# Project healthy schools:
## a school based health education program to prevent childhood obesity

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Advances in medicine and technology have significantly extended the average life expectancy in the last century. However, for the first time in American history, health professionals are anticipating that children born today may live shorter lives than their parents. What could be so ubiquitous as to set back decades of medical advances? It must be a problem for which we don't as yet have a vaccine or a cure, possibly cancer, SARS, or AIDS? Unfortunately, the reason why our children may live shorter lives is not due to something as dramatic as an incurable disease. The next generation may have a shortened life span simply because of obesity. Yes, obesity is killing our children! In the last 30 years the number of overweight children has nearly tripled; more than 17% are now classified as obese (5-6). Children who are overweight have a 70% chance of becoming overweight adults. Health risks associated with overweight include: cardiovascular disease, diabetes, cancer, and depression (2-4). Furthermore, the onset of health complications is occurring at younger ages; particularly, Type 2 diabetes has concurrently been on the rise for children and adolescents (7).
Just within the state of Michigan, the impact of obesity is disturbing. The financial burden of obesity has drained state resources. The Michigan Department of Community Health reports that cardiovascular disease costs the state $13.7 billion, physical inactivity $8.9 billion, and obesity $2.9 billion each year.

Multiple groups are working to try to improve these concerning trends (8-19). Lifestyle changes are an integral part of any effort to positively impact such risk factors. Many different strategies for prevention have been proposed, with no clear consensus as to the optimal approach at this time. Previous research has shown some success with school-based programs aimed at reducing behaviours contributing to the development of cardiovascular risk factors. (10)

Recognition of the need to fight the battle against childhood obesity led to the development of Project Healthy Schools (PHS). Project Healthy Schools (PHS) is a community-university collaborative that provides school-based programming to reduce childhood obesity and its long-term health risks. In Winter, 2004, the University of Michigan's Cardiovascular Centre and MFit Health Promotion Division formed a partnership with the Ann Arbor Public Schools and convened a standing taskforce of representatives from the Washtenaw County Public Health Department, the Ann Arbor Department of Recreation and Education, Mott Children's Hospital, UM School of Public Health, and community leaders and businesses. Building from community partner input and a research base, the project has begun attacking childhood obesity through education, changing the school environment, and measuring the effects on children's behaviours and cardiovascular risk factors. Here we aim to describe the Project Healthy Schools Program and the early results in impacting risk factors for early atherosclerosis in middle school students.

### PROGRAM DESCRIPTION

The Project Healthy Schools program attempts to improve cardiovascular risk factors through both educational and environmental change focusing on five primary goals: 1) increasing intake of fruits and vegetables, 2) decreasing intake of high-sugar beverages, 3) performing at least 150 minutes per week of exercise, 4) decreasing intake of fast and fatty food, and 5) decreasing time spent with television and computer games while increasing time spent with enriching activities such as music and reading.

The educational component of the program consisted of ten fun, interactive learning modules addressing the five program goals. The teaching program emphasized both the use of visual aids as well as student participation in order to engage the students in the activities. The educational modules were administered during the students' advisory class period (homerooms). The modules were taught either by the advisory teachers, or by health educators provided by the Project Healthy Schools team. While each teacher was provided with a standardized curriculum, they were allowed some flexibility in terms of their presentation of the material. The curriculum was presented in ten, 20-minute sessions for a total of three hours and 20 minutes of classroom time.

Environmental change included significant modifications in the school cafeteria. As a result of cooperation with the school's food service vendor, and with input from students and staff, significant changes were implemented in the school cafeteria. The most noteworthy change involved the addition of a salad bar including fresh vegetable choices. Additional healthy snack items were made available, including carrots and celery with peanut butter. Fried chips were replaced with lower-fat baked chips. Marketing techniques which resulted in the increased sale of unhealthy foods were eliminated. Throughout the school, sugar-containing soft drinks were removed and bottled water was made available in the vending machines and in the cafeteria. The school store, which provides snacks for children after school, was changed to eliminate candy and junk food and replaced with healthier options. An information campaign was implemented throughout the middle school with parent email messages, written information and bulletin boards emphasizing healthy eating and physical activity. Several sixth grade assemblies demonstrating physical activity and a field day at the end of the school year were also held.

### PROGRAM PARTICIPANTS

Subjects were recruited from the 6th grade class at a single middle school. The parents of all sixth grade students received a cover letter and consent form explaining the project. All sixth graders received the educational curriculum of Project Healthy Schools. Data was not included for analysis without parental consent and student assent. The study was approved by the University of Michigan Institutional Review Board.

### MEASURES

The study included measurements of risk factors prior to program initiation (January 2005), and at the conclusion of the 12-week program (May 2005).

#### Measurement of height and weight

All consenting students underwent measurements of height and weight to determine their body mass index. Body mass index was defined as the weight in kilograms

divided by the square of the height in meters. Trained examiners performed all measurements. Height was measured using a stadiometre with student's shoes removed. Weight was measured to the nearest 0.1kg.

### Measurement of blood pressure

Blood pressure was measured using an automated blood pressure cuff (Mabis Model 04-244-001, Mabis Health Care, Waukegan, Illinois), with two measurements. Each child was asked to sit quietly for 2-3 minutes and remove constrictive clothing. The right arm was positioned such that the middle of the upper arm was at the same height as the heart. The procedure was repeated after an interval of one minute. Measurements producing outlying results prompted a third measurement. The mean systolic blood pressure was calculated and served as the systolic blood pressure measure.

### Questionnaires

All students completed the SPAN (School Physical Activity and Nutrition) survey assessing their understanding of components of a healthy lifestyle. The questionnaire is a validated tool which includes topics such as the students' amount of physical activity, television and video game use, and dietary intake (20). The questionnaire provides a means of understanding the baseline dietary and exercise habits of the involved students, as well as the impact the educational program has on these habits. The questionnaires were completed during the students' advisory class period.

### Cholesterol profile and glucose levels

All students were invited to participate in the laboratory testing aspect of the study. A subset consented to glucose and cholesterol testing. Finger prick blood samples were taken, and 30-50 microliters of blood analyzed using a Cholestech LDX (Hayward, California, USA) machine to measuring random glucose, total cholesterol, HDL, and LDL cholesterol. Laboratory test results were sent to the student's parents, with a letter of explanation. Abnormal values prompted a call from the researchers to the parents, and referral made for repeat testing and further follow-up with the students' paediatricians.

## DATA ANALYSIS

All data were entered into a Microsoft® Access (Microsoft Corporation, Redmond, Washington) database at the Michigan Cardiovascular Research and Reporting Program (MCORRP). Only records with baseline and follow-up data and appropriate consent were included in this analysis. As all variables were normally distributed, paired t-tests were used to compare measures obtained prior to and at the conclusion of the study.

## RESULTS

Of 250 sixth-graders in the school, 88 (35%) consented to study participation. Fifty-six percent of subjects were male, and the mean age was 11.7 years (SD=1.9) Thirty-one (30%) were Asian, 29(28%) were White, 19 (19%) recorded other, 13(13%) were not reported, 6 (6%) were Black, 3 (3%) were Hispanic, 1(1%) was American Indian, and 13(13%) did not indicate a racial/ethnic status. The high percentage of Asian students reflects the demographics of the neighbourhoods surrounding the particular middle school.

The baseline data demonstrated a high prevalence of cardiovascular risk factors in the study population. At baseline 33% of study participants reported, via the SPAN questionnaire, eating less than three servings of fruits and vegetables per day, 37% drank one or more non-diet soft drinks per day, 31% watched 2 or more hours of television per day, and 39% performed aerobic exercise less than 5 days per week. Mean (standard deviation) baseline measures for the group included body mass index of 19.8 kg/m2 (3.9), systolic blood pressure of 110 mmHg (11), diastolic blood pressure of 65 mmHg (9) and total cholesterol of 169 mg/dL (28). An elevated level of body mass index, total cholesterol, or blood pressure was identified in 27 % of boys and girls.

Follow-up data was available for 83 students (Table 1). Mean total cholesterol values showed significant improvement, decreasing from 169 mg/dL(28) to 151 mg/dL(24), (p<0.0001). Mean LDL cholesterol decreased from 90 mg/dL(23) to 74 mg/dL (21), (p< 0.0001). HDL cholesterol decreased from 52.9 mg/dL (15) to 50 mg/dL (13), (p=.03). Analysis of HDL data by sex showed that the boys decreased by 5.6 mg/dL (SD 9.7), P= 0.0016. For girls, there was a non-significant increase of 0.6 mg/dL. Random glucose decreased from 103mg/dL (30) to 97.4 mg/dL (41) (p=.0099).

| | Pre-intervention (n=83) | Post Intervention (n=83) | p-value |
|---|---|---|---|
| Age | 11.7 +/- .33 | | |
| % Male | 56 | | |
| Body Mass Index | 19.7 | 19.9 | 0.02 |
| Systolic Blood Pressure(mmHg) | 111(12) | 109(11) | 0.2 |
| Diastolic Blood Pressure(mmHg) | 65(9) | 64(8) | 0.2 |
| Total Cholesterol(mg/dL) | 169(28) | 151(24) | <0.0001 |
| HDL Cholesterol(mg/dL) | 52.9(15) | 50 (13) | 0.03 |
| LDL Cholesterol(mg/dL) | 90(23) | 74(21) | <0.0001 |
| Random glucose(mg/dL) | 103(30) | 97.4(41) | 0.0099 |

Table 1

The outlying glucose values of one female student with poorly controlled Type I diabetes were excluded from analysis. Body mass index increased from 19.7 kg/m$^2$(3.9) to 19.9 kg/m$^2$(3.8) (p=.02) consistent with expected growth. Systolic and diastolic blood pressures were unchanged, with systolic blood pressure 111mmHg (12) prior to the program and 109 mmHg (11) post-program (p=0.2), and diastolic blood pressure of 65mm Hg (9) and 64 mmHg (8) (p=0.2).

## DISCUSSION

This study was performed as a pilot study to demonstrate the feasibility of the Ann Arbor Project Healthy Schools intervention, and measure effectiveness of reduction of risk factors for atherosclerosis. This study demonstrates that Project Healthy Schools is feasible. The educational program and screening sessions were incorporated into the school day without significant disruption in school activities. The program was well received by students, teachers, school administration, and parents. The preliminary success of the Project Healthy Schools program in decreasing blood glucose and cholesterol values are encouraging, particularly given the high prevalence of cardiovascular risk factors in the study population.

This pilot project did result in one significant modification. The SPAN questionnaire used to measure lifestyle habits was completed at baseline, but at follow-up, the format was found to be too long. Students left some questions unanswered and the effective completion rate was quite diminished. Thus follow-up data for this part of the study was not used.

Several important lessons were learned during this pilot study.
First, the principal of the school was a strong advocate for the program at all stages of the project. This facilitated implementation, teacher involvement, and 40% student/parent consent to the research phase of the study. Second, making changes in the environment was a challenge. Only through interactive back and forth efforts were we able to begin to change food and beverage choices in the school.
Third, teacher involvement was mixed. All teachers were interested in screening, but a minority actually wanted to learn and teach the activities. Most preferred to have project staff perform this function. Fourth, the original standardized questionnaire documenting food, beverage, and physical activity of each child was too long. It required several advisory periods to complete and was simply impractical given current pressures on middle school curricula. For subsequent years, the questionnaire has been abbreviated.

Fifth, the Ann Arbor School District was extremely supportive. Initial participation was voted on and unanimously approved. In the spring of 2005, the school board heard a first hand presentation of the program to date, including student testimonials. It then approved the program for a second year.

Finally, total cholesterol, LDL cholesterol, and random blood glucose were found to decrease in association with the Project Healthy Schools program.

Obesity is an increasing problem in our society. Addressing obesity and other cardiovascular risk factors at a young age is extremely important. A school-based educational program has obvious advantages in terms of an ability to address many children at the same time with a uniform and reproducible program. School-based programs have been initiated and reported previously, although none have shown benefit in reducing cholesterol values. The CATCH trial, was a large, randomized controlled trial of a school-based intervention involving over 4,000 elementary school children from 96 schools (16). The trial did not demonstrate significant improvement in the outcome measures of blood pressure, obesity, or lipid profiles. The CATCH trial differed from Project Healthy Schools primarily in the age of students involved; the CATCH trial began with students in the third grade, while Project Healthy Schools began with students in the sixth grade. It may be that school-based programs for 6th grade students are more effective in promoting change as students are making more independent decisions. The Planet Health Study, a randomized, controlled trial in Massachusetts involving 1295 6th and 7th grade students, appeared to decrease obesity in females but not in males (10). While the Planet Health trial involved a similar population to Project Healthy Schools, laboratory measures were not included in that study.

While total and LDL cholesterol decreased in this program, so did HDL cholesterol. The statistically significant decrease in HDL may possibly be explained by expected trends in HDL values in adolescents (21).

Over the last several years, studies have demonstrated improvement in cardiovascular risk factors in children by focusing on specific lifestyle interventions. In 1999, Robinson showed decreases in body mass index in children undergoing a classroom based intervention program to decrease television and video game use (15). James et al demonstrated a reduction in the number of overweight children by minimizing the intake of sugar containing beverages (11). There is general recognition that the problems of obesity and increased risk factors for atherosclerosis are complex, and are a result of both poor nutrition choices and physical inactivity. Therefore, further multifaceted interventions emphasizing these points offer potential for success.

There are several limitations of this study. Each student served as his/her own control. However, the follow-up measures in the Spring may have been subject to bias as students may be more active at this time of year. The sample size is small. Of 250 sixth graders, in the school, 88(35%) consented to participation in study. This leads to the possibility that the more interested students, therefore those who were more likely to comply with the programs goals, may have been more likely to participate in the study. Finally, the follow-up thus far is relatively short .We anticipate longer term follow up over time. This study, however, serves to lay the foundation for future larger studies involving multiple schools with follow up over several years.

The next steps of Project Healthy Schools are multiple. The number of schools is being expanded. The survey instrument is being evaluated and shortened. The ability to measure student food and beverage choices is being developed. There is interest in studying whether the benefit in student health is mostly through the educational/behavioural aspect of the program or the environmental change aspects. Finally, the oversight team is beginning to explore how such a successful program might be sustained locally, and expanded and tested in different communities.

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