

Removal of Vending Machines from Schools and Adolescents' BMI: Qualitative and Quantitative Input from Key School Staff

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Abstract

Objective: The objective of this study was to examine body mass index (BMI) changes in adolescents after the removal of vending machines from their respective high schools.

Method: Participants included 1800 high school students from Harrisburg School District, located in a small urban city in Southeastern Pennsylvania. Students' BMI was measured from 2004 through 2007 and the vending machines were removed in the 2006 and 2007 school year. Analysis of variance (ANOVA) was used to examine the mean differences in students' BMI as well as SAS version 9.1 was used for the statistical analysis. Semi-structured interviews were conducted with a food service director and nurse. Both interviews were tape recorded and transcribed afterwards.

Results: Overall, there were no statistical significance found, however, there appeared a general trend towards smaller increases in BMI from 2005-2006 to 2006-2007 school year compared to 2004-2005 and 2005-2006 school years. The BMI mean changed from 0.71 to 0.75. There was an insignificant decrease in 2005-2006 to 2006-2007 school year when the vending machines were removed. Children who had their data for all three years (n=205), BMI increases were smaller over time. Qualitative parts of the result indicated as the schools food service director and a nurse indicated, for the healthier environment in schools, any school having vending machines that are high in sugar content should be removed and follow the wellness policy that came out in the 2007 school year.

Conclusion: The outcomes were not as significant due to removal of vending machines but it appeared that the rate of change in BMI over time will decrease across high school students. There are also other factors, such as poverty, that have a large influence on obesity. As a result, future studies should measure students' actual vending machine use, and interview more school staff on adolescents' food intake.

Introduction

Obesity has become an epidemic in the United States, and has been given more attention due to the increasing prevalence in adults and children (Ogden, Carroll, Curtin, McDowell, Tabak, & Flegal, 2007). Numerous questions arise for future generations and their health status, and, most especially for children. The obesity epidemic among children and adolescents is related to a variety of factors including one of the many, the issue of vending machines that which is one of many factors that contributed to adolescent obesity (Gemmill, & Nancy, 2005). Multifaceted preventions and interventions are extremely important in halting the adulthood obesity epidemic and the chronic diseases that are related to it. This study will look at the

relationship between vending machines and adolescents body mass index (BMI). BMI is calculated as weight in kilograms divided by the square of height in meters (Ogden, Carroll, Curtin, McDowell, Tabak, & Flegal, 2006). The high school students' BMI will be examined before and after the vending machines were removed from the Harrisburg School District located in Southeastern Pennsylvania. The following questions will be addressed: (1) does access or lack of access to vending machines during a school day equate to a lower BMI among high school students? Is the school food environment associated with the prevalence of obesity in high school students?

According to Center for Disease Control and Prevention (CDC); children who are underweight have BMI scores in the 5th percentile; healthy weight is from the 5th to 85th percentile, at risk for overweight is a BMI equal or greater than the 85th percentile, and over weight is equal to or greater than 95th percentile. For this study, I define overweight as a BMI greater than or equal to 85th percentile, and obese as BMI greater than or equal to 95th percentile. The CDC states that when the consumption of calories outnumbers the expenditure there are consequences of gaining weight. CDC collected data from two NHANES surveys in 1976-1980 and 2003-2004 which indicated that the prevalence of obesity in children from 2-5 years increased from 5.0% to 13.9%, children ages 6-11 years was from 6.5% to 18.8%, and for adolescents age 12-19 years, it increased from 5.0%- 17.4% (CDC, 2007). Overall, the trend is increasing across every age group. In addition, 10% of the world's school-age children either have excess body fat or are obese. These children falling into the category of 85-95th percentiles will have a major impact of being overweight or obese when they become adults. This might lead to increases in health care costs as well (Crossman, Sullivan, Benin, 2006).

Several studies have outlined some factors that contribute to the development of obesity. Obesity is not only school but home environment includes watching the television without any physical activities, playing video games, and overeating. Sedentary lifestyles are involved in gaining weight (Hager, 2005). There would be a reduction in obesity level if there was no television viewing and children participating in physical activities at school or at home (Hager, 2006). In addition, the environmental factors including the school, school cafeteria, vending machines, and fast food restaurants that children have an experience with during the school year could play a major role in the development of obesity (Baranowski, et. al., 2000).

The school environment also has a major impact on adolescent's obesity (Malone, 2005). Since, children spend most of their time at school that makes the school the ideal place for implementing such programs preventing obesity. Improvement of students' dietary intake requires extensive support from the school community that involves administrators, nurses, and principals. According to Dietary Guidelines for Americans 2005, children should consume at least five servings of fruit and two glasses of milk everyday. In CDC studies, regarding food intake, quite alarming results were obtained (CDC, 2007). The CDC survey respondents indicated that in grade 9-12, 78% had consumed less than five servings of fruit and 83% had consumed less than three glasses of milk per day. The intake of fruits, juices and vegetables is below the recommended five servings a day in the United States. This may affect the children's dietary behaviors into adulthood while developing obesity, heart diseases, osteoporosis, dental caries, and other chronic diseases (Weber, 2000 & Dinanne). This indicates that children have difficulty meeting the Dietary Guideline Recommendations.

One way children get non-nutritious food is from the vending machines in schools. The vending machines at their schools provide unhealthy food choices that encourage students to make poor food selections instead of healthier ones. This could only be changed through strong support from the school community (Gemmill, & Cotugna, 2005). The school policies on healthy and nutritious food environments are important in enhancing healthy food environments. For example, regarding the policies, a study conducted by Neumark-Sztainer et al. (2005) examined how school lunch and vending machines impact usage and the school food policies. Policies refer to open and closed campus during the lunch hours. For example, the hours of vending machines are turned off and on for open policy and students' permission to go off campus and purchase food.

Neumark-Sztainer (2005) discovered that in schools having the open campus policy, the purchase of fast food was significantly greater by students compared to than students at schools with the closed campus policy. Regarding the vending machines, the usage depended on the location and the types of food that it served. The schools with closed policies had improved their result of purchasing healthier than schools without the policy (Neumark-Sztainer, French, Hannan, Story, & Fulkerson, 2005).

A study conducted by Wiecha et al. (2006) concluded that students who use school vending machines purchased more sugar-sweetened beverages than any nutritious beverages. The greater the amount of vending machines in the school the greater amount of sugar sweetened purchase is observed. The school policies on implementing the removal of sugar-sweetened beverages programs can help the unhealthy environment (Neumark-Sztainer et al, 2005). Vending machines are ways that schools get additional revenue and about 80% of high school students have access to vending machines (Nollen et. al, 2007). The school food policy and location of food, whether it is on campus or fast food restaurants makes a huge difference in students' food choices (Neumark-Sztainer et. al, 2005). Soft drinks from the vending machines which include diet sodas, iced teas, fruit drinks, and sport drinks are linked to excess energy intake and weight gain (French, et. al, 2003). These have no nutritional values and are considered as empty calories. The school administration should examine this epidemic and remove the vending machines that adolescents have easy access to and should consider more health benefits. (French et. al. 2003).

A study conducted by the Centers for Disease Control and Prevention (CDC) on the School Health Policies and Programs Study indicated that 43.0%, 73.9%, and 98.2%, elementary, middle, and high schools, respectively, had access to vending machines, school stores, canteens, or snack bars where unhealthy food was distributed. Moreover, children obtain more calories from drinking sodas, and other non-nutritious foods provided by the vending machines than any other places (CDC, 2007). According to Gemmill and Cotugna (2005), vending machines provide significant revenue for schools. These aid schools for the extracurricular activities which makes it difficult for the removal of vending machines according to administrators. Due to that conflict, school administrators should consult with the contracting company for the replacement of unhealthy foods with more nutritious foods to create a healthier environment in schools (Gemmill, & Cotugna, 2005).

Nollen et. al. (2005) interviewed school personnel to gain insight on the school food environment and its impact on adolescent obesity. The school policies are related to regulation of the legislation. Interviews included school principals, and dietitian/food service managers. Principals did not agree with the concept that schools are the problem source of adolescents' obesity. In the interview process, it was revealed that there are other factors including

community and home environment that play a role in the development of obesity. Food services responded that they try preparing the students for the “real world” healthy and unhealthy food choices. The other staff members of schools including nurses play a crucial role on planning the policies based on the food that children should and should not consume. Nurses have the power to spread the words to students on a healthy food environment, and nurses can inform the students on healthy food choices (Malone, 2005).

Even though researchers are trying to reverse the obesity epidemic, there are still vending machines available in 98% of the United States high school area (Hendel-Paterson, French, & Story, 2004). Parents’ high awareness of soft drinks, numbers of location of machines, the hours of operation, and variety of beverages that are included in vending machines could provide them with a better understanding of how it is operated (Hendel-Paterson, French, & Story, 2004). The schools have the power of preventing the unhealthy food choices that are made by children. A literature review study by Story, Kahingst, and French indicated that interventions had an effect on the school food environment. For example, instead of removing the vending machines they recommended replacing the unhealthy food with low-fat foods and including more fruits and vegetables which could change the school food environment. Also, providing low-calorie foods in vending machines could help the school revenues without losing money (Story, Kaphingst, & French).

This study will examine some factors that could play a role in the development of adolescents’ obesity. Specifically, this study examined the effects of removing the vending machines from high schools on students’ increase in BMI. The Harrisburg School District in Southeastern Pennsylvania removed the vending machines in the 2006-2007 school year and collected students’ body mass index (BMI) data over the same time period. I hypothesized that there would be a smaller increase in BMI between the 2005-2006 and 2006-2007 school years, compared to earlier years. BMI increase as children age, as a result we expect to see BMI increasing over time. A smaller increase in BMI over time would show that removal of the vending machines may have an effect on students’ BMI.

Method

Participants and schools

Students of Harrisburg School District High Schools were selected to be the subjects of the research study. The BMI of 1800 high school students was measured over three school years, 2004-2005, 2005-2006, and 2006-2007. The three high schools included; John Marshal, Science and Technology, & William Penn were selected for this research. The demographics within the school districts were about 75% Black, 16% Hispanic, 6.1% White, and 4.6% others. Within the district, there were 53.7% economically disadvantaged families. The mean age during 2004-2005, 2005-2006, and 2006-2007 school years were 13, 14, and 15, respectively.

Procedure and Data analysis

This study used mixed-method design that includes qualitative and quantitative measures. **Qualitative:** Qualitative measures consisted of school food environment and interview process. Semi-structured interviews were conducted with key school staff that includes the food service director and a nurse. The food service director supervises the entire school district food service who was asked open-ended questions during a 45-minute face-to-face interview in John Marshal cafeteria. The director was interviewed regarding removed school vending machines with the

replacement of what he called “healthy” beverages and the food environment. A 45-minute phone interview with a nurse was conducted about student health status and school policy regarding students’ dietary intake. Both interviews were audio recorded with the permission of interviewees for accuracy of results and were transcribed for validity. Table 1, 2 and 3 describes questionnaires asked to a school director and nurse. The developed questionnaires for the interview were proofread by the faculty advisors in the research area and permission was granted to ask the relevant questions. The school wellness policy was reviewed as part of the qualitative content. The school food policies and practices were not disturbed but the necessary results were drawn from the observations throughout the school and cafeteria.

Quantitative: Quantitative design includes BMI collected for three academic school years. BMI data was calculated from heights and weights collected during each school year. BMI was calculated using the formula weight in kilograms divided by the square of height in meters. For this study, obesity was defined as BMI being greater than 90th percentile. The data were already collected and I was given the permission to implement the study. The BMI data were entered using Microsoft Excel spreadsheet formula and SAS version 8 was used to run the overall analysis. Analysis of variance (ANOVA) tests were used to compare the mean difference in BMI across students’ before and after removal of the vending machines. All these analyses were conducted by my faculty advisor.

Table 1: Interview Questions for Food Service Director and insight on the Vending Machine

Food Service Director

1.	How many vending machines were in the school districts?
2.	What was the reason behind removing the vending machines? Was it because of the benefit of children’s health or you were not getting enough revenues from it?
3.	Were there any vending machines that included nutritious food for example, 100% fruit/juice, water, nutri bar and etc.
4.	Was the food available every time during the school day or was it stopped at certain time of the day?
5.	Do children buy more food from cafeteria due to the removal of vending machines?
6.	Would you bring back vending machines if they are replaced with nutritious food?
7.	What was the reaction of children due to the removal of vending machines?

Table 2: School Policy Interview Questions for the Director

1.	Who sets up the food policy in schools? OR was there any school policy on using vending machines in the school?
2.	Did you consider replacing the unhealthy food in the vending machines with more nutritious foods? Would the revenues be different?
3.	In your opinion, what are some arguments for having or removing vending machines in schools?
4.	How did students feel when the vending machines were removed?

5.	Since the vending machines have been removed, should the school health policies and programs be stricter than what they used to be? (What was the policy on using vending machines?)
6.	Do rules about leaving campus vary across the three high school buildings?
7.	Would you consider your school to have the healthy food environment?

Table 3: Interview Questions for the Nurse

1.	What type of differences have you observed in overweight students compared to students of ideal body weight?
2.	On average, how many weight related health problems do you deal with each month?
3.	Is the body mass index (BMI) report card used here? <ul style="list-style-type: none"> • If yes, what information does the report card contain? Is there any advice for parents, or does it only list the child's weight status? • If yes, what is the typical reaction of parents whose children have been diagnosed with obesity?
4.	Have any steps been taken to help prevent or reduce obesity in students?
5.	From your experience, what are some of the key factors that play into high BMI among students here?
6.	How is children's parents' education level?
7.	Are any of children's parents overweight or obese?

Results

Obesity

Obesity seems to be a problem in schools according to BMI measurements and the percentile rates. The food environment in the cafeteria does have an impact on the development of obesity.

Table 4: Prevalence of Obesity Overall:

2004-2005 (n=776)	2005-2006 (n=1055)	2006-2007 (n=1220)
26.9%	25.5%	27.5%

Table 4 shows the overall prevalence of obesity across the three school years. We found no statistical significant in the result, however, there appeared a general trend towards smaller increases in BMI from 2005-2006 to 2006-2007 school year compared to 2004-2005 and 2005-2006 school years. The BMI mean changed from 0.71 to 0.75. There was an insignificant decrease in 2005-2006 to 2006-2007 school when the vending machines were removed. Children who had their data for all three years (n=205), BMI increases were smaller over time.

The prevalence of obesity by high school is listed in Table 5. There were no significant differences in BMI increases between school years 2004-2005, 2005-2006, and 2006-2007.

Compared to the other two schools, Science and Technology had the highest BMI percentiles. John Marshal high school had the lowest BMI percentiles but it was moderately lower.

Compared to the national prevalence of obesity in 12 to 19-years-olds from 1999-2004 (16%), high school students from Harrisburg Districts School had a higher prevalence rate of obesity.

Table 5: Prevalence of Obesity by School:

<u>2004-2005</u>			<u>2005-2006</u>			<u>2006-2007</u>		
<u>JH</u>	<u>WP</u>	<u>ST</u>	<u>JH</u>	<u>WP</u>	<u>ST</u>	<u>JH</u>	<u>WP</u>	<u>ST</u>
<u>26.4%</u>	<u>26.1%</u>	<u>29.6%</u>	<u>24.0%</u>	<u>28.6%</u>	<u>26.7%</u>	<u>25.0%</u>	<u>28.6%</u>	<u>33.2%</u>

Wellness policy

The Pennsylvania Department of Education’s Division of Food and Nutrition required that Harrisburg School District have a wellness policy to maintain a healthy food environment. The food offered in the cafeteria should contain certain percentages of fat, carbohydrates, and protein as well as a la carte items should be cut down. The wellness policy came out in 2007 and according to the policy’s regulations schools are required to implement programs that will build a healthy school food environment. The school nurse and food director indicated that they knew about the wellness policy to be effective in 2007. Hence, they removed vending machines before hand.

The overview of the policy emphasized more on students’ intake of proper nutrition, and healthy life-style that enhance and improve students’ achievement in school. The policy requires nutrition education, physical activity, physical education, and other school based activities to be included. This policy is developed to bring a positive, clean, and safe food environment in school. Some basic nutrition guidelines will provide less than 200 calories per serving in vending machines. There will be at least one fresh fruit served, and greater than two grams of fiber to be served. There will not be deep fried and minimal nutritional value food served in schools (Student Wellness, 2006).

School food environment

Two high school food cafeterias including John Marshal and Science and Technology were observed during the summer months and William Penn School was observed from outside of the school; I observed whether the restaurants were available close to school or not. Two schools that were observed from inside the cafeteria had different settings for food serving. For example, at John Marshal high school, there were four vending machines including bottled water bottle, vitamin beverages, fruit juices, and other beverages on what they called “healthy” drinks. There were no vending machines consisting of chips, candies, and others snack foods. At the Science and Technology high school, the school was not in session at the time of observation. Due to the conflict only the food set-up was observed and vending machines were not seen. Since the cafeteria was observed during the summer time, fruits and healthy beverages were served in cafeteria menus as well as unhealthy food was being served including french fries, and

burgers. The cafeteria lunch menu might be a little different during the regular Fall and Spring semester as compared to summer.

Insights of school nurse and food service director on food environment were examined to find similarities in themes. Both mentioned the wellness policy, and how nurses are trying to implement the programs after school or during the school year to bring the healthy environment to school. The food service director mentioned the grant that is given to school from Department of Agriculture to offer fresh fruits and vegetables. The purpose of this grant is to engage students to eat fruits and vegetables and encourage their parents to purchase healthier food. The interview with the food service director satisfied the content and face validity. Table 6 shows the relevant responses obtained from the interview.

Table 6: Responses obtained from Food Service Director, their policy, and Nurse

This table describes the similarities in themes for food service director and the nurse.

Themes	Food Service Director	Policy	Nurse
1.	Vending machines were replaced with Fruitopia beverages	The food service director with school wellness committee which is comprised of superintendents, wellness coordinator, and some teachers and staff members	Students who are obese are usually sick, have asthma, don't want to go to phys. Ed., feel uncomfortable about their body image
2.	Due to regulations, they removed sugar content	Removal of vending machines made the revenues went down a little bit	Mostly, the diseases are asthma, diabetic, and gastric reflux
3.	Now they have fruit juice but not other snacks	Schools had to go to a healthier environment	Parents get the BMI report cards explaining BMI, height, weight
4.	Vending machines are open from breakfast until lunch time and off after lunch time	Before they removed the vending machines, students were explained as he said "we not trying to take things away but this is considered healthy"	There are programs offered at school that nurses can utilize, PENA (Pennsylvania Evocates for Nutrition & Activities)
5.	There was no change in purchasing food from cafeteria	Vending machines should be removed, "if someone is selling soft drinks in cafeteria, they should be removed".	The accessibility of corner stores, picky about food, & poverty level had an impact on the development of obesity
6.	There is a possibility to replace with pre-plate salads but offered in cafeteria	Students are not supposed to leave the campus	Parents education level indicates that some finished high school, some can't read, & some with college level degree
7.	Students realized about healthy environment and vending machines were removed gradually	Schools have healthier environment as the food service director indicated	Nurses could not determine, if parents are obese than their children are more likely to be obese and home environment count as well

Discussion

The finding from this study show that there were no significant differences in BMI changes as a result of unhealthy foods and beverages from the high school vending machines. However, there was a smaller but insignificant increase in BMI between the 2005-2006 and 2006-2007 school years which may be a result of the vending machines being removed. This is disappointing because we can not say that removing unhealthy vending machine options or adopting the school wellness policy has made a big impact. The wellness policy may not have an effect yet due to the limited amount of time that the policy was in effect; it would take more time for the implementation. Although, the effective policy rules may make a difference in the future by adding healthy beverages in vending machines in school as well as having a healthy food environment. The small increase in BMI percentile may have to do with the school food environment and that might have replicated the finding by Nollen, et. al., 2007 that had the result of increased BMI in children due to the food environment in school.

Themes provided by the nurse had their relevance. It was surprising that the nurse mentioned accessibility of corner stores that are located within a 1 to 2 block radius of the school and students being picky about the food that is served in schools. There may be other factors that influence obesity level in students, including the poverty level in the school district. The food service director mentioned that 6-7% of students are allotted reduced lunch and 72 % are offered free lunches due to low income population. The schools ought to change the unhealthy environment with the support from nurses and food service directors. They have the power to implement the programs.

After the interview when the permission was given by the food service director, pictures of vending machines were taken. Within the cafeteria, there were about four to five vending machines containing healthy and unhealthy beverages. Although he mentioned in his interview that they removed the high sugar content beverages, thorough critical examination of vending machines found that they still have some unhealthy beverages. They still have sugar content beverages included in their vending machines. They still have sugar-sweetened beverages in their vending machines, even though they refer to them as “healthy” beverages.

The food service director mentioned the financial status referred to the question on revenue. He indicated that the revenue from removing vending machines declined a little bit after the Fruittopia drink removal. The revenue really did not matter because student’s health was more important than the financial status. Since that change, now they offer 100% juice, vitamin beverages, ice-tea and iced-tea. A critical observation through vending machines showed that all the healthy and unhealthy beverages were seen throughout vending machines. Part of the healthier environment in school both the food service director and the nurse mentioned one fact that all school should remove their vending machines if they contain soft drink beverages.

The study limitations include timing, seasonal settings, and the measurement of vending machine usage. Timing because vending machines were just removed in 2006-2007 and BMI data was collected the same year. It might have given more accurate findings if the BMI was measured after several years. The other is seasonal setting, because during the school year period students are in the same environment. However, during the summer time they reside in their respective neighborhoods where their BMI may differ because of various influences. There should be more interviews with school staff and directors to gain opinions on school food environment. Also, the study did not measure students’ vending machine purchases. These limitations should be addressed in future studies.

Conclusions and implications

The outcomes were not as significant due to removal of vending machines but it appeared that the rate of change in BMI over time will decrease across high school students. There are foods available to students during the school year, especially during lunch and outside of school may make a huge difference. The other factors, like poverty have a large influence on obesity. As a result, future studies should measure students' actual vending machine use, and examine other factors that may have influence on adolescents' obesity. For example, studies should examine adolescents' physical activities at school, food intake while they are in school and outside of school, and parental supervision.

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References

- Atlantis, E., Barnes, EH, & Sigh, F. 2006. Efficacy of exercise for treating overweight in children and adolescents: a systematic review. *International Journal of Obesity*. 30, 1027-1040.
- Cullen, K. W., Eagan, J., Baranowski, T., Owens, E., & Moor, C. 2000. Effect of a la carte and snack bar foods at school on children's lunchtime intake of fruits and vegetables. *Journal of the American Dietetic Association*. 100:12, 1482-1486.
- Center for disease control and prevention. 2007. <http://www.cdc.gov/HealthyLiving/>
- Datar, A., & Sturm, R. 2006. Childhood overweight and elementary school outcomes. *International Journal of Obesity*. 30, 1449-1460.
- French, S. A., Story, M., Fulkerson, J. A., & Gerlach, A. F. 2003. Food environment in secondary schools: a la carte, vending machines, and food policies and practices. *American Journal of Public Health*. 93:7, 1161-1167.
- Neumark-Sztainer, D., French, S. A., Hannan, P. J., Story, M., & Fulkerson, J. A. 2005. School lunch and snacking patterns among high school students: associations with school food environment and policies. *International Journal of Behavioral Nutrition and Physical Activity*. 2:14, 1-7.
- Gemmill, E., & Cotugna, N. 2005. Vending machine policies and practices in Delaware. *The Journal of School Nursing*. 21:2, 94-99.
- Hager, R. L. 2006. Television viewing and physical activity in children. *The Journal of Adolescent Health*. 39, 656-661.
- Hendel-Paterson, M., French, S. A., & Story, M. 2004. Parental attitudes towards soft drink vending machines in high schools. *The Journal of American Dietetic Association*. 104:10, 1597-1600.
- Johnson, M. L., Burke, B. S., & Mayer, J. 2007. The prevalence and incidence of obesity in a cross-section of elementary and secondary school children. *The American Journal of Clinical Nutrition*. 4:3, 231-238.
- Lissau, I, & Poulsen, J. 2005. Nutrition policy, food and drinks at school and after school care. *International Journal of Obesity*. 29, S58-S61.
- Livingstone, M, McCaffrey, T., & Rennie, KL. 2006. Childhood obesity prevention studies: lessons learned and to be learned. *The Journal of Health Nutrition*. 9: 8A, 1121-1129.

- Malone, S. K. 2005. Improving the quality of students' dietary intake in the school setting. *The Journal of School Nursing*. 21:2, 70-76.
- New, S. A., & Livingstone, B. E. 2003. An investigation of the association between vending machine confectionery purchase frequency by schoolchildren in the UK and other dietary and lifestyle factors. *The Journal of Public Health Nutrition*. 6:5, 497-504.
- Nollen, N. L. et.al. 2007. The school food environment and adolescent obesity: qualitative insights from high school principals and food service personnel. *International Journal of Behavioral Nutrition and Physical Activity*. 4:18, 1-12.
- Ogden, C. L., Carroll, M. D., Curtin, L. R., McDowell, M. A., Tabak, C. J. & Flegal, K. M. Prevalence of overweight and obesity in the United States, 1999-2004. *American Medical Association*. 295:13, 1549-1555.
- Probart, C., McDonnell, E., Bailey-Davis, L, Weirich, E. 2006. Existence and predictors of soft drink advertisements in Pennsylvania High Schools. *Journal of the American Dietetic Association*. 106:12, 2052-2056.
- Student Wellness. 2006. Food Service Department Harrisburg School District.
- Story, M., Kaphingst, K. M., & French, S. The role of schools in obesity prevention. 16:1, 109-142.
- Wiecha, et. al. 2006. School vending machine use and fast-food restaurant associated with sugar-sweetened beverage intake in youth. *Journal of American Diet Association*. 106. 1624-1630.