assigned to the food service modification also received supplemental nutrition education,

whereas the remaining food service modification and the control centers were provided with supplemental safety education materials. Teacher-training workshops led by health education and nutrition specialists preceded all program activities. Children in each of the preschool centers were evaluated twice each year for 3 years, with semiannual measures taken of health knowledge and attitudes, dietary intake, growth patterns, body fatness, and blood cholesterol. Evaluation of the Healthy Start program showed that meals and snacks in the intervention preschools became more heart healthy. Specifically, the saturated fat content of preschool menus decreased from 12.5% to 8.0% EI in intervention schools, whereas the saturated fat content in the control schools decreased from 12.1% to 11.6%.^{44,45} Although several strategies were used to achieve this goal, reducing the fat content of milk and other dairy products, as suggested in the AHA's recommendations, was commonly employed. In addition, children in the intervention preschools, as compared with controls, experienced greater improvement in nutrition and overall health knowledge scores.⁴⁶ Noteworthy recent results indicate a significant decrease in total serum cholesterol among the Healthy Start children who participated in the food service intervention groups (-6.0 mg/dL) as compared with controls (-0.4 mg/dL).⁴⁷ In addition, children with elevated cholesterol levels at baseline were significantly more likely to have cholesterol levels in the normal range (<170 mg/dL) at follow-up if they were assigned to a food service modification/intervention preschool.⁴⁷

Taken together and combined with results from other early childhood health promotion initiatives,^{43,48,49} the above findings suggest that multicomponent preschool programs can be effective in promoting the adoption of heart-healthy behaviors and reducing risk factors for CVD. Similar to school-based programs and central to successful outcomes are theoretically derived developmentally appropriate interventions that address knowledge and behavioral skill training, provide participatory opportunities for children, and target dimensions of the preschool environment that extend beyond the classroom.

Summary and Future Directions

The collective results of school-based research support the recommendations outlined in the AHA's *Guide for Improving Cardiovascular Health at the Community Level*³³ that emphasized schools as important components of population-based cardiovascular health promotion and risk-reduction efforts. Specifically, the majority of school-based studies, including those summarized in the Table^{21,22,50-61} and reviewed by Resnicow and Robinson³⁵ and Meininger,⁶² reported statistically significant effects on health knowledge, attitudes, and behavioral outcomes. Although on average the diet and physical activity changes reported in some studies may appear to be modest in magnitude, from a population perspective they translate into potentially sizable reductions in population-attributable CVD risk and must be interpreted within the context of population-wide strategies. Similarly, the results of school-based intervention research to date have showed a modest change in physiological indicators including serum cholesterol, blood pressure, and measures of

adiposity. Critical reviews of CATCH and other school-based research that included physiological indicators as primary outcomes offer insight and provide direction for future school-based initiatives.⁶³ Specifically, the characteristics of the intervention (eg, dose, duration, and methods of delivery), effects of pubertal maturation (eg, interindividual differences in physiological changes during puberty that bias the effects of intervention), and methodological limitations inherent in school-based designs (eg, differential selection, attrition) are important areas for consideration. To ensure the fidelity of the intervention, the quality and quantity of implementation, training, and support for providers are as essential as is ongoing process evaluation.⁶⁴⁻⁶⁶ Across well-controlled and well-conducted studies, differential results in physiological outcome indicators point to the need for researchers to pay more attention to developmental age, gender, culture, and sociodemographic factors. Taken together, these results indicate that the modification of risk factors for CVD in "real-world" school settings must be reinforced and complemented at multiple levels of intervention. Toward that goal, from a population perspective, broader public health interventions as suggested in the AHA's *Guide for Improving Cardiovascular Health at the Community Level* are warranted.³³ Partnerships between healthcare and educational professionals in collaboration with policymakers and community leaders will be required to actualize the school environment in promoting the cardiovascular health of all of our children and youth and reducing the risk and public health burden of CVD.

Recommendations

The AHA's Council on Cardiovascular Disease in the Young (CVDY) supports the need for both high-risk and population-based approaches to cardiovascular health promotion and risk reduction beginning in early childhood. Consistent with the AHA's *Guide for Improving Cardiovascular Health at the Community Level*, CVDY endorses the role of schools and school health programs as central and essential components of population-based strategies. To this end, goals and recommendations that are designed to optimize the school environment (including preschools and after-school programs) in promoting cardiovascular health for children and youth are listed below. Information that is relevant to these recommendations is included in the Guidelines and School Health Objectives portion of the Suggested Reading section.

Heart Health Education and Health Behaviors

Goals

- All schools should implement evidence-based, comprehensive, age-appropriate curricula about cardiovascular health, methods for improving health behaviors, and the reduction of CVD risk.
- All schools should implement age-appropriate and culturally sensitive curricula on changing students' patterns of dietary intake, physical activity, and smoking behaviors.

Recommendations

- School curricula should include general content about the major risk factors for CVD and content specific to the

sociodemographic, ethnic, and cultural characteristics of the school and the community.

- School curricula should include research-based content about the effective methods of changing CVD-related health behaviors.
- Schools should provide the behavioral skill training necessary for students to achieve the regular practice of healthy behaviors.
- PE class should be required at least 3 times per week from kindergarten through grade 12, with an emphasis on increasing the participation of all students in age-appropriate MVPA. The AHA advocates 150 minutes of PE during each school week for elementary school students and at least 225 minutes per week for middle school students.
- Meals provided in schools should be conducive to cardiovascular health and conform to current recommendations for macronutrient and micronutrient content.
- School buildings and surrounding environments should be designated tobacco-free settings.

School Policies

Goals

- All schools should institute policies that enforce the implementation of the current national recommendations for physical activity and nutrition for children and youth, including the modification of food services and PE programs.
- All schools should institute policies that they be maintained as tobacco-free environments.

Recommendations

- School policies should address all foods and snacks consumed on- and off-premises during school hours.
- After-school programs should institute policies that are conducive to the consumption of nutritious healthy snacks and an appropriate level of physical activity for all children in their programs. These policies should take into account the stocking of vending machines and the marketing of foods.

School and Community Linkages

Goal

- All schools should establish links with the community resources and infrastructures necessary to support cardiovascular health promotion and risk reduction for children and youth.

Recommendation

- As community thought leaders, schools should make the promotion of healthy patterns of dietary intake and physical activity behaviors in their community a priority.

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Suggested Reading

Guidelines and School Health Objectives

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