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## Disparities persist in nutrition policies and practices in Minnesota secondary schools

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### Abstract

Access to healthy foods among secondary school students is patterned by individual-level socioeconomic status, but few studies have examined how school nutrition policies and practices are patterned by school-level characteristics. The objective of this study was to examine school nutrition policies and practices by school characteristics (location, racial/ethnic composition and free/reduced priced lunch eligibility [FRPL]) in Minnesota secondary schools between 2008 and 2012. Data from the 2008 to 2012 Minnesota School Health Profiles survey were used to assess

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Conflict of interest

The authors declare no conflict of interest.

school nutrition policies and practices, and National Center for Educational Statistics (NCES) data were used for school characteristics (n = 505 secondary schools). Nutrition policies and practices included: 1) the availability of low-nutrient, energy dense (LNE) items, 2) strategies to engage students in healthy eating, and 3) restrictions on advertisements of LNE products in areas around the school. Among school-level characteristics, school location was most strongly related to school nutrition policies. Across all years, city schools were less likely than town/rural schools to have vending machines/school stores [prevalence difference (PD)=13.7, 95% confidence interval (CI) -25.0,-2.3], and less likely to sell sports drinks (PD= -36.3, 95% CI: -51.8, -20.7). City schools were also more likely to prohibit advertisements for LNE products in school buildings (PD=17.7, 95% CI: 5.5, 29.9) and on school grounds (PD=15.6, 95% CI: 1.7, 29.5). Between 2008 and 2012 the prevalence of some healthy eating policies/practices (limiting salty snacks, offering taste testing, banning unhealthy food advertisements in school publications) declined in city schools only, where these policies/practices had previously been more common. Monitoring of these trends is needed to understand the impact of these policies on student outcomes across school settings.

## Keywords

Nutritional policies; secondary schools; health disparities; adolescent obesity; rural health

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## INTRODUCTION

Rates of obesity for all U.S. adolescents have been rising for more than three decades<sup>1</sup> and are disproportionately higher among some populations. Racial/ethnic minority youth are more likely to be overweight or obese compared to non-Hispanic white youth,<sup>1-5</sup> and youth from low-income households are more likely to be overweight or obese compared to those from higher income households.<sup>2-4,6</sup> Disparities in obesity extend to geography as well, with children in rural areas more likely to be obese or overweight than urban children.<sup>7,8</sup>

Obesity also clusters according to school characteristics. Secondary schools with high minority enrollment or low mean parental education have students with disproportionately higher body mass index (BMI), and schools located in non-metropolitan areas have a high proportion of students who are obese.<sup>9</sup> More research is needed to examine how youth obesity may be patterned by school characteristics,<sup>10</sup> beyond family, peer and neighborhood influences.<sup>11,12</sup>

School nutrition and physical activity policies may contribute to patterns in adolescent obesity rates.<sup>9,13</sup> Specific policy solutions for reducing obesity include regulating the food environment by restricting competitive food and fundraiser sales,<sup>14-16</sup> using price incentives and other strategies to engage students in healthy eating,<sup>13,17,18</sup> and eliminating advertisements for unhealthy products in schools.<sup>13,19</sup> School policies related to the availability of healthy food are a plausible mechanism by which disparities in obesity and related health behaviors might arise. However, little is known about how policies and

practices vary at the school level by geography, socioeconomic status, and racial and economic composition of students at the school.<sup>13</sup>

To fill this gap, this paper examined policies and practices that may improve the school food environment and promote healthy eating by school characteristics. Our aim was to explore differences in the prevalence of nutritional policies and practices in Minnesota secondary schools by racial/ethnic composition of the student body, free/reduced price lunch eligibility, and school location between 2008 and 2012.

## METHODS

The study was part of the School Obesity-related Policy Evaluation (ScOPE) study, which aims to evaluate nutrition and physical activity policies and practices in Minnesota secondary schools; it was approved by the Institutional Review Board at the University of Minnesota. Data on school nutrition policies and practices were obtained from the 2008 to 2012 Minnesota School Health Profiles principal survey<sup>20</sup> administered by the Minnesota Department of Education with funding and technical assistance from the Centers for Disease Control and Prevention. This survey is a random, biennial, self-administered assessment, mailed to school principals or designees. Between 2008 and 2012, the response rate for principals ranged from 70% to 84%.<sup>20</sup> For this study, three policy and practice questions were assessed: 1) the availability of low-nutrient, energy-dense (LNED) snacks, 2) implementation of strategies to promote healthy eating at school, and 3) banning advertisements for LNED foods.<sup>21</sup> Profiles questions were the same in all study years.

### Availability of LNED foods

Principals were asked: “Can students purchase any snack foods or beverages from one or more vending machines at the school or at a school store, canteen, or snack bar?” If yes, they were asked whether students could purchase each of the following items: a) soda pop or fruit drinks that are not 100% juice; b) sports drinks (e.g., Gatorade); c) chocolate candy or other kinds of candy; and d) salty snacks that are not low in fat. Response options were “Yes/No.”

### Strategies to engage students in healthy eating

Principals were asked: “During this school year, has your school done any of the following? a) Priced nutritious foods and beverages at a lower cost while increasing the price of less nutritious foods and beverages; b) Collected suggestions from students, families, and school staff on nutritious food preferences and strategies to promote healthy eating; c) Provided information to students or families on the nutrition and caloric content of foods available; d) Conducted taste tests to determine food preferences for nutritious items; and e) Provided opportunities for students to visit the cafeteria to learn about food safety, food preparation, or other nutrition-related topics.” Response options were “Yes/No.”

### Banning advertisements for LNED foods

Principals were asked: “Does your school prohibit advertisements for candy, fast food restaurants, or soft drinks in the following locations? a) In the school building; b) On school

grounds, including on the outside of the school building, on playing fields, or other areas of the campus; c) On school buses or other vehicles used to transport children; d) In school publications (e.g., newsletters, newspapers, web sites, or other school publications).” Response options were “Yes/No.”

National Center for Educational Statistics (NCES) Common Core Data <sup>22</sup> were used to characterize schools. High schools were defined as those with a low grade of 9 or higher and a high grade of 10 or higher. Junior/ senior high schools had a low grade of 8 or lower and a high grade of 10 or higher. Schools with no grade below 5<sup>th</sup> grade and no grade above 9<sup>th</sup> were classified as middle schools. Other school characteristics included the percent of minority (non-white and/or Hispanic) enrollment in three categories (<5%, 5-<50%, 50%), percent student free/reduced price lunch (FRPL) eligibility in three categories (<20%, 20-<60%, 60%), and school location in three categories (city, suburban, and town/rural). School location was determined using a combination of NCES and Rural-Urban Commuting Areas classification schemes.<sup>22,23</sup> School-level data for 2012 are based on the 2011 NCES data.

The association between school characteristics and nutrition policies and practices were estimated across years (2008, 2010, 2012) between school locations (with town/rural as the reference group), FRPL eligibility categories (with <20% FRPL as the reference group), and minority enrollment categories (with <5% minority enrollment as the reference group) using generalized estimating equation models with a robust unstructured correlation structure, binomial distribution and logit link, adjusted policy prevalence differences (PD) and 95% confidence intervals (CI). All models included school level (middle, junior/senior high, high school) to account for the Profiles stratified sampling scheme. A Taylor series expansion was used to obtain the standard error (and 95% CI) for adjusted prevalences and adjusted PD from the logistic regression models. All models included location, FRPL eligibility, and minority enrollment, also adjusted for school level and year. Interactions were tested between year and school location, FRPL eligibility, and minority enrollment and estimated adjusted PD (95% CI) stratified by year where significant interactions were found. This modeling strategy allowed us to identify trends over time and differences by school characteristics across years. Analyses were conducted in Stata Statistical Software (version 12.1, 2011, StataCorp).

## RESULTS AND DISCUSSION

### School characteristics

Table 1 presents school characteristics from 2008 to 2012 for schools included in the analysis. The analysis included 505 unique schools (some schools were part of the sample in more than one year). The sample was equally divided between high schools, junior/senior high schools, and middle schools. In all years, at least two-thirds were rural or small town schools. Few schools (less than 10%) had more than half minority enrollment and all of these schools were located in a city. FRPL eligibility was more variable; in most of the schools, 20-60% of students were eligible. Online Supplemental Materials present the unadjusted prevalence of each school policy or practice from 2008 to 2012 according to each school characteristic, including the availability of LNE items (Online Supplement A),

healthy eating strategies (Online Supplement B) and banned ads for LNE items (Online Supplement C).

### Average prevalence differences in policies by school characteristics

Differences in the adjusted prevalence of school policies and practices by school location and FRPL eligibility are presented in Table 2. Differences are averaged across all years (2008, 2010, and 2012) unless there was a statistically significant interaction between year and either school location or FRPL eligibility, in which case differences are presented in each year. Across all years, on average, city schools were less likely than town/rural schools to have vending machines or school stores (PD= -13.7, 95% CI: -25.0, -2.3), and less likely to sell sports drinks (PD= -36.3, 95% CI: -51.8, -20.7). City schools were also more likely to ban advertisements for LNE products in school buildings (PD=17.7, 95% CI: 5.5, 29.9) and on school grounds (PD=15.6, 95% CI: 1.7, 29.5).

Study findings suggest that there are a number of policies and practices in Minnesota city schools that support a healthier food environment for their students compared with schools in rural areas and towns. At least two other (cross-sectional) studies of secondary schools – one in Utah and one in a multistate sample of secondary schools – found that rural schools trailed behind city schools in a number of policies and practices to promote healthy eating.<sup>24,25</sup> Rural schools may be particularly understaffed, overwhelmed by academic achievement tests, or lack wellness coordinators to implement policy.<sup>14</sup> Although these challenges may not be unique to rural schools, they may contribute to the lack of prioritizing initiatives aimed at improving nutrition.

Across all years, suburban schools were more likely to sell soda than town/rural schools (PD=12.3, 95% CI: 0.6, 24.0). It could be that, in more affluent areas where fewer students participate in subsidized meal programs, competitive food sales provide revenue to cover operational costs of food services.<sup>26</sup> However, suburban schools had other policies, including being less likely to sell sports drinks (PD= -9.2, 95% CI: -17.3, -0.9) and more likely to ban advertisements of LNE products on school grounds (PD=16.1, 95% CI: 5.6, 26.7) compared with rural schools.

Unlike previous studies,<sup>24,25</sup> the current study found, on average, no policy differences by FRPL eligibility or minority enrollment. In our sample of schools, it was difficult to separate the influence of race/ethnicity, socioeconomic status, and location in shaping policy environments, given that few Minnesota town or rural schools have a high minority enrollment, and few schools with high FRPL eligibility have low minority enrollment. Our results suggested that policy differences were more strongly associated with school location or socioeconomic factors than the racial/ethnic makeup of the school. Future research in more diverse settings is needed to adequately assess the relationship between racial/ethnic school composition and school policies and practices.

### Overall trends over time

Overall trends over time indicated a number of changes from 2008 to 2012. The proportion of schools selling sports drinks declined from 2008 to 2012 ( $p = 0.04$ ), consistent with another study of Minnesota secondary schools based on the same data source that found a

decline in the sale of candy, salty snack, and sugary drinks among middle schools between 2002 and 2010.<sup>27</sup> This finding could reflect increased attention to the nutritional quality of food and beverages sold in vending machines and school stores, particularly in schools with younger students. Schools became less likely to ban advertisements for LNED items on school grounds ( $p = 0.01$ ), suggesting an increased use of advertising for revenue<sup>28,29</sup> that may be used to cover basic costs and programming when financial resources are limited.<sup>30</sup> This shift toward increased advertising should be examined in future research, and linked to changes in school budgets and student health outcomes.

### **Trends over time by school characteristics**

Trends over time in policies and practices with a statistically significant difference by school location or FRPL eligibility are presented in Figure 1. In 2008, city schools were less likely to sell salty snacks than rural schools, but this was no longer the case in 2012 (Figure 1a). City schools were also more likely to offer taste testing (Figure 1b) and ban advertisements in school publications (Figure 1c) than town/rural schools in 2008, but this was no longer the case in 2012. Additionally, by 2012, schools with high and moderate FRPL eligibility were less likely to offer pricing incentives for healthy food items than schools with low FRPL eligibility, whereas this was not the case in 2008 (Figure 1d).

Study findings suggest that maintaining policy environments consistent with healthy eating over time may be challenging for some schools. City schools may have initially played a leadership role in health promotion, compared with schools elsewhere, for political or other reasons.<sup>31</sup> However, it appears that such policies were not sustained in city schools in recent years, perhaps because policies related to sales or advertising can garner much-needed financing for school programs.<sup>29</sup> While the shifts observed in the current study represent a reduction in urban/rural disparities by some measures, they also indicate an overall worsening of conditions in city schools.

### **Strengths**

This study has several strengths. The study used a large sample of schools to examine the current state of policies in Minnesota. Unlike previous studies,<sup>24,25</sup> the current study captured multiple years and documented changes over time. The nutritional policies examined included those recommended for schools by the Institute of Medicine<sup>32</sup> and policies that promote Healthy People 2020 goals.<sup>33</sup> This study is also one of the first to examine differences in policy implementation across school-level characteristics including the racial/ethnic and socioeconomic composition of students, location, and grades enrolled.

### **Limitations**

This study also has limitations. Findings from Minnesota schools may not be generalizable to other states. Previous work by the authors examined obesity-related school policies and found that Minnesota falls roughly in the middle,<sup>34</sup> suggesting that these findings may be applicable to other areas. In addition, Minnesota has a mix of urban, suburban and rural areas similar to many other states.

Nutrition policies and practices at the school level were self-reported by school principals or designees, and it is possible that respondents were not aware of the current policy environment or did not accurately report answers. Although survey response rates were adequate, it is also possible that schools that did not participate were different from those that did participate. Only select nutritional policies that have been measured over time are reported, rather than reporting on all possible obesity-related indicators or policies.

## CONCLUSIONS

In Minnesota, schools located in cities generally provide a healthier food environment for their students compared with schools in rural areas and towns. Despite these initial advantages, some policies and practices in city schools are eroding over time, while town and rural school policies have largely remained unchanged. Meanwhile, across all schools, advertising of LNEED items appears to be increasing over time. These results indicate a need for further research to monitor future changes in these trends, and to understand the impact of these policies on diet, weight and academic outcomes across school settings.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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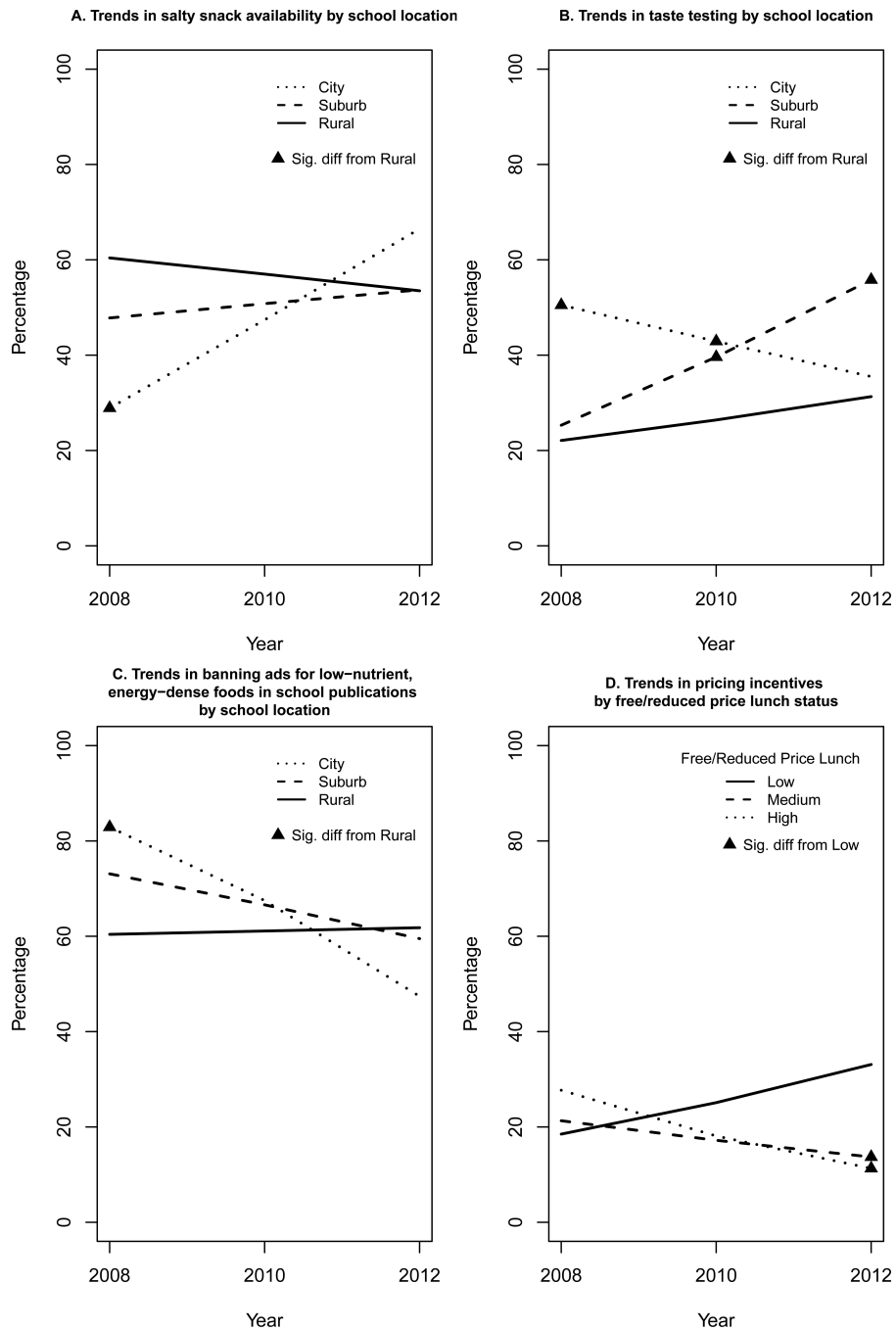
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**Figure 1.** Adjusted prevalence of policies with different trends over time, Minnesota, 2008–2012.

**Table 1**

Demographic Characteristics of Schools Participating in the Minnesota School Health Profiles Survey in 2008, 2010, and 2012

	2008 N= 203 N (%)	2010 N=226 N (%)	2012 <sup>a</sup> N = 275 N (%)
<b>Grade Level<sup>b</sup></b>			
Middle School	68 (33.5%)	82 (30.4%)	95 (33.8%)
Junior/Senior High School	68 (33.5%)	98 (36.8%)	101 (36.7%)
High School	67 (33%)	87 (32.7%)	83 (30.2%)
<b>School Location<sup>c</sup></b>			
City	28 (13.8%)	38 (14.3%)	26 (9.5%)
Suburb	39 (19.2%)	49 (18.4%)	47 (17.1%)
Town/Rural	136 (67%)	179 (67.3%)	202 (73.5%)
<b>Free/Reduced Price Lunch (FRPL) Eligibility<sup>d</sup></b>			
< 20%	57 (28.1%)	51 (19.2%)	50 (18.2%)
20- <60%	130 (64%)	195 (73.3%)	207 (75.3%)
60%	16 (7.9%)	20 (7.5%)	18 (6.5%)
<b>Minority Enrollment<sup>e</sup></b>			
< 5%	70 (34.5%)	79 (29.7%)	67 (24.4%)
5- <50%	113 (55.7%)	167 (62.8%)	191 (69.5%)
50%	20 (9.9%)	20 (7.5%)	17 (6.2%)

<sup>a</sup>Data for school location, minority enrollment and FRPL school level data from 2011

<sup>b</sup>Middle School defined as having a low grade of 5 and a high grade of 9; Junior/ Senior High School defined as having a low grade of 8 and a high grade of 10; High School defined as having a low grade of 9 and a high grade of 10

<sup>c</sup>Classified according to NCES and Rural-Urban Commuting Areas schemes

<sup>d</sup>Percent of students eligible to receive free/reduced price lunch

<sup>e</sup>Percent of non-white and/or Hispanic students enrolled at school

Table 2

Nutrition Policies and Practices by School Location, Free-Reduced Price Lunch (FRPL) Status: Average Adjusted Prevalence Differences (PD),<sup>a</sup> and 95% Confidence Intervals (CI) from 2008-2012

	City PD (95% CI) compared town/ rural	Suburb PD (95% CI) compared to town/rural	High % FRPL PD (95% CI) compared to low % FRPL	Medium % FRPL PD (95% CI) compared to low % FRPL
<b>Availability of LINED<sup>b</sup> items</b>				
Vending machine/ school store	-13.7 (-25.0, -2.3)	-3.1 (-10.7, 4.4)	-10.0 (-26.3, 6.3)	-0.1 (-6.9, 6.6)
Soda available	-8.1 (-24.2, 8.0)	<b>12.3 (0.6, 24.0)</b>	-2.4 (-30.9, 26.0)	1.1 (-9.1, 11.4)
Sports drinks available	<b>-36.3 (-51.8, -20.7)</b>	<b>-9.2 (-17.3, -0.9)</b>	3.7 (-15.6, 22.9)	-2.6 (-9.9, 4.6)
Candy available	-5.6 (-22.3, 11.0)	0.3 (-12.6, 13.2)	-9.4 (-33.1, 14.3)	9.1 (-19.7, 1.5)
Salty snacks available	<b>-31.6<sup>c</sup> (-53.1, -10.0)</b>	-17.1 <sup>c</sup> (-35.7, 1.5)	4.9 (-20.3, 30.0)	-6.1 (-16.8, 4.6)
<b>Healthy eating strategies</b>				
Pricing incentives	-11.8 <sup>d</sup> (-28.2, 4.6)	-8.3 <sup>d</sup> (-20.6, 4.0)		
	8.9 <sup>e</sup> (-12.9, 30.7)	0.7 <sup>e</sup> (-15.8, 17.2)		
	6.2 (-7.4, 19.7)	3.2 (-6.3, 12.7)	10.7 <sup>c</sup> (-22.8, 44.1)	1.9 <sup>c</sup> (-9.4, 13.3)
			-6.7 <sup>d</sup> (-27.4, 13.9)	<b>-8.5<sup>d</sup> (-16.7, -0.2)</b>
Food preferences of students	0.9 (-12.2, 14.0)	-3.7 (-14.9, 7.4)	-11.4 (-34.9, 12.1)	<b>-19.5<sup>e</sup> (-32.7, -6.2)</b>
Info on nutrition content	6.9 (-6.6, 20.5)	6.2 (-4.6, 16.9)	-17.4 (-40.1, 5.2)	-7.6 (-17.1, 1.9)
Taste testing	<b>23.5<sup>c</sup> (2.5, 44.4)</b>	0.3 <sup>c</sup> (-14.3, 14.8)	-5.8 (-22.9, 11.3)	-5.9 (-15.2, 3.3)
	12.2 <sup>d</sup> (-1.5, 25.9)	9.7 <sup>d</sup> (-1.1, 20.5)		-0.1 (-8.5, 8.4)
	0.9 <sup>e</sup> (-15.7, 17.5)	<b>21.1<sup>e</sup> (5.9, 36.3)</b>		
Learning opportunities in cafeteria	5.0 (-6.9, 16.8)	-0.8 (-10.0, 8.5)	-13.2 (-27.2, 0.8)	-3.7 (-12.2, 4.7)
<b>Banned ads for LINED items</b>				
In building	<b>17.7 (5.5, 29.9)</b>	6.3 (-4.8, 17.4)	-12.0 (-33.3, 9.5)	-7.7 (-16.4, 1.0)
On grounds	<b>15.6 (1.7, 29.5)</b>	<b>16.1 (5.6, 26.7)</b>	-0.5 (-23.1, 22.1)	-6.9 (-16.4, 2.6)
On bus	7.9 (-5.0, 20.8)	9.3 (-0.4, 19.0)	-4.2 (-24.2, 15.8)	-5.6 (-14.6, 3.5)
In school publications	<b>22.7<sup>c</sup> (6.9, 38.6)</b>	13.6 <sup>c</sup> (-2.3, 29.5)	-2.7 (-24.1, 18.7)	-6.3 (-15.0, 2.4)
	6.4 <sup>d</sup> (-8.3, 21.1)	5.9 <sup>d</sup> (-4.8, 16.7)		

	City PD (95% CI) compared town/rural	Suburb PD (95% CI) compared to town/rural	High % FRPL PD (95% CI) compared to low % FRPL	Medium % FRPL PD (95% CI) compared to low % FRPL
	-15.1 <sup>e</sup> (-34.1, 4.0)	-2.5 <sup>e</sup> (-17.8, 12.8)		

<sup>a</sup> All models adjusted for location (city, suburb, town/rural), FRPL eligibility (the percent students eligible to receive free/reduced price lunch), minority enrollment (the percent of non-white and/or Hispanic students enrolled at school) and school grade level (middle school, junior/senior high school, or high school). Bolded PDs are statistically significant at alpha = 0.05

<sup>b</sup> Low-nutrient, energy-dense

<sup>c</sup> 2008

<sup>d</sup> 2010

<sup>e</sup> 2012