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Recommended school policies are associated with student sugary drink and fruit and vegetable intake

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Abstract

Objective—To examine the association between 8 recommended school obesity-related policies and student behaviors and weight in a cohort of Minnesota schools.

Method—Existing surveillance surveys were used to examine the relationship between school policies to promote healthy eating and physical activity and student weight, diet, and activity behaviors from 2002 to 2006 among students (n=18,881) in a cohort of 37 Minnesota junior-senior high and high schools using fixed effects linear regression models.

Results—Each additional recommended policy was associated with a significant decrease in consumption of sugary drinks and an increase in consumption of fruits and vegetables. There were no associations with weekly hours of sedentary activities, days per week of vigorous activity, or body mass index percentile.

Conclusion—Students attending schools that added recommended policies to promote healthy eating showed improved dietary behaviors, independent of secular trends compared with students in schools that did not add recommended policies.

Keywords

school policy evaluations; student BMI percentile; school nutrition policies

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Introduction

Approximately one in five adolescents in the US was obese ($\geq 30\text{kg/m}^2$) in 2009-2010 (Ogden et al., 2012). Obesity prevalence was higher among adolescents than any other age group, with no change in prevalence from 2007-2008 (Ogden et al., 2012). Schools have been an important setting for obesity prevention efforts for the past decade and school policies to promote physical activity and healthy eating are an important prevention tool. However, there is insufficient evidence to determine whether these policies are effective in slowing or reversing the epidemic of childhood obesity (Jaime and Lock, 2009; Katz et al., 2005; Kropfski et al., 2008) and available studies have methodological limitations (Kropfski et al., 2008). More rigorous study designs, including longer evaluation periods, may be required to see the impact of school policies on student weight (Kropfski et al., 2008). Another limitation of the school policy evaluation literature has been a focus on the singling out of one or two policies, especially nutrition related policies without considering the overall policy environment. There is some evidence that groups of policies may be more important than others (Nanney et al., 2010) and identifying the most effective strategies is a public health priority (Robinsin, 2012). We examine the association between each additional increase in food- and activity-related policies that are recommended to schools based on the available empirical evidence and student diet, activity, and weight in a cohort of Minnesota schools from 2002 to 2006.

Methods

The School Obesity-related Policy Evaluation study (ScOPE) uses a cohort of junior-senior high and high schools and cross sections of students in those schools to evaluate the association between school policies and practices and student weight and weight-related behaviors, over time. Two existing surveillance data sets were used to accomplish ScOPE study goals: Minnesota School Health Profiles and Minnesota Student Survey. Each is described below. The University of Minnesota Institutional Review Board approved this study (1007E85315).

Exposure measure

ScOPE uses policy data from a random sample of Minnesota public middle, junior-senior high and high schools collected every two years as part of the Center for Disease Control and Prevention (CDC) School Health Profiles (Profiles) study. Profiles data are used to monitor implementation of school health policies and educational practices, including, physical activity, food service, and nutrition. The CDC oversees methodology, questionnaire development, and analysis of Profiles data. In 2002, 376 Minnesota schools were randomly selected and 282 schools participated (75%) in Profiles. In 2006, 392 Minnesota schools were selected and 278 schools participated (71%) in Profiles. Forty schools were sampled in both 2002 and 2006.

Principals in each school completed a survey that assessed school nutrition and physical activity policies and practices. Eight evidence-supported policies were identified and summed to create a recommended policy score. Policies included: 1) PE required in any of

grades 6th-12th(yes/no) (O'Malley et al., 2009); 2) intramural sports opportunities available (yes/no) (O'Malley et al., 2009); availability of healthy items 3) fruits/vegetables and 4) 100% fruit juice; and less healthy items 5) salty snacks, 6) chocolate candy, 7) other candy and 8) soda or sports drinks in vending machines/school stores (Coffield et al.; Fox et al., 2009; Kubik et al., 2005; Nanney et al., 2010).

Outcome measure

Student data were drawn from the 2004 and 2007 Minnesota Student Survey (MSS), an anonymous self-report survey administered to 6th, 9th and 12th grade students every three years. All public schools with students in eligible grades throughout Minnesota are invited to participate. In 2004 and 2007, the percentage of operating schools that participated in the MSS ranged from 89 to 91 percent (301 and 309 schools, respectively), and the percentage of all Minnesota 6th, 9th and 12th grade students in public schools who submitted usable surveys ranged from 68 to 72 percent (131,862 and 136,549 students, respectively). Outcome measures were student self-reported daily glasses of sugary drinks, fruit and vegetable servings, hours per week of sedentary activities, and days per week of vigorous physical activity for at least 20 minutes. MSS data for 9th and 12th grade students from the cohort of 40 schools were used for the behavioral variables. Body mass index percentile, calculated from self-reported height and weight (item excluded from 6th grade survey) was only available in 2007.

Analysis

All analyses were performed at the school level, with individual student responses averaged within school. Restricting analyses to the school level allowed us to make school-level inferences and appropriately reflect the degrees of freedom in the data. In an effort to control for secular and school specific trends, we restricted our analyses to a cohort of 40 junior or senior high schools that were randomly sampled in both 2002 and 2006 and had participated in the MSS in 2004 and 2007. There were only 3 middle schools with Profiles and MSS data in these years so they were excluded from the analyses. School policy data were linked with student self-report data aggregated to the school level for 2002 to 2004 and 2006 to 2007. We estimated the association between policy and the dependent variables glasses of sugary drinks per day, servings of fruits and vegetables, hours per week of sedentary activities and days per week of vigorous physical activity using separate fixed effects regression models. All schools including those that added, lost or had no policy change, were included in these models. Linear regression models were used to estimate the association between the number of policies in a school and average student behaviors. Year was included in regression models to adjust for secular changes in behavior and fixed effects for each school were included to adjust for measured and unmeasured school-level confounders that did not vary over time (Harper et al., 2012). We found no significant policy by time interactions. BMI was available for 2007 only and was modeled as the dependent variable in a linear regression including 2002 and 2006 policy level as well as adjustments for school grade level, geographic location, minority percent and free-reduced price meal eligibility percent. The main effect we report in this model is the association between policy level and 2007 average student BMI percentile. All analyses were conducted using Statistical Software version 12.1, 2011, StataCorp.

Results

Table 1 shows a description of the school cohort and changes in the recommended policy score over time. The school cohort was mostly white. The school-level student population was mostly white. Across schools, eligibility for the free and reduced priced meal program was generally less than 40%. There was a significant mean increase (5.02%) in free-reduced price lunch eligibility from 2002 to 2006 in these 37 schools. No other changes over time in school characteristics were statistically significant. On average, schools reported an increase of 0.4 recommended policies from 2002-2006. One third of the schools had no change in the key policy score from 2002 to 2006; 25% had 1 to 3 fewer recommended policies and 42% had 1 to 6 more recommended policies. Table 2 describes the association between number of policies and school-level student behaviors adjusted for secular trends. With each additional policy, there was a statistically significant decrease of 0.08 ($p=0.04$) daily glasses of sugary drinks and an increase of 0.07 ($p=0.01$) daily servings of fruits and vegetables. There were also nonsignificant increases in weekly hours of sedentary activities and days per week of vigorous physical activity. There were no significant decreases in mean school level BMI among students with each additional policy.

Discussion

In a cohort of Minnesota junior-senior high and high schools, recommended school policies that promote healthy eating were associated with modest improvements in consumption of sugary drinks and fruits and vegetables among students attending those schools. Sugary drink consumption has been associated with obesity among adolescents (Brener et al., 2011). Replacing energy dense low nutrient foods with foods of lower energy density, such as fruits and vegetables, can be an important part of a weight-management strategy. (Ledoux et al., 2011; Tohill et al., 2004).

Our study approach addresses methodological limitations of previous school policy evaluations in several ways. We focused on policies to prevent or control obesity based on empirical research. Eight school policies and practices were selected based upon findings from the evaluation research literature, including systematic reviews, as associated with youth obesity (O'Malley et al., 2009; Coffield et al.; Fox et al., 2009; Kubik et al., 2005; Nanney et al., 2010)). We evaluated the impact of school policies following a cohort of junior-senior high and high schools over time which is especially important given how slow these schools have been in improving practice as compared to elementary and middle schools (O'Toole et al., 2007). An evaluation of a cohort of schools and cross sections of students is a methodological contribution to the field. The regression models for student behavior outcomes included a fixed effect for schools, allowing us to adjust for all measured and unmeasured school characteristics that did not change with time. However, there are study limitations. All data were self-reported and could be subject to misclassification. We did not adjust for time-varying confounders, which could bias our associations. Finally, the cohort is more rural and white and has lower eligibility for free and reduced school meal participation than all Minnesota schools in 2002 and 2006. Future studies should attempt to replicate and extend these findings to include a broader set of policies in a larger cohort of schools.

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Table 1

Characteristics of a cohort of Minnesota secondary schools, 2002 to 2006, (N=37)

School Characteristics	2002	2006	p-value ^d
Grade level	N (%)	N (%)	0.371
High school ^a	21 (57%)	18 (49%)	
Junior-Senior High school ^b	16 (43%)	19 (51%)	
Geographic location			NA
City	4 (11%)	4 (11%)	
Suburb	2 (5%)	2 (5%)	
Town/Rural	31 (84%)	31 (84%)	
Minority Enrollment			0.324
< 5%	20 (54%)	20 (54%)	
5-<20%	15 (41%)	14 (38%)	
20–50%	1 (3%)	2 (5%)	
> 50%	1 (3%)	1 (3%)	
Free-Reduced Price Meal Eligibility			< 0.001
< 20%	14 (38%)	12 (32%)	
20-<40%	20 (54%)	18 (49%)	
40–60%	3 (8%)	7 (19%)	
> 60%	0	0	
Key Policy Score (0–8)^c	Mean (SD)	Mean (SD)	0.273
	3.57 (1.56)	3.92 (1.46)	

^aHigh school is defined as having grades between 9–12.^bJunior-Senior high school is defined as having a low grade between 6–8 and high grade of 10–12.^cSum of school policies: Available (1) PE required in any grades 6th–12th grade (2) intramural sports opportunities (3) fruits/vegetables (4) 100% fruit juice and; Not available (5) soda or sports drinks (6) chocolate candy (7) other kinds of candy (8) salty snacks^dp-values are from McNemar Chi-square test for grade level and paired t-tests for minority enrollment (continuous), free-reduced price lunch eligibility (continuous) and key policy score. There were no changes over time in school location.

Table 2

Associations between policy changes and student outcomes in a cohort of Minnesota schools, 2002 to 2006 (N=37).

	2002 Mean student outcome (SD) ^e	2006 Mean student outcome (SD)	Estimated Difference in student outcome with a 1 key policy increase(CI) ^f	P-value
BMI Percentile ^a	NA	59.4 (3.7)	-0.13 (-1.04, 0.78)	0.78
Daily glasses of sugary drinks ^{b,c}	2.34 (0.40)	2.24 (0.41)	-0.08 (-0.15, -0.00)	0.04
Daily servings of fruits and vegetables ^c	2.76 (0.31)	2.92 (0.25)	0.07 (0.02, 0.12)	0.01
Weekly hours of sedentary activities ^{c,d}	11.83 (1.97)	11.69 (1.60)	0.02 (-0.32, 0.36)	0.90
Days a week of vigorous physical activity lasting at least 20 minutes ^c	3.45 (0.32)	3.82 (0.36)	0.05 (-0.02, 0.13)	0.15

^a Adjusted for 2002 policy score and other demographics. Models for BMI are adjusted for school location, minority and free and reduced priced meal enrollment percent

^b Sugary drinks include soda and sports drinks

^c Models for student behavior outcomes include a fixed effect for school

^d Sedentary activities include computer or video games, TV, DVD and video watching

^e Standard Deviation

^f Confidence Interval