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RESEARCH ARTICLE

Profits, Commercial Food Supplier Involvement, and School Vending Machine Snack Food Availability: Implications for Implementing the New Competitive Foods Rule*

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ABSTRACT

BACKGROUND: The 2013-2014 school year involved preparation for implementing the new US Department of Agriculture (USDA) competitive foods nutrition standards. An awareness of associations between commercial supplier involvement, food vending practices, and food vending item availability may assist schools in preparing for the new standards.

METHODS: Analyses used 2007-2012 questionnaire data from administrators of 814 middle and 801 high schools in the nationally representative Youth, Education, and Society study to examine prevalence of profit from and commercial involvement with vending machine food sales, and associations between such measures and food availability.

RESULTS: Profits for the *school district* were associated with decreased low-nutrient, energy-dense (LNED) food availability and increased fruit/vegetable availability. Profits for the *school* and use of company suppliers were associated with increased LNED availability; company suppliers also were associated with decreased fruit/vegetable availability. Supplier ''say'' in vending food selection was associated with increased LNED availability and decreased fruit/vegetable availability.

CONCLUSIONS: Results support (1) increased district involvement with school vending policies and practices, and (2) limited supplier ''say'' as to what items are made available in student-accessed vending machines. Schools and districts should pay close attention to which food items replace vending machine LNED foods following implementation of the new nutrition standards.

Keywords: health policy; nutrition and diet; school food services; competitive foods.

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By July 1, 2014, all US schools participating in federally reimbursable meal programs such as the National School Lunch Program or the School Breakfast Program must implement new nutrition standards for food and beverages sold in schools outside of the reimbursable meal programs.[1] Such foods and beverages—referred to as *competitive foods,* because they compete with reimbursable meals—are usually sold through *à la carte* cafeteria sales, school or student stores/snack bars/carts, or vending machines. The new standards essentially require removing low-nutrient, energy-dense (LNED) foods that provide calories primarily through fats or added sugars with minimal vitamins and minerals.[2] However, the realities of removing such foods—and decisions on what to replace them with—are complex. The availability of LNED foods has been and continues to be especially high in school vending machines.[2-7] School administrators commonly report that sales profits underlie decisions to have vending machines in general and LNED foods specifically.[8-11] Profits are typically used for food service programs, athletics, or supplemental activities for which little discretionary funding is available.[11-14]

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Reports from US public school administrators show that almost one third of middle and two thirds of high school students attended schools where foods were sold in student-accessible vending machines.[15] Whereas some schools or districts provided vending food items directly, and therefore, directly absorbed either the profit or loss from such activity, beverage suppliers or other vending companies were the primary source of foods sold in vending machines in 2012 (25% of middle and 51% of high school students attended schools where this was the case).[16] Thus, efforts to transition and implement the new nutrition standards for vending machine food items require that most schools and/or districts need to work with their commercial suppliers.

Little is known about the associations between commercial involvement with school food vending and the types of foods made available to students. Previous research on sugar-sweetened beverages (SSBs) in schools indicates that commercial involvement may influence both item availability and student consumption. In a nationally representative sample of secondary schools, school policy allowing beverage supplier contractual involvement (exclusive beverage contract incentives and beverage supplier ''say'' in vending machine beverage choices) was related to increased overall SSB access.[17] In a separate nationally representative study, students attending schools without exclusive beverage contracts had significantly lower SSB consumption rates than those attending schools with such contracts.[18] It seems likely that commercial involvement may similarly influence vending machine *food* availability. A better understanding of the influence of overall profits and commercial involvement with school vending machine food sales could inform strategies to help schools transition to the new nutrition standards.

The current study used 6 years of data from administrators of schools attended by nationally representative samples of public middle and high school students to investigate 2 main research questions. (1) Where food vending machines are available to students, what was the prevalence of profit from and commercial involvement with vending machine food sales? (2) Were profits and commercial involvement associated with LNED food availability, low-fat snack food availability, and/or fruit and vegetable availability? On the basis of the results, recommendations are made for schools and districts to consider as they move forward with implementing the new nutrition standards.

METHODS

Participants and Procedure

This study utilized 6 years of data (2007-2012) from 1 component of the annual Youth, Education, and Society (YES) study conducted by the Institute for Social Research at the University of Michigan. A rotating sample design of approximately 600 schools was drawn from 380 school districts, so as to be representative of all public middle and high schools in the coterminous United States each year. One half of sampled schools contained an eighth-grade target class; remaining schools were divided equally between targeted 10th- and 12th-grade classes.[19] Mailed questionnaires with a modest monetary incentive were sent to each sampled school's principal in the spring; follow-up calls and questionnaire mailings were made as necessary to encourage participation. Response rates averaged 72% without replacement for nonresponding schools and 86% with replacement. Schools were invited to participate for 3 years. Principals completed questionnaire sections on general school characteristics, nutrition policies/programs, food and beverage supplier agreements, and school wellness policies; some principals assigned the task to other administrators. It was suggested that food service personnel complete the detailed questions on food and beverage availability across venues, and this occurred in 43% of schools. At the start of the study, pilot testing of various measures of food and beverage availability as well as school policy was conducted with a convenience sample of both middle and high school principals. Detailed reliability and validity studies of the measures used were not conducted; however, participants reported no difficulties in completing the measures.

Instruments

Food vending machine measures. *Food vending availability*: ''Does your school have each of the following: Vending machines that sell food items to students?'' (yes/no). *School profits*: ''Does your school receive any profit from foods and/or beverages sold in the following locations? Vending machines'' (yes/no/don't know). *District profits*: ''Other than the profits your

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school gets, does your school district receive any profit from foods or beverages sold in the following locations? Vending machines'' (yes/no/don't know). *Commercial supplier*: ''Does any company (such as a beverage supplier or vending company) sell food items in vending machines at your school?'' (yes/no). If respondents indicated a commercial supplier was used, 2 additional questions were asked. *Commercial incentives*: ''Does your school receive incentives, such as cash awards or donations of equipment, supplies, or other donations, once total food receipts from a vendor exceed a specific amount?'' (yes/no). *Commercial receipts*: ''Does your school receive a specified percentage of the food sales receipts from vending machines?'' (yes/no). Finally, respondents were asked about s*upplier say*: ''Who has a major 'say' in deciding what food items are offered in vending machines to students at your school? The beverage supplier or other vending company'' (yes/no; coded for those who reported having a commercial supplier).

Food availability measures. Respondents were asked to indicate food availability by the following question stem: ''Please indicate whether the following food items are available to students from vending machines anywhere in your school.'' Individual items were then listed, with yes/no responses. The current analyses utilized the following items: (1) candy; (2) salty snacks that are not low in fat, such as regular potato chips (hereafter referred to as regular fat salty snacks); (3) cookies, crackers, cakes, or other baked goods that are not low in fat (hereafter referred to as regular fat baked goods); (4) low-fat salty snacks, such as pretzels, baked chips, or other low-fat chips (hereafter referred to as low-fat salty snacks); (5) low-fat cookies, crackers, cakes, pastries, or other low-fat baked goods (hereafter referred to as low-fat baked goods); (6) fresh fruit; (7) other fruit (such as dried or canned fruit); and (8) vegetables (such as carrot sticks or celery sticks).

Control variables. Control variables included administrator-reported student enrollment, student body racial/ethnic composition, and percentage of students eligible for free/reduced-price lunch. Models also controlled for population density, region of the United States, and year (using dummy terms). High school models also controlled for grade level (10 vs 12).

Data Analysis

Analyses used survey commands in SAS v.9.2 (SAS Institute, Cary, NC). Data were weighted to adjust for differential probability of school selection, nonresponse, and estimated enrollment in the target grade. Weighted results represent the percentage of all target grade *students* with specified outcomes or conditions. Analyses were clustered by school to adjust for individual schools repeating study participation. Results are presented separately for middle schools (8th grade) and high schools (10th and 12th grades combined). After removing cases with missing data on food vending availability and control variables, 1582 middle school cases (814 unique schools) and 1558 high school cases (801 unique schools) were available for initial analysis reporting on food vending machine availability. Remaining analyses were restricted to only those cases with food vending availability: 495 middle school cases and 1061 high school cases.

RESULTS

Over the 6 years included in the current analyses, 32% of middle and 68% of high school students attended schools with food vending availability. Table 1 presents descriptive statistics and grade comparisons for food vending machine profits and commercial involvement, as well as food availability for students attending schools with food vending. Whereas the majority of both middle and high school students attended schools that reported receiving any profits from vending machine sales, significantly more high school students did so than middle school students (88% vs 80%). None of the other profit or commercial involvement measures differed significantly between middle and high school students. Any district profits were reported for approximately 38% of middle and high school students. A commercial supplier was used for vending food sales in schools attended by approximately 84% of middle and high school students. Among schools with commercial suppliers, more than 70% of students attended schools that received commercial receipts; receiving commercial incentives was less frequent, present in schools attended by only approximately 20% of secondary students. Roughly 30% of students attended schools where the commercial supplier had a major ''say'' in vending food item selection.

In schools with food vending, half of students had at least 1 type of LNED snack food available through vending machines, and approximately two thirds had vending machines with low-fat baked goods available. Low-fat salty snacks showed higher availability rates—approximately 90% for both middle and high school students. Fruits and vegetables were much less likely to be made available through vending machines. About one fifth of secondary students had nonfresh (dried or canned) fruit available, with lower rates for fresh fruit and vegetables.

Associations Between Profits, Commercial Involvement, and Vending LNED Food Availability

Table 2 presents the results of bivariate percentages and adjusted odds ratios from multivariate

Table 1. **Percentages of Students in US Public Secondary Schools With Food Vending Machines: Profits, Commercial Involvement, and Snack Food Prevalence, 2007-2012**

	Middle School			High School			
	N Schools*	% Students†	(SE)	N Schools	% Students	(SE)	p‡
Independent variables							
School receives profits from vending machine sales	488	79.5	(2.2)	1043	88.2	(1.2)	**.000**
District receives profits from vending machine sales	475	38.2	(2.7)	1023	37.8	(1.8)	.899
Company sells food items in vending machines	495	83.5	(1.9)	1056	84.1	(1.3)	.792
School receives incentives§	409	19.7	(2.2)	878	21.7	(1.5)	.455
School receives percentage of food sales receipts§	408	72.9	(2.5)	876	74.5	(1.7)	.592
Supplier has major "say" in food items offered§	412	28.7	(2.7)	886	29.2	(1.8)	.892
Dependent variables							
Low-nutrient, energy-dense (LNED) snacks							
Candy	489	38.3	(2.8)	1048	46.2	(2.0)	**.024**
Regular fat salty snacks‖	490	50.0	(2.6)	1050	53.8	(1.9)	.258
Regular fat baked goods¶	488	48.2	(2.7)	1049	53.7	(1.9)	.095
Low-fat snacks							
Low-fat salty snacks#	489	89.2	(1.6)	1043	91.9	(0.9)	.126
Low-fat baked goods**	487	66.1	(2.5)	1047	71.9	(1.5)	**.042**
Fruits and vegetables							
Fresh fruit	489	14.8	(1.9)	1047	18.9	(1.5)	.105
Other fruit††	488	19.1	(2.0)	1044	20.4	(1.4)	.599
Vegetables‡‡	490	13.2	(1.8)	1048	15.1	(1.3)	.389

*Unweighted N of school cases.
†Weighted percentage of all students attending US public schools with the specified variable in schools with food vending machines.
‡p values from bivariate Rao-Scott chi-square test of differences between middle and high school prevalence estimates. p values below .05 are bolded to highlight significance.
§Reported only if a company was reported to sell food items in vending machines.
‖Salty snacks that are not low in fat, such as regular potato chips.
¶Cookies, crackers, cakes, or other baked goods that are not low in fat.
#Low-fat salty snacks, such as pretzels, baked chips, or other low-fat chips.
**Low-fat cookies, crackers, cakes, pastries, or other low-fat baked goods.
††Other fruit (such as dried or canned fruit).
‡‡Vegetables (such as carrot sticks or celery sticks).

models investigating relationships between profit and commercial involvement measures and LNED food availability. The columns labeled ''% Without'' and ''% With'' present unadjusted percentages of students with food item availability in schools with and without the various profit and commercial involvement measures. For example, among middle schools that *did not* receive any profits from vending machine food sales, vending machine candy was available to 22% of students. In contrast, among middle schools that *did* receive some type of vending machine profits, 42% of students had candy available in the venue.

Evidence was found for a significant and positive association with LNED food availability and school profit, commercial suppliers, commercial incentives, and commercial receipts. Supplier ''say'' was dramatically associated with a higher likelihood of LNED foods. For both middle and high school students, each LNED food item type showed significantly higher availability in schools with supplier say than in schools that had a commercial supplier but the supplier did not have a major say in vending machine food item selection. District profit was associated with significantly lower candy availability for middle school students, but did not show evidence of associations with any LNED food items for high school students.

Associations Between Profits, Commercial Involvement, and Vending Low-Fat Snack Food Availability

None of the profit or commercial involvement measures examined in the current analyses showed significant associations with low-fat snack food availability for either middle or high school students (data not shown).

Associations Between Profits, Commercial Involvement, and Vending Fruit and Vegetable Availability

Table 3 shows that having a commercial supplier was associated with significantly lower fruit and vegetable availability for both middle and high school students, and supplier say was also associated with lower availability for middle school students. District profit was associated with significantly higher fruit and vegetable availability for high school students; no significant associations were observed for middle school students, but the associations were in the same direction. School profits, commercial incentives, and commercial receipts were not significantly associated with vending machine fruit and vegetable availability.

DISCUSSION

This study found that two thirds of high school and one third of middle school students attended schools

Table 2. **Associations Between Profits, Commercial Involvement, and Vending Low-Nutrient, Energy-Dense (LNED) Snack Food Availability Among Students in US Public Secondary Schools With Food Vending Machines, 2007-2012**

	Middle School Students					High School Students				
	% Without*	% With†	AOR‡	(95% CI)	p	% Without	% With	AOR	(95% CI)	p
School receives profit										
Candy	22.2	42.2	2.22	(1.19-4.11)	**.012**	30.8	48.7	1.61	(0.97-2.68)	.066
Regular salty snacks§	42.4	52.0	1.36	(0.81-2.28)	.248	39.4	56.0	1.71	(1.09-2.68)	**.020**
Regular baked goods‖	36.9	51.5	1.93	(1.15-3.25)	**.013**	43.7	55.4	1.42	(0.93-2.19)	.107
District receives profit										
Candy	46.1	25.2	0.39	(0.24-0.65)	**.000**	48.0	43.3	0.91	(0.67-1.24)	.539
Regular salty snacks	51.8	46.1	0.89	(0.59-1.34)	.568	54.4	52.6	1.00	(0.74-1.34)	.981
Regular baked goods	51.3	43.8	0.78	(0.51-1.17)	.229	55.1	51.4	0.89	(0.65-1.20)	.440
Company supplies food items										
Candy	17.2	42.4	3.49	(1.70-7.19)	**.001**	33.4	48.7	1.92	(1.23-3.00)	**.004**
Regular salty snacks	47.4	50.6	1.18	(0.67-2.07)	.574	48.0	55.0	1.33	(0.91-1.94)	.144
Regular baked goods	35.2	50.8	1.96	(1.13-3.39)	**.016**	49.1	54.8	1.24	(0.84-1.84)	.276
Among schools with company supplier:										
School gets incentives										
Candy	41.0	47.0	1.21	(0.72-2.05)	.469	47.0	55.9	1.52	(1.04-2.23)	**.031**
Regular salty snacks	49.9	51.1	0.97	(0.58-1.63)	.914	52.5	63.8	1.61	(1.11-2.34)	**.012**
Regular baked goods	49.9	53.8	1.12	(0.66-1.90)	.683	53.5	59.5	1.25	(0.86-1.82)	.250
School gets specified percentage of sales										
Candy	25.2	48.6	2.70	(1.53-4.78)	**.001**	36.4	52.7	1.64	(1.11-2.43)	**.014**
Regular salty snacks	43.6	53.0	0.98	(0.54-1.77)	.276	48.3	57.1	1.24	(0.86-1.78)	.254
Regular baked goods	39.6	55.2	1.99	(1.22-3.27)	**.006**	48.4	57.0	1.30	(0.91-1.85)	.155
Supplier has major "say" in food items offered										
Candy	32.2	67.5	4.88	(2.86-8.33)	**<.0001**	39.7	69.9	3.35	(2.25-5.01)	**<.0001**
Regular salty snacks	43.7	67.8	2.74	(1.61-4.66)	**.000**	46.0	75.9	3.73	(2.59-5.38)	**<.0001**
Regular baked goods	43.4	69.0	2.85	(1.72-4.72)	**<.0001**	46.7	73.5	3.03	(2.10-4.39)	**<.0001**

AOR, adjusted odds ratio; CI, confidence interval. Middle school model Ns (unweighted) range from 402 to 490 school cases; high school model Ns (unweighted) range from 869 to 1049 school cases. All cases weighted to represent the percentage of target grade *students* with specified outcomes or conditions.

*Unadjusted percentage of students attending US public schools *without* the specified vending machine practice and *with* the specified snack item.

†Unadjusted percentage of students attending US public schools *with* the specified vending machine practice and *with* the specified snack item.

‡All models controlled for student body racial/ethnic composition, student body free and reduced-price lunch eligibility, total school enrollment, population density, region, and year. High school models also controlled for grade. p values below .05 are bolded to highlight significance.

§Salty snacks that are not low in fat, such as regular potato chips.

‖Cookies, crackers, cakes, or other baked goods that are not low in fat.

with student-accessible food vending machines. In such schools, vending machine profits and commercial involvement were significantly associated with the availability of 2 specific food types: LNED foods, as well as fruits and vegetables. No associations were observed for low-fat snack items (salty snacks or baked goods). The following patterns were observed: (1) school profits were associated with increased LNED food availability; (2) district profits were associated with decreased middle school LNED food availability and increased high school fruit and vegetable availability; (3) having a company supplier was associated with increased LNED food availability and decreased fruit and vegetable availability; and (4) supplier say in vending food item selection was associated with increased LNED food availability and decreased middle school fruit and vegetable availability.

The impact of changes to the food vending environment associated with implementing the new competitive food nutrition standards will clearly be felt more strongly at the high school than middle school level given availability levels of food vending machines. However, if food vending was present, few substantive differences in the prevalence and influence of profits and commercial involvement were observed between the middle and high school levels, indicating that such schools may experience similar challenges with nutrition standard implementation given that the new food standards do not vary by grade level.[1]

This study indicates that receiving any school profits as well as schools receiving commercial incentives and receipts were associated with increased LNED availability. This association raises the issue of changes in overall revenue that may be associated with changes in the types of food and beverage items approved under the new standards. Although some studies have shown that schools can limit the number or size of LNED food items or increase the number of low-fat snack options without negatively impacting overall revenue,[20-22] others indicate that revenue loss may accompany improved food vending nutrition standards.[23] The essential question is whether the availability, variety, and appeal of products meeting the new standards

Table 3. **Associations Between Profits, Commercial Involvement, and Vending Fruit/Vegetable Snack Food Availability Among Students in US Public Secondary Schools With Food Vending Machines, 2007-2012**

	Middle School Students					High School Students				
	% Without*	% With†	AOR‡	(95% CI)	p	% Without	% With	AOR	(95% CI)	p
School receives profit										
Fresh fruit	14.9	14.9	0.76	(0.37-1.57)	.465	21.1	18.4	0.87	(0.50-1.51)	.615
Other fruit§	18.3	19.5	1.03	(0.52-2.05)	.934	24.3	20.0	0.79	(0.49-1.26)	.322
Veggies‖	12.9	13.3	0.78	(0.37-1.66)	.519	16.7	14.8	0.78	(0.44-1.41)	.415
District receives profit										
Fresh fruit	14.0	17.3	1.36	(0.74-2.48)	.320	14.7	25.2	1.92	(1.36-2.71)	**.000**
Other fruit	19.6	20.0	0.93	(0.53-1.65)	.811	19.0	23.4	1.22	(0.87-1.73)	.251
Veggies	13.0	14.5	1.27	(0.67-2.40)	.460	12.1	19.9	1.79	(1.22-2.61)	**.003**
Company supplies food items										
Fresh fruit	21.9	13.5	0.55	(0.27-1.15)	.110	30.6	16.7	0.44	(0.28-0.68)	**.000**
Other fruit	32.7	16.5	0.40	(0.21-0.75)	**.004**	28.2	19.0	0.57	(0.38-0.88)	**.011**
Veggies	20.6	11.7	0.49	(0.24-1.00)	**.050**	26.9	12.9	0.36	(0.23-0.57)	<**.0001**
Among schools with company supplier:										
School gets incentives										
Fresh fruit	14.1	11.8	0.74	(0.34-1.65)	.467	16.9	16.7	0.94	(0.58-1.51)	.798
Other fruit	17.2	13.0	0.77	(0.35-1.69)	.521	19.6	17.9	0.88	(0.56-1.37)	.560
Veggies	12.6	9.1	0.65	(0.26-1.58)	.340	12.8	13.5	0.99	(0.60-1.63)	.975
School gets specified percentage of sales										
Fresh fruit	17.3	11.5	0.55	(0.26-1.14)	.107	20.3	15.7	0.75	(0.49-1.13)	.167
Other fruit	19.3	14.3	0.68	(0.35-1.34)	.270	22.8	17.9	0.79	(0.52-1.20)	.263
Veggies	14.6	10.1	0.58	(0.27-1.28)	.179	14.0	12.7	0.87	(0.54-1.39)	.561
Supplier has major "say" in food items offered										
Fresh fruit	16.4	6.5	0.34	(0.13-0.87)	**.024**	16.7	16.4	0.97	(0.63-1.51)	.902
Other fruit	17.7	13.7	0.74	(0.35-1.54)	.419	18.6	20.4	1.13	(0.77-1.65)	.531
Veggies	14.2	5.8	0.35	(0.14-0.88)	**.026**	11.8	15.8	1.34	(0.86-2.11)	.199

AOR, adjusted odds ratio; CI, confidence interval. Middle school model Ns (unweighted) range from 403 to 490 school cases; high school model Ns (unweighted) range from 865 to 1044 school cases. All cases weighted to represent the percentage of target grade *students* with specified outcomes or conditions.

*Unadjusted percentage of students attending US public schools *without* the specified vending machine practice and *with* the specified snack item.

†Unadjusted percentage of students attending US public schools *with* the specified vending machine practice and *with* the specified snack item.

‡All models controlled for student body racial/ethnic composition, student body free and reduced-price lunch eligibility, total school enrollment, population density, region, and year. High school models also controlled for grade. p values below .05 are bolded to highlight significance.

§Other fruit (such as dried or canned fruit).

‖Vegetables (such as carrot sticks or celery sticks).

will meet student demands, or if students will spend fewer dollars on in-school competitive venue food purchases.[1]

Receiving school profits from vending machines was associated with increased LNED availability, but district profits were associated with lower middle school LNED availability and with increased high school fruit and vegetable availability. This study does not provide data to explain this association; however, district profits may be an indicator of increased district involvement with vending contract terms and conditions. Previously published recommendations to promote nutritious and healthy school food and beverage vending options have included a strong focus on district involvement,[24] including consolidation of vending operations at the district level to improve efficiency and ensure compliance; contractual language ensuring district control over item selection as well as number and placement of vending machines; payment of sponsorship fees and commission rates to the district; district control over advertising and enforceability of all contract terms and conditions, etc.

Commercial involvement with item provision and item selection were associated with increased LNED availability and decreased fruit and vegetable availability. Studies looking to increase student selection of healthier vending machine foods and beverages have found that commercial involvement is associated with lower levels of collaboration;[25] commercial organizations are hesitant to change product selection and risk student demand and associated income. Previous voluntary agreements by commercial food suppliers to limit sales of unhealthy foods and beverages in schools prior to the new nutrition standards have had limited effectiveness in part due to limited monitoring and enforcement.[26] The new standards include record-keeping requirements documenting compliance, but final issues related to who is responsible for record-keeping, ensuring compliance, and enforcing penalties for noncompliance have not yet been addressed; the USDA indicates these issues will be covered in a forthcoming proposed rule.[1] Presently, the recommendation is that planning and cooperation may be best facilitated by local wellness policy designee(s) working

together with local educational agencies and school food authorities. The findings from the current analyses clearly indicate that caution should be exercised when considering allowing supplier say in decisions related to food selection or compliance confirmation.

Healthy People 2020 objectives specifically call for increases in not only the variety and contribution of fruits and vegetables to American diets, but also the proportion of school districts that require fruits or vegetables to be available wherever other food is offered or sold in schools.[27] The new nutrition standards do not include this requirement. Instead, competitive foods must meet specific nutrient standards and (1) be a whole grain-rich product; *or* (2) have as a first ingredient a fruit, vegetable, dairy product, or protein food; *or* (3) be a combination food with at least one fourth cup of fruit and/or vegetable, *or* (4) contain 10% of the daily value of 1 nutrient of public health concern (only through June 30, 2016). The new standards have been designed to closely align with existing guidelines such as those developed by the Alliance for a Healthier Generation;[28] one of the National Automatic Merchandising Association's (NAMA, Chicago, IL) Fit Pick® program provides a listing of snack foods that meet Alliance standards (Fit Pick Standard 35-10-35; available at fitpick.org). Whereas the listing clearly includes some fruit options such as fruit cups and dried fruits, the majority of items are baked or salty snacks. This study found that commercial food supplier involvement was not significantly related to low-fat snack availability. On the basis of this study, strong supplier say may continue to be associated with decreased fruit and vegetable availability.

Limitations

These findings are subject to limitations. The data are cross-sectional and preclude causal interpretation. Further, the data are based on school administrator responses to self-administered questionnaires, raising the possibility of social desirability bias and/or reporting error. To minimize social desirability bias, respondents were guaranteed that they and their schools would not be identified. To minimize response error, questionnaire directions called for different segments of the questionnaire to be completed by personnel most knowledgeable about the subject matter: principals for policy-related measures, and food service managers for food and beverage availability measures. In addition, follow-up calls were made to clarify incomplete or inconsistent responses.[19,29] Limitations notwithstanding, these analyses provide a picture of the relationships between commercial involvement, school food vending practices, and vending machine food item availability in a national sample of US public middle and high schools that may help inform school and district decisions as they prepare to implement the new competitive foods nutrition standards.

IMPLICATIONS FOR SCHOOL HEALTH

These findings have implications for 3 specific issues related to the implementation process: (1) degree of district involvement; (2) degree of supplier decision-making ability; and (3) consideration of what food items will replace vending machine LNED foods following implementation of the new nutrition standards. This study lends support for increased district involvement with school vending policies and practices given the negative association with LNED foods and the positive association with fruits and vegetables. This study also indicates that schools and districts should consider limiting the degree of supplier ''say'' as to what items are actually made available in student-accessed vending machines. Finally, the USDA nutrition guidelines do not pre-empt more stringent local or state policies related to school competitive venue nutrition standards.[1] School and district decision makers should consider meeting the *Healthy People 2020* objectives and require that fruits or vegetables be available wherever other food is offered or sold in schools.[27]

Conclusion

The 2013-2014 school year was one of preparation for implementing the new USDA competitive foods nutrition standards. An awareness of the current associations between commercial supplier involvement, school food vending practices, and school food vending item availability may assist schools in preparing for the new standards.

Human Subjects Approval Statement

Ethical approval was obtained from the University of Michigan Behavioral Sciences Institutional Review Board.

REFERENCES

1. US Department of Agriculture. National School Lunch Program and School Breakfast Program: nutrition standards for all foods sold in school as required by the Healthy, Hunger-Free Kids Act of 2010—interim final rule. *Fed Regist*. 2013;78:39068-39120.
2. O'Toole TP, Anderson S, Miller C, Guthrie J. Nutrition services and foods and beverages available at school: results from the School Health Policies and Programs Study 2006. *J Sch Health*. 2007;77(8):500-521.
3. Finkelstein DM, Hill EL, Whitaker RC. School food environments and policies in US public schools. *Pediatrics*. 2008; 122(1):E251-E259.
4. Fox MK, Gordon A, Nogales R, Wilson A. Availability and consumption of competitive foods in US public schools. *J Am Diet Assoc*. 2009;109(2):S57-S66.

5. French S, Story M, Fulkerson J, Gerlach A. Food environment in secondary schools: a la carte, vending machines, and food policies and practices. *Am J Public Health*. 2003;93(7):1161-1167.
6. Pasch KE, Lytle LA, Samuelson AC, Farbakhsh K, Kubik MY, Patnode CD. Are school vending machines loaded with calories and fat: an assessment of 106 middle and high schools. *J Sch Health*. 2011;81(4):212-218.
7. Kakarala M, Keast DR, Hoerr S. School children's consumption of competitive foods and beverages, excluding a la carte. *J Sch Health*. 2010;80(9):429-435.
8. Larson N, Story M. Are 'competitive foods' sold at school making our children fat? *Health Aff*. 2010;29(3):430-435.
9. Story M, Nanney MS, Schwartz MB. Schools and obesity prevention: creating school environments and policies to promote healthy eating and physical activity. *Milbank Q*. 2009;87(1):71-100.
10. Institute of Medicine. *Nutrition Standards for Foods in Schools: Leading the Way Toward Healthier Youth*. Washington, DC: The National Academies Press; 2007.
11. Government Accountability Office. *Competitive Foods Are Widely Available and Generate Substantial Revenues for Schools*, GAO-05-563. Washington, DC: Government Accountability Office; 2005.
12. Anderson PM, Butcher KF. Reading, writing, and refreshments—are school finances contributing to children's obesity? *J Hum Resour*. 2006;41(3):467-494.
13. Peterson C. Competitive foods sales are associated with a negative effect on school finances. *J Am Diet Assoc*. 2011;111(6):851-857.
14. Gordon A, Crepinsek MK, Nogales R, Condon E. *School Nutrition Dietary Assessment Study-III: Volume I: School Foodservice, School Food Environment, and Meals Offered and Served*. Princeton, NJ: Mathematica Policy Research, Inc.; 2007.
15. Johnston LD, O'Malley PM, Terry-McElrath Y, Freedman-Doan P, Berglund PA. *Bridging the Gap: Complete Descriptive Statistics on Secondary Schools; School Years 2006-2007 through 2010-2011*. Ann Arbor, MI: Bridging the Gap Program, Survey Research Center, Institute for Social Research; 2011. Available at: http://www.bridgingthegapresearch.org/research/secondary_school_survey/. Accessed September 17, 2013.
16. Terry-McElrath YM, Turner L, Sandoval A, Johnston LD, Chaloupka FJ. Commercialism in US elementary and secondary school nutrition environments: trends from 2007-2012. *JAMA Pediatr*. 2014;168(3):234-242.
17. Terry-McElrath YM, O'Malley PM, Johnston LD. Factors affecting sugar-sweetened beverage availability in competitive venues of US secondary schools. *J Sch Health*. 2012;82(1):44-55.
18. Briefel RR, Wilson A, Gleason PM. Consumption of low-nutrient, energy-dense foods and beverages at school, home, and other locations among school lunch participants and nonparticipants. *J Am Diet Assoc*. 2009;109(2):S79-S90.
19. Johnston LD, O'Malley PM, Terry-McElrath YM, Freedman-Doan P, Brenner JS. *School Policies and Practices to Improve Health and Prevent Obesity: National Secondary School Survey Results, School Years 2006-07 and 2007-08*. Ann Arbor, MI: Bridging the Gap Program, Survey Research Center, Institute for Social Research; 2011. Available at: http://www.bridgingthegapresearch.org/_asset/984r22/SS_2011_monograph.pdf. Accessed September 17, 2013.
20. French S, Jeffery R, Story M, et al. Pricing and promotion effects on low-fat vending snack purchases: the CHIPS study. *Am J Public Health*. 2001;91(1):112-117.
21. Wharton CM, Long M, Schwartz MB. Changing nutrition standards in schools: the emerging impact on school revenue. *J Sch Health*. 2008;78(5):245-251.
22. Trevino RP, Pham T, Mobley C, Hartstein J, El Ghormli L, Songer T. HEALTHY study school food service revenue and expense report. *J Sch Health*. 2012;82(9):417-423.
23. Han-Markey TL, Wang L, Schlotterbeck S, et al. A public school district's vending machine policy and changes over a 4-year period: implementation of a national wellness policy. *Public Health*. 2012;126:335-337.
24. Ashe M, Feldstein LM, Graff S, Kline R, Pinkas D, Zellers L. Local venues for change: legal strategies for healthy environments. *J Law Med Ethics*. 2007;35:138-147.
25. Kocken PL, Eeuwijk J, van Kesteren NMC, et al. Promoting the purchase of low-calorie foods from school vending machines: a cluster-randomized controlled study. *J Sch Health*. 2012;82(3):115-122.
26. Mello MM, Pomeranz J, Moran P. The interplay of public health law and industry self-regulation: the case of sugar-sweetened beverage sales in schools. *Am J Public Health*. 2008;98(4):595-604.
27. US Department of Health and Human Services. *Nutrition and Weight Status Objectives: Healthier Food Access*. Washington, DC: US Department of Health and Human Services, Office of Disease Prevention and Health Promotion; 2013. Available at: http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=29. Accessed September 17, 2013.
28. Alliance for a Healthier Generation. *Competitive Foods and Beverage Guidelines: Alliance and USDA Interim Final Rule Comparison*. Available at: https://schools.healthiergeneration.org/_asset/px4rhh/13-6002_USDARuleKeyComp.pdf. Accessed September 17, 2013.
29. Johnston LD, Delva J, O'Malley PM. Soft drink availability, contracts, and revenues in American secondary schools. *Am J Prev Med*. 2007;33(4S):209-225.