FOOD SALES IN SCHOOLS AND STUDENT HEALTH

An Undergraduate Research Scholars Thesis

by

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ABSTRACT

Food Sales in Schools and Student Health. (May 2015)

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Amidst a raging debate about rising obesity rates lies uncertainty about the impact of vending machines and school stores on student health outcomes. This paper seeks to bring clarity by understanding the relationship between competitive food sales in schools and student body mass index. Competitive food sales compete with food sold in the cafeteria and, for the time period sampled, included items not under government regulation for nutrition. The Health Behavior in School-Aged Children data sets from the United States for the 2001 - 2002, 2005 - 2006, and 2009 - 2010 school years including a total, nationally representative sample of 27,681 students are analyzed. Results demonstrate that student access to competitive food sales in school does not have a statistically significant relation to student health outcomes. Findings debunk the myth that food items for sale in schools that are not nutritionally regulated are to blame for the rising tide of childhood obesity. Results inform decision-making about the relative importance of altering competitive food sales in schools as a means to improve student health outcomes.

CHAPTER I

INTRODUCTION

The obesity crisis plaguing schoolchildren across the nation places schools at the center of a fierce battle for the health of our nation's children. The CDC reports "Childhood obesity has more than doubled in children and quadrupled in adolescents in the past 30 years" ("Childhood Obesity"). The role of schools in fighting this epidemic is paramount and yet great debate exists as to what interventions are most effective. Competitive food is "sold in competition with the National School Lunch Program (NSLP) and the School Breakfast Program . . . [and] are often sold in vending machines or snack bars and are not required to meet the nutrition guidelines for school meals established by the U.S. Department of Agriculture" (Hook 23). Competitive food sales in schools is an important part of the debate for student health, with restrictions ranging from limitation to complete elimination.

There is a consensus in the literature that a comprehensive, holistic approach is necessary to combat obesity – there is no silver bullet when it comes to improving health outcomes for school-aged children. While "Schools provide the most effective and efficient way to reach a large segment of the population, including young people, school staff, families and community members" one solitary intervention is not enough (Pérez-Rodrigo 131). The American Dietetic Association, School Nutrition Association, and Society for Nutrition Education jointly contend for the necessity of a comprehensive approach, citing the critical role of schools, necessity for instruction to be paired with healthy food options, and impact of student health on academic performance (Briggs 1738).

Health and education success are intertwined because "schools cannot achieve their primary mission of education if students are not healthy and fit" (Story 72). Therefore, seeking to improve dietary behavior and health outcomes for students serves to benefit the students themselves, their schools through better academic performance and, ultimately, society through positive externalities resulting from a better-educated society. It is clear that the health status of school-aged children has far-reaching implications.

In this paper, I examine the relationship between competitive food sales in schools and student health as measured by body mass index (BMI), calculated using one's height and weight to obtain an overall health measure which is categorized as either underweight, normal weight, overweight, or obese. It is important to understand this is a basic health measure and does not account for the percentage of one's body mass made up of muscle versus fat. Utilizing BMI as my outcome variable and the presence of competitive food sales in schools as my key variable of interest, I control for demographics including age, gender, and race. I further account for the dataset utilized because three separate sets were merged, frequency of students' physical activity and family level income. To make an argument for causality, it would need to be established that there is not a relationship between the presence of competitive food sales in schools, or lack thereof, and the preexisting health of the student population.

Utilizing data for the school years 2001-2002, 2005-2006, and 2009-2010, I expand the timeframe from a previous study that tracked the changing variety of foods available in schools and concluded, "Some minimal evidence was found for relationships between the school food

environment and student BMI-related outcomes and food consumption measures" (Terry-McElrath S45). This also expands upon Van Hook and Altman's examination of competitive food sales and childhood obesity through utilizing a broader data set and including high school students in the sample. Further, this paper expands the relevant literature through focusing on student BMI rather than eating habits. While competitive food sales are just one aspect of understanding the impact school-level food policies can have on student health outcomes, it is of crucial importance to understand its specific role. Data from a nationally representative sample of schools and students are used to understand differences in student health outcomes between schools with competitive food sales and others without.

There has been extensive research regarding the association between the types of food offered for sale in vending machines (one type of competitive food sales) and student eating habits. One such study found that "Snack vending machines were negatively correlated with fruit consumption" (Kubik 1168). Rovner concluded "In younger grades, availability of fruit and/or vegetables and chocolate and/or sweets was positively related to the corresponding food intake … Among the older grades, there was no significant effect of food available in vending machines on reported consumption of those food" (13). However, these studies leave the question up for debate regarding the specific relationship between student access to competitive food sales and student body mass index.

Previous research has noted the interesting relationship between vending machines and school finances. Specifically, "There has been an increase in penetration of so-called competitive foods that compete with federally funded school meal programs in public schools—school stores,

school vending machines, and à la carte options during mealtimes. As a result, many school districts and several states have examined these food options and reassessed the potential health costs on the one hand and financial benefits on the other" (Fletcher 1059). There are also "under-funded US districts making money by establishing 'pouring rights' contracts with soft drink companies, allowing them to place vending machines on school property" (Jaime 52). Therefore, the sale of competitive foods in schools has a unique place in the debate over student health as it has both financial and health implications.

This analysis carries significant policy implications because understanding the role of competitive food sales in comprehensive school health programs will inform program structure and implementation. Specifically, results carry the potential to dispel the myth that competitive food sales through vending machines and school stores is a main culprit in the childhood obesity epidemic. It is necessary to understand the relationship between competitive food sales in schools and student BMI in order to inform evidence-based policymaking.

One specific policy example, the Smart Snacks in School regulation is currently in its first year of implementation during this 2014-15 school year. This requires all food for sale in schools during the school day to meet nutrition requirements and applies to "foods sold a la carte, in the school store, and vending machines" ("Healthier"). In this paper I examine the relationship between competitive food sales in schools and student health prior to this regulation; thus, for the time period sampled all competitive food sales were not required to meet nutritional standards. For this reason, my research is timely in understanding the potential impact of this new regulation.

CHAPTER II

METHODS

Data

The World Health Organization (WHO) Regional Office for Europe sponsored the Health Behavior in School-Aged Children data series in the early 1980s. Collected every four years, the data series has grown to include "over 44 countries and regions across Europe and North America" ("About HBSC"). The 2001 – 2002, 2005 – 2006, and 2009 – 2010 Health Behavior in School-Aged Children (HBSC) data sets from the United States of America utilized in this study were obtained from the Inter-University Consortium for Political and Social Research (ICPSR). ICPSR cites that "The HBSC study has two main objectives. The first objective is to monitor health-risk behaviors and attitudes in youth over time to provide background data and to identify targets for health promotion initiatives. The second objective is to provide researchers with relevant information in order to understand and explain the development of health attitudes and behaviors through early adolescence" ("Health Behavior").

The HBSC data is divided into survey results from student and school administrator questionnaires. The student questionnaire covers topics such as student demographics, eating habits, health status, parental demographics, family dynamics, technology use, self-image, emotional health, and peer relations. The school administrator questionnaire includes questions surrounding the offering of different types of food for sale at school, vending machine access, health education topics taught in each grade, physical education requirements, health facilities, and staff training.

Model specification

I devised a model to understand the relationship between competitive food sales in schools and student health outcomes. The model utilized is laid out in equation (1).

$$BMI = \beta_1 * CompetitiveFoodSales + \beta_2 * Age + \beta_3 * Gender + \beta_4 * Age * Gender + \beta_5 * Race + \beta_6 * DataYear + \beta_7 * DaysActive + \beta_8 * Hungry + \varepsilon \quad (1)$$

BMI, the outcome variable, was used in three variations. BMI was first used as a continuous variable, then as a binary variable and recoded to equal 1 if students were obese (*BMI_Over*) and again as a binary variable recoded to equal 1 if students were obese or at risk of being obese (*BMI_AtRiskorOver*). Students were designated as obese if their body mass index was greater than the 95th percentile and were considered at risk if their body mass index was between the 85th and 95th percentiles. The key variable of interest *CompetitiveFoodSales* identifies if students can purchase food or beverages from vending machines at school or school stores, canteens, or snack bars. Note that the 2009 dataset does not include a specification for school stores, though it does include all other listed outlets for competitive food sales. *Age*, *Gender*, the interaction variable *Age*Gender* as well as the variable *Race* were included to control for a student's demographics, which carry the potential to impact their health status, as measured by BMI. *DataYear* controls for the three data sets that were merged together.

DaysActive refers to the number of days in the past week that students were active and thus controls for the amount of physical activity students are receiving and the subsequent impact on student health, as measured by BMI. The variable *Hungry* controls for how often students go to

school or bed hungry, with values including never, sometimes, often, and always. This is utilized to control for family income. Surprisingly, students who never go to school or bed hungry are least likely to be at risk of obesity or already be obese. This contradicts the expectation that students who are the least hungry would naturally be less healthy due to eating more food and thus validates the use as an income control.

Thus, the regression includes the key interest variable, if students have access to competitive food sales at school, and controls for student demographics, the dataset, student physical activity, and family income. This design is intended to control for influences on student health status, as measured by BMI. Standard errors were clustered at the school level in order to provide more accurate results because, in some cases, multiple students were surveyed from the same school. A standard OLS regressions was run for each variation of BMI.

Results utilizing this regression are intended to represent the relationship between competitive food sales in schools and student BMI. Keeping in mind the data comes from multiple years and does not track the same students, one cannot claim causality as this examination does not follow the specific introduction, or removal, of competitive food sales in schools. However, my approach does attempt to account for significant impacts on BMI through controlling for demographics, student physical activity, and family income. One explanatory issue for these results is that schools may have banned competitive food sales due to the unhealthiness of students. In this case, the absence of competitive food sales may mistakenly be associated with students having higher BMIs.

CHAPTER III

RESULTS

Summary statistics

Table 1 below describes the basic characteristics of the variables of interest.

Table 1: Variable Summary

Variable	Obs	Mean	Std. Dev.	Min	Max
BMI	27681	21.237	4.498	10.98	48.7
BMI_Over	27681	0.132	0.338	0	1
BMI_AtRiskorOver	27681	0.308	0.462	0	1
CompetitiveFoodSales	27681	0.859	0.348	0	1
Age	27681	13.455	1.616	10	17.3
Gender	27681	0.489	0.500	0	1
Race					
White	27681	0.498	0.500	0	1
Asian	27681	0.035	0.183	0	1
American Indian	27681	0.014	0.119	0	1
Native Hawaiian or Other Pacific Islander	27681	0.005	0.073	0	1
Two or More Races	27681	0.184	0.387	0	1
Hispanic	27681	0.100	0.300	0	1
DataYear					
2005	27681	0.241	0.428	0	1
2009	27681	0.348	0.476	0	1
DaysActive	27681	4.423	2.224	0	7
Hungry					
Sometimes	27681	0.199	0.399	0	1
Often	27681	0.033	0.178	0	1
Always	27681	0.013	0.114	0	1

These summary statistics provide an overview of the sampled population. With a BMI of 18.5 to 24.9 considered healthy, the mean value of 21.237 falls in the healthy range. The vast majority of schools do have competitive food sales, as evidenced by the mean value of 0.859. Students sampled ranged from ages 10 to 17 with the mean age of 13.5 exactly in the middle. The

observations are representative through an equal sampling of males and females. On average, students were physically active just over half of the days of the past week. Further, the majority of students (76%) never went to school or bed hungry, indicating the majority of students are not from a low-income background.

Regression results

Table 2: OLS Estimate of Relationship between Competitive Food Sales in Schools and Student BMI

	BMI			BMI_Over			BMI_AtRiskorOver		
	Coef.	Std. Err.	P-value	Coef.	Std. Err.	P-value	Coef.	Std. Err.	P-value
CompetitiveFoodSales	0.083	0.108	0.439	-0.001	0.007	0.918	0.008	0.011	0.441
Age	0.673	0.027	0	-0.007	0.002	0	-0.006	0.003	0.016
Gender	-0.050	0.479	0.916	0.018	0.034	0.608	0.090	0.049	0.069
Age*Gender	0.030	0.036	0.403	0.003	0.003	0.245	0.000	0.004	0.916
Race									
White	-1.414	0.087	0	-0.063	0.007	0	-0.120	0.009	0
Asian	-2.119	0.157	0	-0.096	0.011	0	-0.173	0.017	0
American Indian or Alaska Native	-0.189	0.374	0.614	-0.006	0.026	0.814	-0.044	0.029	0.132
Native Hawaiian or Other Pacific Island	-0.780	0.399	0.051	-0.027	0.031	0.387	-0.084	0.041	0.039
Two or more races	-0.588	0.106	0	-0.021	0.008	0.012	-0.037	0.010	0
Hispanic	-0.353	0.122	0.004	-0.015	0.010	0.125	-0.018	0.012	0.13
DataYear									
2005	0.145	0.091	0.11	0.024	0.006	0	0.035	0.009	0
2009	0.341	0.080	0	0.014	0.006	0.014	0.025	0.008	0.002
DaysActive	-0.168	0.013	0	-0.013	0.001	0	-0.017	0.001	0
Hungry									
Sometimes	0.318	0.071	0	0.022	0.006	0	0.029	0.007	0
Often	0.073	0.145	0.612	0.014	0.012	0.246	0.021	0.015	0.152
Always	0.315	0.266	0.236	0.026	0.019	0.18	0.053	0.025	0.032
Constant	13.377	0.401	0	0.282	0.025	0	0.473	0.039	0

The table above demonstrates the relationship between competitive food sales in schools and student BMI, subdivided into three columns by BMI specification. The first column

demonstrates the regression results using BMI as a continuous variable. The second column utilizes BMI as an indicator variable with the value 1 if student BMI is categorized as obese. The last column uses BMI as an indicator variable to denote if a student is obese or at risk of becoming obese.

Regardless of the BMI specification, the presence of competitive food sales in schools is neither economically nor statistically significant in explaining student health, as measured by BMI. Age is statistically significant in all three regressions but only carries economic significance when considering BMI as a continuous variable. Further, the age and gender interaction variable is not statistically nor economically significant. Regarding race, individuals who are white, Asian or categorized as two or more races are less likely to have a higher BMI, which is statistically significant across all BMI variations.

The control for the data year is statistically significant at a 5% significance level in all three regressions, which accounts for any changes between the data sets and sampled years not accounted for by the other control variables. As would be expected, students who are more physically active are less likely to have a higher BMI. For the income control variable *Hungry*, students who sometimes go to school or bed hungry are more likely to have a higher BMI, though not more likely to be at risk of obesity or be obese.

CHAPTER IV

CONCLUSION

In this paper I sought to understand the relationship between competitive food sales and student health, as measured by body mass index. Competitive food sales, for the time period sampled, is the sale of food within schools that is not held to governmental nutritional standards and can be sold through locations such as vending machines or school stores, canteens, or snack bars. With a fiery debate about the presence of vending machines, in particular, in schools, I found it of great interest to understand if competitive food sales in schools is to blame for the obesity epidemic.

Utilizing a nationally representative sample of students from the Health Behavior in School-Aged Children dataset, I ran regressions controlling for a variety of demographics and other variables presumed to impact student body mass index, including amount of physical activity and a control for family income.

I conclude that the presence of vending machines, school stores, canteens, or snack bars within schools is not statistically significant in explaining student health outcomes, as measured by BMI. As such, I do not anticipate a significant impact on student health resulting from new nutrition guidelines regulating competitive food sales in schools. As the myth has been dispelled that unregulated food for sale in schools is to blame for children's poor health, it is up to students, families, and policymakers alike to battle obesity.

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