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State but not District Nutrition Policies Are Associated with Less Junk Food in Vending Machines and School Stores in US Public Schools

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Abstract

Background—Policy that targets the school food environment has been advanced as one way to increase the availability of healthy food at schools and healthy food choice by students. Although both state- and district-level policy initiatives have focused on school nutrition standards, it remains to be seen whether these policies translate into healthy food practices at the school level, where student behavior will be impacted.

Objective—To examine whether state- and district-level nutrition policies addressing junk food in school vending machines and school stores were associated with less junk food in school vending machines and school stores. Junk food was defined as foods and beverages with low nutrient density that provide calories primarily through fats and added sugars.

Design—A cross-sectional study design was used to assess self-report data collected by computer-assisted telephone interviews or self-administered mail questionnaires from state-, district-, and school-level respondents participating in the School Health Policies and Programs Study 2006. The School Health Policies and Programs Study, administered every 6 years since 1994 by the Centers for Disease Control and Prevention, is considered the largest, most comprehensive assessment of school health policies and programs in the United States.

Subjects/setting—A nationally representative sample (n = 563) of public elementary, middle, and high schools was studied.

Statistical analysis—Logistic regression adjusted for school characteristics, sampling weights, and clustering was used to analyze data. Policies were assessed for strength (required, recommended, neither required nor recommended prohibiting junk food) and whether strength was similar for school vending machines and school stores.

Results—School vending machines and school stores were more prevalent in high schools (93%) than middle (84%) and elementary (30%) schools. For state policies, elementary schools that required prohibiting junk food in school vending machines and school stores offered less junk food than elementary schools that neither required nor recommended prohibiting junk food (13%

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vs 37%; $P = 0.006$). Middle schools that required prohibiting junk food in vending machines and school stores offered less junk food than middle schools that recommended prohibiting junk food (71% vs 87%; $P = 0.07$). Similar associations were not evident for district-level policies or high schools.

Conclusions—Policy may be an effective tool to decrease junk food in schools, particularly in elementary and middle schools.

The potential of the school food environment to influence students' dietary intake is well-recognized. Improving the health of the school food environment is considered an important obesity-prevention strategy (1,2). An ongoing concern is the continued availability of junk food or high-calorie, low-nutrition food and beverage items offered for sale to students in school vending machines and school stores/canteens/snack bars (hereafter referred to as school stores). According to the School Health Policies and Programs Study 2006, 21% of elementary schools, 62% of middle schools, and 86% of high schools had one or more vending machines available for student use (3). School stores, although less prevalent, were still present in 17% of elementary schools, 33% of middle schools, and 50% of high schools (3). Although healthier items, such as bottled water and low-fat snacks, can be purchased from these venues, sugar-sweetened beverages and high-fat, high-calorie snacks continue to be among the most common items offered for sale to students (3).

Policy that targets the school food environment has been advanced as one way to increase the availability of healthy foods at school and ultimately encourage healthy food choices by students (4–6). Since 2003, there has been an increase in state legislative policy action focused on childhood obesity prevention, with the most commonly introduced legislation targeting school nutrition standards and vending machines (7,8). At the district level, federal legislation enacted in 2004 required school districts participating in the reimbursable school meals program to establish by the start of the 2006–2007 school year, a school wellness policy that included nutrition guidelines for all foods and beverages available at school (9). Although it is encouraging that both state- and district-level policy initiatives have focused on school nutrition standards, it remains to be seen whether these policies contribute to healthy food practices at the school level, where student behavior will be impacted, especially given concerns about policy rigor and policy implementation and oversight, which were not addressed in the legislation (8,10,11).

The School Health Policies and Programs Study, a survey administered by the Centers for Disease Control and Prevention every 6 years since 1994, is considered the largest and most comprehensive assessment of school health policies and programs in the United States (12). School Health Policies and Programs Study 2006 provides a unique opportunity to examine selected school nutrition standards across multiple school settings (elementary, middle, and high school) and to assess food practice at the school level relative to the strength (require, recommend, neither require nor recommend) of district- and state-level policy. For the current study, data collected from a nationally representative sample of public schools participating in School Health Policies and Programs Study 2006 were used to examine whether state- and district-level nutrition policies that addressed junk food availability in school vending machines and school stores were associated with less junk food in these school venues. Junk food was defined as foods/beverages with low nutrient density that provides calories primarily through fats/added sugars (3).

For this research, a rigorous policy required prohibiting junk food in school vending machines and school stores. This approach was chosen for several reasons. Both venues are a common source of energy-dense, low-nutrient foods and beverages in public schools; many schools permit students to purchase items from both venues throughout the school

day; many schools offer one or both venues; and, unlike à la carte programs, neither venue is a part of the school nutrition services program (3).

METHODS

Sample

For School Health Policies and Programs Study 2006, state-level data were collected from education agencies in all 50 states and the District of Columbia; district-level data were collected from a nationally representative sample of public school districts ($n = 538$); and school-level data were collected from a nationally representative sample of public and private elementary, middle, and high schools ($n = 1,103$) (12). At each level, self-report data were collected by computer-assisted interviews or self-administered mailed questionnaires and completed by designated respondents identified as most knowledgeable about the policies addressed in a particular questionnaire (12). Data collection occurred from January to October 2006 (13) (see Kyle and colleagues for details about the study, including sampling, response rates, data collection and cleaning, and sample weighting [13]). Aims for the present study required that the analysis sample be limited to schools that completed the state and district food service questionnaires and the school-level healthy and safe school environment questionnaire. As a result, the sample consisted of 563 schools, which included 214 (38%) elementary schools, 165 (29%) middle schools, and 184 (33%) high schools. Schools were located in 198 districts and 39 states. All schools were public schools because of the nesting of schools within the sampled districts. The study was approved for secondary data analyses by the University of Minnesota Institutional Review Board under the exemption category.

Measures

State and District Policy—The School Health Policies and Programs Study 2006 state- and district-level nutrition services questionnaires included the following question: “Does your state (district) require or recommend that schools be prohibited from offering junk foods (foods or beverages that have low nutrient density, that is, they provide calories primarily through fats or added sugars and have minimal amounts of vitamins or minerals)?” For each of eight food venues (à la carte during breakfast or lunch periods, at student parties, in afterschool or extended-day programs, at staff meetings, at meetings attended by students’ family members, in school stores, in vending machines, and at concession stands), response options were require, recommend, neither require nor recommend (14,15). This research included only data for school stores and vending machines.

For state policy, a three-category variable was created to assess strength and consistency of policy across vending and school store venues. The state policy variable was categorized as follows: required prohibiting junk food in vending machines and school stores, recommended prohibiting junk food in vending machines and school stores, and neither required nor recommended prohibiting junk food in vending machines and school stores. The number of schools in each category was 239, 154, and 135, respectively. Three states had inconsistent policies for vending machines and school stores. For example, one state recommended that schools prohibit junk food in vending machines, but neither required nor recommended prohibiting junk food in school stores. Schools ($n = 25$) located in these states were placed in the neither required nor recommended category. State-level policy data were missing from one state that included 10 schools.

For district policy, a four-category variable was created. The required, recommended, and neither required nor recommended categories were the same as described here for state policy. The number of schools in each category was 126, 107, and 177, respectively. Among

school districts, 59 reported inconsistent policies. Given the larger proportion of inconsistent policies at the district level compared to the state level, a fourth category for inconsistent policies was created and included 148 schools. District-level policy data were missing from two districts that included five schools.

School Practice—Three questions from the School Health Policies and Programs Study 2006 school-level healthy and safe school environment questionnaire were used to assess junk food availability at school (16). Respondents were asked “Can students purchase food or beverages from a) one or more vending machines at the school and b) a school store, canteen or snack bar?” Respondents were also asked “Can students purchase the following from vending machines or school stores? a) chocolate candy; b) other kinds of candy; c) cookies, crackers, cakes, pastries or other baked goods that are not low in fat; d) salty snacks that are not low in fat, such as regular potato chips; e) ice cream or frozen yogurt that is not low in fat; f) 2% or whole milk (plain or flavored); and g) water ices or frozen slushes that do not contain juice.” Another question asked “Can students purchase the following from vending machines or school stores? a) soda pop or fruit drinks that are not 100% juice and b) sports drinks, such as Gatorade.” For all questions, response items were yes/no.

For analysis, a three-category variable was created as follows:

1. No Food Sold: if students could not purchase food or beverages from school stores and vending machines.
2. No Junk Food Sold: if students could purchase food or beverages from school stores and/or vending machines and could not purchase any of the food or beverage items mentioned here.
3. Junk Food Sold: if students could purchase food or beverages from school stores and/or vending machines and could purchase one or more of the food and beverage items described here. For multivariate analysis, a dichotomous variable was created to assess whether schools did or did not (sum of No Food Sold and No Junk Food Sold categories) sell junk food to students.

School Demographic Characteristics—According to the School Health Policies and Programs Study methodology report (17), school size was categorized as small or large based on median student enrollment. School ZIP codes were used to classify schools by urbanicity (urban vs nonurban) and poverty level (low vs high) using US Census data. Median value across all ZIP codes was used as the cut point to classify a school as urban or nonurban, based on percent of population living in rural areas, and high or low poverty, based on percent of children living in poverty.

Statistical Analysis

Descriptive statistics were used to examine variables of interest. Logistic regression was used to examine the association between state- and district-level policy prohibiting junk food sales to students in vending machines and school stores and availability of junk food in vending machines and school stores at the school level. Separate multivariate logistic models were used to assess state-level and district-level policies. Both models were stratified by school type (ie, elementary, middle, high school) and included adjustments for school size, urbanicity, and poverty. Adjusted proportions and associated *P* values for the multivariate logistic models were obtained using generalized estimating equations, assuming an independent working correlation matrix to account for clustering of schools within districts and within states (18).

All analyses were additionally adjusted by sampling weights developed especially for the subset of 563 schools, which were nested in districts and states. The new sampling weights were created by taking the original school sampling weights and scaling them up or down by a nonresponse propensity weight created using the scaled inverse of the probability a school was in the nested sample based on its original sampling strata (defined by urban/nonurban and high/low-poverty characteristics). In addition, to preserve sample size for correct inference, weights were scaled so that they summed to the observed sample sizes within school type. All analyses were performed using SAS software (version 9.1, 2003, SAS Institute, Cary, NC).

RESULTS

Among the school sample, 68% were categorized as large, 67% as urban, and 58% as high poverty. Vending machines and/or school stores were more prevalent in high schools (93%) than middle (84%) and elementary schools (30%) (see Table 1). Among these schools, junk food was available for purchase by students in vending machines and/or school stores in 100% of high schools, 93% of middle schools, and 73% of elementary schools. Across schools, the five most prevalent types of junk foods students could purchase from these venues were sports drinks, soda pop/fruit drinks, salty snacks not low in fat, baked goods not low in fat, and candy (not including chocolate).

In multivariate analyses, elementary schools with state policies that required prohibiting junk food sales to students in vending machines and school stores offered significantly less junk food than elementary schools with state policies that neither required nor recommended prohibiting junk food sales (13% vs 37%; $P = 0.006$). Middle schools with state policies that required prohibiting junk food sales to students in vending and school stores offered less junk food for sale than middle schools with state policies that recommended prohibiting sales. This association neared statistical significance (71% vs 87%; $P = 0.07$). Similar associations were not evident for district policies or among high schools (see Table 2).

Multivariate analyses also revealed a significant association among high schools for the proportion of schools offering junk food by school size (small vs large) in both the adjusted state-level (95% vs 99%; $P = 0.01$) and district-level (87% vs 99%; $P = 0.001$) models. For both models, there were no significant associations between the proportion of junk food that schools offered by poverty level and urbanicity (data not shown).

DISCUSSION

The 2007 Institute of Medicine report, “Nutrition Standards for Foods in Schools: Leading the Way Toward Healthier Youth,” concluded that the federally reimbursable school meals program should be the primary source of nutrition at school and access to competitive food sources, which include vending machines and snack bars, should be limited and, when available, consist of nutritious items, such as fruits, vegetables, and nonfat or low-fat milk and dairy products (19). School Health Policies and Programs Study 2006 found that the prevalence of vending machines and school stores had decreased somewhat compared to the School Health Policies and Programs Study 2000, especially in elementary and high schools (3,20). Similarly, the nutritional quality of food and beverages offered to students from vending machines and school stores improved during this 6-year period, although items high in fat and added sugars remained among the most common items offered for sale to students (3,20). Also during this time period, voluntary agreements with the beverage, snack, and dairy industries to provide healthier foods and beverages to schools were facilitated by the Alliance for a Healthier Generation (21). Despite these advancements and a national concern about a childhood obesity epidemic that has been linked to increased availability and

accessibility of low-nutrient, energy-dense food and beverages (22–24), many US schools persist in providing vending machines and school stores that offer junk food for sale to students during the school day (2,3,25). In the present study, among schools with vending machines and/or school stores, a large majority offered junk food for sale to students, including all high schools.

Findings from the current study suggest that state-level policy may be an effective tool to decrease junk food availability in schools, particularly among elementary and middle schools. Study results also indicate that policy rigor, defined as policy that required prohibiting junk food in vending machines and school stores, was associated with improved outcomes at the school level.

Significant or near significant associations at or near a $P < 0.05$ level were not apparent for district-level policies. This appears to be the result of less rigorous policy at the district level when compared to state-level policy. For example, 43% of schools were located in states that required schools to prohibit offering junk food for sale to students in vending machines and school stores. In contrast, only 22% of schools were located in districts with equally rigorous district policies. Similarly, only 4% of schools were located in states with inconsistent policies, defined as different junk food requirements for vending machines and school stores, whereas 26% of schools were located in districts with inconsistent policies. District policy makers have a more proximal association with schools than state policy makers, which may result in a more cautious or less rigorous approach to policy-setting and a tendency to defer meaningful rule-making responsibilities to officials at the local or school level. This hypothesis merits further evaluation, particularly given the federally mandated role of district administrators in setting nutrition policy for schools. The present study did not examine the concordance between state- and district-level policy and the association between policy concordance and rigor and school-level practice. Future research should consider this association as well.

The lack of an association between policy and junk food availability in vending machines and school stores among high schools at both the state and district level was not unexpected, given the almost ubiquitous presence of these popular food venues among the high school sample. Nevertheless, it is concerning that the associations seen among elementary and middle schools between rigorous state-level policy and junk food availability were not evident among high schools. There were essentially no differences between the most- and least-rigorous policies and junk food availability in high schools at both state- and district-levels. For high schools, these findings suggest that policy alone, especially policy established at levels distal to the school, is less likely to facilitate healthy change in junk food availability in vending machines and school stores. Successful, albeit short-term, interventions targeting the high school food environment have been few, and mostly demonstrated the benefits of involving local school staff and students in change strategies to increase availability of healthier food items, as well as manipulating price in favor of healthy food choice (26–28). Successful, sustainable change in the high school food environment will likely require a combination of rigorous policy across school, district, and state levels, as well as local school-based efforts that engage school staff and students. This approach could also contribute to healthy change in middle and elementary schools.

This study has several strengths, including use of data collected from a nationally representative sample of elementary, middle, and high schools, which were linked to district- and state-level policy data collected as part of the School Health Policies and Programs Study 2006. This study is among the first to report on the association between state- and district-level policy prohibiting schools from selling junk food in vending machines and school stores and the availability of junk food in vending machines and school

stores at the school level. The analysis approach allowed for the detection of differences in policy translation in elementary, middle, and high school settings and at state and district levels, which has important implications for policy makers.

Study limitations are the same as those described for the School Health Policies and Programs Study 2006 (12). Although all state agencies participated in data collection, at the district and school level response rates were 74.5% and 77.9%, respectively. Among responding districts, participation in the nutrition services module was 64.5%. Among responding schools, participation in the healthy and safe school environment module was 72.4%. It is possible that districts and schools that participated were different by important characteristics from districts and schools that did not participate. Data collection occurred via self-report, which is subject to social desirability bias. In addition, although questionnaires were completed by designated respondents identified as most knowledgeable about the policies addressed in a particular questionnaire, it is possible that actual knowledge about a particular item was lacking or did not reflect current school practice (12). A study assessing the reliability and validity of the School Health Policies and Programs Study 2000 questionnaires found that correspondence between survey questions and policies was generally good; however, threats to validity of some items on the district and state questionnaires and reliability of select items on the school-level questionnaires were identified (29). Finally, given the cross-sectional nature of this study, a causal link between policy and junk food availability cannot be established.

In conclusion, vending machines and school stores that sell junk food to students during the school day are popular and pervasive food venues in US schools. This study suggests that the potential for policy to decrease junk food availability in these popular food venues is promising. Not surprisingly, policy rigor was associated with less junk food, especially in elementary schools, but also in middle schools. When setting policy targeting junk food availability in schools, school nutritionists and other health professionals who are in positions to contribute to the policy-making process are encouraged to consider policy rigor, as well as incorporate a process that engages school staff and students. This integrative approach can be especially beneficial in high schools, where prevalence of vending machines and schools stores is high and resistance to healthy change appears to be strong. Creating a healthy school food environment is challenging work that will continue to require the attention of many, including school nutritionists and other health professionals who are dedicated to developing and disseminating meaningful food policy that translates into healthy school practice.

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Table 1Prevalence of vending machines and school stores in a nationally representative sample of US public schools^a

	Total ^b (n = 551)	Elementary schools (n = 210)	Middle schools (n = 158)	High schools (n = 183)
		← % →		
Vending machines and school stores	20	6	30	48
Vending machines only	27	13	45	41
School stores only	9	11	9	4
No vending machines and no school stores	43	70	16	7

^aSchools were participants in School Health Policies and Programs Study 2006.^bSample sizes were adjusted by sampling weights and reflect missing data from 12 schools.

Table 2

Association between policy prohibiting junk food in vending machines and school stores and percent of schools offering junk food, School Health Policies and Programs Study 2006^a

	Elementary Schools (n = 214)		Middle Schools (n = 165)		High Schools (n = 184)	
	% Offering junk food	P value	% Offering junk food	P value	% Offering junk food	P value
State-level policy						
Require	13	0.006	71	0.52	96	0.41
Neither require nor recommend ^b	37		79		100	
Recommend	22	0.13	87	0.34	97	0.46
Neither require nor recommend ^c	37		79		100	
Require	13	0.25	71	0.07	96	0.64
Recommend ^d	22		87		97	
District-level policy						
Require	18	0.26	79	0.85	97	0.72
Neither require nor recommend ^b	27		81		98	
Recommend	23	0.70	78	0.84	96	0.44
Neither require nor recommend ^c	27		81		98	
Require	18	0.66	79	0.95	97	0.62
Recommend ^d	23		78		96	
Inconsistent	20	0.43	74	0.46	98	0.79
Neither require nor recommend ^e	27		81		98	

^a All percentages were calculated from logistic regression and adjusted for school demographics (school size, urbanicity, and poverty), sampling weights and cluster design.

^b Schools with vending and school store policy that required prohibiting junk food compared to schools that neither required nor recommended prohibiting junk food.

^c Schools with vending and school store policy that recommended prohibiting junk food compared to schools that neither required nor recommended prohibiting junk food.

^d Schools with vending and school store policy that required prohibiting junk food compared to schools that recommended prohibiting junk food.

^e Schools with district vending and school store policy that was inconsistent compared to schools that neither required nor recommended prohibiting junk food.