The Heart Smart Cardiovascular School Health Promotion: Behavior Correlates of Risk Factor Change

MARIAN L. ARBEIT, M.S., R.D., LDN, CAROLYN C. JOHNSON, PH.D.,
DENISE S. MOTT, M.ED., DAVID W. HARSHA, PH.D.,
THERESA A. NICKLAS, DR.P.H., LDN, LARRY S. WEBBER, PH.D.,
AND GERALD S. BERENSON, M.D.1

Department of Medicine, Louisiana State University Medical Center, 1542 Tulane Avenue,
New Orleans, Louisiana 70112-2865

Background. A growing awareness of health promotion and positive lifestyle change, coupled with the knowledge that cardiovascular risk has its origins in childhood, has led to the development of health promotion programs in the elementary school. While most school-based programs target specific behaviors or enlist singular intervention modalities, the Heart Smart cardiovascular school health promotion targeted the total school environment with a multidisciplinary approach to prompt the school's varied institutions to implement changes in curriculum, school lunch, and physical education.

Methods. Components of the Heart Smart environmental intervention included: (a) a school lunch program providing cardiovascular healthful food choices, reduced in fat by 30% and in sodium and sugar by 50%; (b) a physical education program promoting personal fitness and aerobic conditioning; and (c) cardiovascular risk factor screening, measuring fasting lipids and lipoproteins, anthropometrics, and blood pressure. Changes in cardiovascular risk factor status, school lunch selections, and exercise performance were compared.

Results. Screening participants showed greater improvement in health knowledge than nonparticipants. School lunch choices were successfully altered, and children whose lunch choices were cardiovascular healthful evidenced the greatest cholesterol reduction. Improvements in run/walk performance were related in predicted directions to the overall cardiovascular risk profile. Increases in high-density lipoprotein cholesterol were observed at intervention schools.

Conclusion. Observations indicate a relationship between behavior change and physiologic changes achieved in a total school health promotion to reduce cardiovascular risk.

INTRODUCTION

Epidemiologic studies indicate that serum total cholesterol and hypertension are primary physiological risk factors for arteriosclerotic cardiovascular (C-V) disease (1-4). Cigarette smoking, obesity, and family history are other major lifestyle variables contributing to heart disease (5). In the Bogalusa Heart Study, an ongoing epidemiologic study of the early natural history of coronary artery disease and hypertension, elevations in serum lipids and blood pressure and adverse dietary intake patterns, as well as the formation of pathologic C-V lesions,

1 This research was supported by funds from the National Heart, Lung, and Blood Institute of the United States Public Health Service. National Research and Demonstration Center—Arteriosclerosis, HL15103.
2 To whom reprint request should be addressed.
have been detected in children and young adults (6, 7). Although clinical manifestations of C-V disease appear only later in life, it is now recognized that atherosclerosis and essential hypertension begin in childhood (6, 8, 9). Bogalusa findings indicate that risk factors, both physiologic (lipids and blood pressure) and behavioral (dietary and lifestyle patterns), tend to “track”; that is, risk factor levels for a child in relation to his/her peers tend to persist within a given rank over time. This persistence of the relative level of risk factor variables over time implies that C-V risk can be predicted in early life and that steps may be taken to intervene in health-compromising lifestyles and behaviors.

Based on the extensive observations from the epidemiologic research in the Bogalusa Heart Study, a school-based initiative in pediatric preventive cardiology was developed. Since approximately 95% of all children attend elementary and secondary schools (10), the public education system was an appropriate, logical vehicle for health intervention. Recognizing that components of a school environment do not exist in isolation, a combined approach of intervention modalities (curriculum, school lunch, physical education), as well as environmental supports (parents, school personnel), was implemented for behavioral risk reduction (Table 1). In this manner, the various interpersonal and institutional forces within the school were enlisted to reinforce and facilitate the heart health message. The Precede model also was used in program planning and development. The purpose was to establish an intervention in which predisposing factors (knowledge, attitudes, beliefs, values, and perceptions), enabling factors (accessible and available resources and skills), and reinforcing factors (attitudes and behaviors of teachers and peers) could be targeted for intervention (11). Additionally, to test the feasibility of a high-risk approach for risk factor reduction in a school setting, a family health promotion was developed as well (12).

This article provides observations obtained during the 2½ years of intervention. Behavior correlates of risk factor change will be discussed in terms of individual program components.

**METHOD**

*Population*

The Heart Smart program was initiated in four elementary schools in Jefferson Parish (County), Louisiana, a suburb of New Orleans. This site was selected because of the mixed racial and socioeconomic distribution. The composition of the public school system is mainly of children from lower to upper-middle income families. The racial distribution is as follows: 58% white, 32% black, and 10% other, primarily Vietnamese, with about 2% Hispanic.

*Design*

An intervention vs control design was implemented with a population (public health) approach within four schools. Each school was randomly assigned to intervention or control conditions (two schools per condition). Analyses were directed toward fourth and fifth grades in each school.
### TABLE 1

**COMPONENTS OF THE HEART SMART MODEL FOR SCHOOL-BASED CARDIOVASCULAR HEALTH PROMOTION**

<table>
<thead>
<tr>
<th>Components</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-V risk factor screening</td>
<td>Fasting lipids and lipoproteins, anthropometrics; blood pressure; available to students and school personnel</td>
</tr>
<tr>
<td>Heart health curriculum (grades K–6)</td>
<td>Behavior-oriented presentation of C-V physiology, nutrition, and exercise; emphasis on self-esteem and decision making</td>
</tr>
<tr>
<td></td>
<td>Kindergarten—American Heart Association, “Treasure Chest”</td>
</tr>
<tr>
<td></td>
<td>1–3—American Health Foundation, “Juno’s Journey”</td>
</tr>
<tr>
<td></td>
<td>4–6—Heart Smart curriculum</td>
</tr>
<tr>
<td>Staff development</td>
<td>Teacher in-service education on C-V health and curriculum</td>
</tr>
<tr>
<td>School lunch</td>
<td>Fractional reduction of sodium, sugar, and fat in menus; offer vs serve for traditional vs C-V healthful food choices</td>
</tr>
<tr>
<td>Superkids—Superfit exercise</td>
<td>C-V fitness skills and curriculum in physical education classes; personalized fitness and conditioning activities</td>
</tr>
<tr>
<td>Parent outreach</td>
<td>—“COR” Health Advisory Committee:</td>
</tr>
<tr>
<td></td>
<td>Coalition of parents, teachers, school lunch personnel, physical education staff, and Heart Smart staff to enhance school and family adoption of C-V health principles</td>
</tr>
<tr>
<td></td>
<td>—Parent volunteer program</td>
</tr>
<tr>
<td></td>
<td>—Newsletter, “Heart Smart Gazette”</td>
</tr>
<tr>
<td>Family health promotion</td>
<td>12-week program promoting eating and exercise lifestyle changes in families of children at high risk for C-V disease (child identified at 90th percentile for lipids, weight, and/or blood pressure from C-V risk factor screening)</td>
</tr>
</tbody>
</table>

**Evaluation**

Evaluation of the Heart Smart program concentrated on fourth and fifth grades, and fell into four main categories: (a) C-V risk factors; (b) school lunch; (c) physical fitness; and (d) C-V health knowledge.

**C-V risk factor screening.** The following physiologic measurements were obtained during Heart Smart C-V risk factor screening: serum lipids and lipoproteins by venipuncture following fasting overnight; height; weight; triceps and subscapular skinfolds; waist circumference; and blood pressure (Fig. 1). Measurement protocols were similar to those developed for the Rogalusa Heart Study (6). C-V risk factor measurements were obtained at three intervals during the school year: fall, winter, and spring. Of 870 eligible fourth and fifth graders at the four schools, a total of 530 (61%) received parental consent to participate (Table 2). Table 2 includes only children who were present during the entire school year. In the fall,
venipuncture, anthropometric, and blood pressure data were obtained on all consenting students. During the winter, anthropometric and blood pressure data were collected. In the spring, anthropometric and blood pressure estimates were obtained on all children, and venipuncture was optional for fifth graders. This method of sampling was initiated to allay parental concerns over repeated venipunctures within the same school year.

### TABLE 2

**"HEART SMART" C-V SCREENING PARTICIPATION RATES, 1985–1986**

<table>
<thead>
<tr>
<th>School</th>
<th>Eligible fourth and fifth graders (N)</th>
<th>Fall screening (includes VP) (%)</th>
<th>Winter screening (no VP) (%)</th>
<th>Spring screening (optional VP for fifth grade) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>216</td>
<td>60</td>
<td>62</td>
<td>59</td>
</tr>
<tr>
<td>2</td>
<td>190</td>
<td>62</td>
<td>61</td>
<td>62</td>
</tr>
<tr>
<td>3&lt;sup&gt;a&lt;/sup&gt;</td>
<td>230</td>
<td>64</td>
<td>62</td>
<td>56</td>
</tr>
<tr>
<td>4</td>
<td>234</td>
<td>61</td>
<td>60</td>
<td>58</td>
</tr>
<tr>
<td>Average participation</td>
<td></td>
<td>62</td>
<td>61</td>
<td>59</td>
</tr>
</tbody>
</table>

*Note. VP, venipuncture.
<sup>a</sup> Intervention schools.*
Lifestyle assessment. The dietary evaluation strategy consisted of student self-reports of school lunch menu choices (C-V healthful or regular) following the meal. The reports were read by optical scan. School food service recipes were analyzed for nutrient content, and plate waste studies were conducted to examine acceptability of the lunch. Since all fifth grade students did not participate in the lunch program, our sample was self-selected. Fitness levels were evaluated by a run/walk held in the fall and spring by rigorously trained Heart Smart physical educators during physical education classes. A C-V health knowledge test was analyzed for measurement integrity (13) and administered during the fall and spring to all fourth and fifth grade students to assess any gains in health knowledge.

Statistical analyses involved comparison of fourth and fifth grade student data at each intervention school with same-grade students at comparison schools. The problem of school assignment to experimental conditions and analyzing individual data is noted. With assignment by school, technically the school becomes the unit of analysis; however, with only four schools, this is not feasible. Data analyses, therefore, focused on individuals, with the recognition that individual student data may not represent independent observations.

PROGRAM CONTENT

Reflecting the multifactorial etiology of C-V disease, the Heart Smart program featured varied initiatives in the school. The targeted areas for intervention included nutrition, exercise, and the development of behavior skills needed to adopt healthful lifestyles (decision making, communication, self-esteem, and assertiveness) and to deter onset of cigarette smoking and other risk-related behaviors (i.e., alcohol and drug abuse), while encouraging responsibility for one’s health. Objectives of the program included the following.

(1) Dietary patterns consistent with American Heart Association Guidelines (14):

(a) reducing dietary fat intake to <30% of total energy intake,
(b) reducing saturated fat to <10% of total energy intake,
(c) reducing sodium chloride intake to <5 g per day,
(d) attainment and maintenance of ideal body weight;

(2) Adoption of physical activity patterns and behavioral skills conducive to lifetime physical fitness;
(3) Deterred onset of cigarette smoking and other unhealthful behaviors through the promotion of self-esteem and cognitive and attitudinal awareness.

Program components included C-V screening, a C-V health curriculum and staff development programs, modification of school lunch, and an aerobic physical education program. The Heart Smart screening, in addition to determining children’s physiologic status and possible future risk for heart disease, was designed to enhance the curriculum content in intervention schools (e.g., C-V fitness and healthy eating and exercise) and the general program philosophy of self-esteem and responsibility for health decisions. Students in intervention schools were
provided with an overview of C-V physiology, the relation of lipids, adiposity, and blood pressure to C-V health, and the effect of lifestyles on risk factor status. In keeping with the reciprocal determinism inherent in social learning, risk factor screening provided students with opportunities for role rehearsal and modeling of positive health behaviors.

**CURRICULUM**

A C-V health curriculum was developed to be incorporated into the teaching program as a general science course (15). It focused on healthful eating habits and exercise, self-esteem, responsibility for one’s own care, and adoption of healthful lifestyles through training in behavioral skills. Inoculation against the adoption of unhealthful lifestyles was promoted through assertiveness training, decision making, and enhancing self-esteem.

The program extended through the entire elementary school grades, K–6. Consequently, the curriculum scope and sequence considered the developmental maturity of the child during these formative years. The content covered four major areas: C-V anatomy and physiology; nutrition and eating behavior; physical activity and exercise behavior; and behavioral and coping skills. The curriculum was teacher-delivered and consisted of 15–35 hr per year per grade, with a progressive increase in complexity of health education as a science.

To provide for optimal curriculum implementation and to promote positive role modeling of teachers, an extensive staff development program was developed (16). Within-school staff development consisted of a variable method approach: (a) an intense 2-day preservice workshop on principles of C-V health and also curriculum materials; (b) bimonthly booster sessions to assist with curriculum implementation; and (c) optional after-class nutrition and exercise sessions. Concurrently, collaboration with a local university provided the setting for the development of teacher-facilitators, who received intensive graduate-level training in C-V health promotion (17).

**Superkids-Superfit Exercise Program**

Superkids-Superfit was a comprehensive C-V fitness program (18). The purpose was to promote knowledge, behavioral skills, and patterns of physical activity consistent with lifelong maintenance of C-V health. The Superkids-Superfit curriculum consisted of 12 didactic lessons and aerobic activities in C-V healthful fitness concepts to be administered by physical education staff (18). It was designed to gradually increase the participant’s level of fitness through personalized, noncompetitive leisure-time activity. Students learned the following: the relationship of exercise to heart disease; the benefits and guidelines of exercise; components of fitness; developing and monitoring a personal fitness program; heart rate and blood pressure responses to exercise; care and prevention of fitness-related injuries; and basic exercise anatomy and physiology. Students engaged in activities such as jogging, power walking, jump roping, fitness stations, aerobic dance, and aerobic group games. The objective was to have students become responsible for their personal fitness through individual activities and decision making.

Additionally, a year long fitness program was incorporated into the school’s
existing physical education curriculum. Weekly log books, total school activities such as geographic fun runs, and afternoon perk-ups served to reinforce the exercise program. The Superkids-Superfit Resource Guide provided conditioning guidelines and activities accentuating C-V fitness. The activities were structured so that the physical education or classroom teacher could use the program to maintain C-V fitness and provide behavioral reinforcement throughout the entire school year by encouraging parent and summer activity.

School Lunch Program

In the Bogalusa Heart Study, dietary research on health-risk eating behaviors indicates that 10-year-old children obtain 38% of their total energy intake from fat, with 16% from saturated fat (19). School lunch contributes 33% of the total daily sodium intake, 25% of the saturated fat, 27% of the protein, and 22% of the total energy intake. In addition, school lunch provides 8% of the daily sucrose intake (20).

Dietary objectives of the Heart Smart school lunch program included providing (a) approximately 1/3 of the RDA for total energy (≈600 kcal), (b) 20 g of total dietary fat, (c) 6 g of saturated fat, and (d) 600 mg or less of sodium while maintaining the Type A lunch pattern for school children (21). The Heart Smart school lunch program extended education in the classroom by exposing children to C-V healthful food items. In the Heart Smart school lunch program, C-V healthful menus were served as an alternative to the regular school lunch menus. The “offer vs serve” format of one entrée, starch, vegetable, and dessert on the hot food line included a C-V healthful alternative for most of the foods offered. The food choices offered to the students provided an opportunity for role rehearsal of new behavioral skills and active decision making relative to food selection.

The Heart Smart school lunch program served as an institutional model to promote achievement of dietary objectives, create a laboratory for student skill development, and evaluate eating behavior changes. Major components of the Heart Smart school lunch intervention included: (a) fractional reduction of recipes to achieve desired food composition; (b) daily food choices to observe student food selection and decision making; and (c) daily salad bar composed of C-V healthful choices. Recipes were modified to reduce salt by 50%, simple sugar by 50%, and fat by 30% and/or to change the type of fat from saturated to unsaturated fat. The salad bar consisted solely of C-V healthful selections. Alteration of school lunches and encouragement of improved “brown bag” lunches complemented and reinforced the nutrition component of the curriculum. Changes were achieved through attention to menu planning, food purchasing, recipe modification, food preparation, and production techniques. A concentrated training program for cafeteria workers ensured improvement of breakfast and lunch provided at the school.

RESULTS

Physiologic assessment of 556 fourth and fifth graders identified children with elevated (>90th percentile) serum lipids, blood pressure, and/or ponderal index
HEART SMART SCHOOL HEALTH PROMOTION

(Bogalusa Heart Study norms) (Table 3). Baseline levels essentially matched those observed in the Bogalusa Heart Study (8). Twenty-five percent of school employees screened demonstrated an elevated risk factor status (data not shown). In comparing participants with nonparticipants in the risk factor assessment, we found participation in the Heart Smart risk factor screening to be associated with cognitive test scores (Table 4). Analysis of pretest means indicated that the two groups of screening participants and nonparticipants were not significantly different. In the intervention schools, where the Heart Smart curriculum and exercise components were administered, however, fourth grade screening participants showed significantly higher knowledge gains than nonparticipants. Students in the control schools, who received a noneducational orientation to screening, evidenced lesser, nonsignificant knowledge gains.

School Lunch Program

Risk factor data were additionally used to address the impact of the school lunch program (22). Physiologic data on 136 fifth graders were compared with the number of C-V healthful school lunch selections. Students were assigned to quartiles, according to pre- and post-changes in risk factors (total cholesterol, weight/height\(^3\), systolic and diastolic blood pressures). It was determined that children in the quartile showing the greatest cholesterol reduction had the largest number of C-V healthful food choices (61% selecting three or more C-V healthful foods, compared with 42% in the quartile with the least lipid reduction) (Fig. 2). Likewise, among children in the quartile showing the greatest reduction in ponderosity (\(N = 32\)), 81% selected three or more C-V healthful foods, compared with 47% in the quartile of children with the least reduction (Fig. 3). No trend of this type was noted for pre- and post-systolic or diastolic blood pressure changes.

Another positive finding refers to the effectiveness of school lunch alterations. On the average, C-V healthful lunch choices contained 61% less sodium, 74% less saturated fat, and 37% less sugar than the usual menu (23); however, U.S. Department of Agriculture School Lunch Type A requirements were met.

<table>
<thead>
<tr>
<th>TABLE 3</th>
<th>PREVALENCE OF ELEVATED C-V RISK FACTORS AMONG CHILDREN(^a) AND EMPLOYEES(^b) AT HEART SMART SCHOOLS, 1985–1986</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Children ((N = 556)) (%)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>21</td>
</tr>
<tr>
<td>Obesity (weight/height(^3))</td>
<td>15</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>15</td>
</tr>
<tr>
<td>Triglycerides(^c)</td>
<td>17</td>
</tr>
<tr>
<td>High-density lipoprotein(^a) (&lt;10th percentile)</td>
<td>5</td>
</tr>
<tr>
<td>Low-density lipoprotein(^a)</td>
<td>12</td>
</tr>
<tr>
<td>Very-low-density lipoprotein(^a)</td>
<td>5</td>
</tr>
</tbody>
</table>

\(^a\) Based on Bogalusa Heart Study norms, 90th percentile value.

\(^b\) Based on LRC data.

\(^c\) Indicates lipids after fasting.
TABLE 4
MEAN CARDIOVASCULAR KNOWLEDGE SCORES OF FOURTH GRADERS BY PARTICIPATION IN RISK FACTOR SCREENING

<table>
<thead>
<tr>
<th>Intervention schools</th>
<th>Control schools</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pretest</td>
</tr>
<tr>
<td>Screening participants (N = 108) (N = 102)</td>
<td>9.69</td>
</tr>
<tr>
<td>Screening nonparticipants (N = 51) (N = 58)</td>
<td>9.43</td>
</tr>
</tbody>
</table>

* Participant/nonparticipant differences, \( P < 0.05 \).

Note. Participants in C-V risk factor assessments in intervention schools scores significantly higher than nonparticipants in C-V knowledge post-tests. No corresponding differences were found in post-test cognitive scores between participants and nonparticipants in control schools.

Since approximately 90% of the school population participated in the modified school lunch program and since 22% of daily energy intake is obtained via school lunch (20), we investigated growth patterns among fifth grade students. Anthropometric indices obtained on fourth and fifth graders at three intervals (fall, winter, spring) of a school year indicated that consistent, positive growth occurred at normal expected patterns and rates at all four schools (Figs. 4 and 5).

Superkids-Superfit Exercise Program

Changes in physical status were also assessed in terms of the exercise component. Physical fitness as gauged by 1-mile run/walk times significantly improved on an age-/sex-specific basis over the course of the intervention. Fifth grade boys’

FIG. 2. Percentages of C-V healthful school lunch selections of fifth graders (N = 102) by quartiles of change in pre- and post-cholesterol. Healthful school lunch selections are correlated with positive changes in total cholesterol.
times significantly decreased by 1.3 min compared to control boys; fifth grade girls' times also demonstrated a decrease, but this was not statistically significant (Table 5).

In addition, subjects (N = 107) who improved their run/walk times manifested systolic blood pressure decreases on an average of 1.6 mm Hg (P < 0.05). Likewise, subscapular and tricep skinfolds decreased 4.3 and 2.8 mm, respectively (P < 0.0001 for both). Also, very close correlations of weight to run/walk perfor-
ARBEIT ET AL.

Heart Smart
n=534

Total School Intervention cm Control
* program not fully implemented

Fig. 5. Pre-, interim-, post-mean levels of height by intervention method. Consistent, expected increases in height were observed in all Heart Smart schools.

Performance were noted (boys: $r = 0.45, P < .01$; girls: $r = 0.25$). Pearson product-moment correlations between C-V fitness, measured by the 1-mile run/walk time, and C-V risk factor levels were computed ($N = 134$) (Fig. 6). Run/walk performance was related in expected directions to the overall C-V risk profile. It is concluded that a school-based C-V fitness program can impact children's C-V endurance and risk factor variables.

In comparing pre- and post-results obtained in the four schools, data also indicated significant increases in high-density lipoprotein (HDL) cholesterol in intervention school children compared with control populations ($P < .05$), further supporting a population approach to C-V disease prevention in children. Figure 7 indicates increased HDL levels in each race/gender group in school 1 (total intervention), as compared with a consistent decrease in HDL in each race/gender group at the other schools.

**TABLE 5**

Mean Pre- and Postintervention Run/Walk Times (Minutes) in Experimental and Control Schools by Grade and Sex ($N = 280$)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Sex</th>
<th>Pretest</th>
<th>Post-test</th>
<th>%Δ</th>
<th>Control</th>
<th>Post-test</th>
<th>%Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>$\bar{x}$</td>
<td>SD</td>
<td>$\bar{x}$</td>
<td>SD</td>
<td>%Δ</td>
</tr>
<tr>
<td>4</td>
<td>Boys</td>
<td>50</td>
<td>11.4</td>
<td>2.6</td>
<td>11.4</td>
<td>3.3</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>42</td>
<td>13.1</td>
<td>2.1</td>
<td>13.8</td>
<td>3.4</td>
<td>+3.3</td>
</tr>
<tr>
<td>5</td>
<td>Boys</td>
<td>33</td>
<td>12.0</td>
<td>3.4</td>
<td>10.7</td>
<td>3.7</td>
<td>-10.8**</td>
</tr>
<tr>
<td></td>
<td>Girls</td>
<td>36</td>
<td>13.0</td>
<td>2.9</td>
<td>12.6</td>
<td>2.4</td>
<td>-3.1</td>
</tr>
</tbody>
</table>

**P < 0.01.**
HEART SMART SCHOOL HEALTH PROMOTION

"Heart Smart" (N=134)


DISCUSSION

Several outstanding C-V health promotions have been conducted in the school setting (24). Virtually all have targeted only scientific health behaviors for change, i.e., diet (25), physical activity, and smoking (26), or have used singular vehicles

FIG. 7. Pre- and post-mean levels of HDL by race and sex by method of cardiovascular health promotion: Heart Smart. Significant increases in HDL were achieved at the total intervention school, as compared with control schools.
for risk factor reduction, i.e., curriculum (27) and the family (28). Still others have successfully targeted specific grades of a school (29, 30). In contrast, the Heart Smart model has used the organizational approach of transforming the total school environment to contribute to the implementation of health promotion efforts (31, 32). All available vehicles for implementation of dietary, exercise, and behavior skill change were developed and constituted a comprehensive health education program.

The social learning model served as the primary theoretical framework for the total school involvement of the Heart Smart intervention (33). Through principles of social cognitive theory, it is asserted that the individual maintains a reciprocal interaction with the environment and that behaviors, environment, and personal factors continuously impact upon each other (34). In addition to providing opportunities for modeling and role rehearsal of positive health behaviors, the Heart Smart intervention, specifically the curriculum, uses training concepts to inoculate children against learned helplessness by teaching decision-making skills and assertiveness. The total school approach to C-V health promotion was successfully implemented. In terms of knowledge change, significant increases in pre- and post-knowledge scores were not substantiated. As others have indicated, changes in knowledge do not necessarily afford corresponding changes in health behavior (25, 35). However, the combined approach of intervention modalities and environmental supports did appear to effect positive changes in eating and exercise behavior, as well as physiologic improvements in risk factor status.

Current debate concerns the nutrient adequacy of dietary modifications reflecting AHA recommendations. Belmaker and Cohen (36) reviewed research questions concerning the feasibility, efficacy, and safety of the prudent diet in childhood and early adolescence and concluded that "there are no proven health hazards of the prudent diet in healthy, well-nourished adolescents." Our school population data support this conclusion for elementary school children as well.

In all likelihood the extensive evaluation, including C-V risk factors, extensive lipid and lipoproteins, and blood pressure measurements, is not practical for a school-administered health education program. A team of trained professional personnel such as nurses, behavioral physiologists, and laboratory technicians is not feasible. Growth, height, weight, waist, hip, and perhaps blood pressure measurements may prove feasible. The capillary finger stick method may provide blood cholesterol determination. However, our studies recommend that a general risk factor profile as a pre-school entrance examination be achieved.

Behavioral concepts of self-esteem and self-efficacy are crucial components in the adoption of health behaviors; as such they are the foundation for successful health promotion in the elementary school. Empowerment of children provides the basis for not only skill acquisition, but also maintenance of new behaviors in the presence of anticipated peer pressure.

SUMMARY

The Heart Smart environmental approach to health promotion was successfully implemented by school personnel. C-V healthful school lunch selections have been correlated with risk factor improvements; proper growth and development
have been maintained in conjunction with planned reductions in saturated and total fat content of foods. Exercise data show significant positive results as well. Further, significant gains in HDL were documented in intervention schools. The Heart Smart program demonstrates the feasibility and utility of a comprehensive C-V health promotion program in the elementary school. Behavioral changes, as initiated in the Heart Smart program, have great potential for reducing the C-V risk of our nation's children.

ACKNOWLEDGMENTS

The authors thank the Jefferson Parish School System and the schools, faculty, and parents who participated in the Heart Smart program. Additionally, recognition is extended to Igor Vizelberg, B.S., and Thomas Sellers, Dr. P.H., for statistical assistance, and to Patricia Constant for assistance with manuscript preparation. Special appreciation is expressed to the students, without whom we could not have developed this program.

REFERENCES

16. Downey AM, Virgilio SJ, Serpas DC, Nicklas TA, Arbeit ML, Berenson GS. Heart Smart—A


Received June 26, 1990
Revised June 25, 1991
Accepted June 28, 1991