

# Evaluating the Impact of a Connecticut Program to Reduce Availability of Unhealthy Competitive Food in Schools

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## ABSTRACT

**BACKGROUND:** This article seeks to inform state and local school food policies by evaluating the impact of Connecticut's Healthy Food Certification (HFC), a program which provides monetary incentives to school districts that choose to implement state nutrition standards for all foods sold to students outside reimbursable school meals.

**METHODS:** Food service directors from all school districts participating in the National School Lunch Program (NSLP) (N = 151) in Connecticut were surveyed about the availability of competitive foods before and after the 2006-2007 implementation of HFC. Food categories were coded as healthy or unhealthy based on whether they met the Connecticut Nutrition Standards. Data on NSLP participation were provided by the State Department of Education. Changes in NSLP participation and availability of unhealthy competitive foods in elementary, middle, and high schools were compared pre- and post-HFC across districts participating (n = 74) versus not participating (n = 77) in HFC.

**RESULTS:** On average, all districts in Connecticut reduced the availability of unhealthy competitive foods, with a significantly greater reduction among HFC districts. Average NSLP participation also increased across the state. Participating in HFC was associated with significantly greater NSLP participation for paid meals in middle school; however, implementing HFC did not increase overall NSLP participation beyond the statewide upward trend.

**CONCLUSION:** The 2006-2007 school year was marked by a significant decrease in unhealthy competitive foods and an increase in NSLP participation across the state. Participation in Connecticut's voluntary HFC further reduced the availability of unhealthy competitive foods in local school districts, and had either a positive or neutral effect on NSLP participation.

**Keywords:** schools; nutrition policy; competitive foods.

**Citation:** Long MW, Henderson KE, Schwartz MB. Evaluating the impact of a Connecticut program to reduce availability of unhealthy competitive food in school. *J Sch Health.* 2010; 80: 478-486.

Received on July 28, 2009

Accepted on March 23, 2010

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Facing an alarming increase in child and adolescent overweight in the United States, policymakers are seeking to improve the nutrition and physical activity environment of children, with a particular focus on the nutritional environment of schools.<sup>1,2</sup> Although efforts continue to improve the nutritional quality of foods sold in the National School Lunch Program (NSLP), recent emphasis has been placed on reducing the negative nutritional impact of “competitive foods.”<sup>3,4</sup> Competitive foods include all foods and beverages sold on school grounds that are not part of a federally supported meal (eg, à la carte foods sold in the cafeteria, vending machines, school stores, fundraisers).<sup>5</sup>

A Government Accountability Office (GAO) report found that 9 out of 10 US public schools in 2003-2004 sold competitive foods and documented a significant recent increase in these foods in middle schools.<sup>6</sup> Data from the third School Nutrition Dietary Assessment Study, a nationally representative survey of public schools conducted in 2004-2005, found that 40% of all students consume at least 1 competitive food item on a typical school day, increasing from 29% in elementary school to 55% in high school.<sup>7</sup> While competitive foods sometimes include fruit and vegetables, they are more often snack foods high in fat, sugar and salt, such as candy and full-fat potato chips.<sup>7-10</sup> There is evidence of a negative relationship between the availability of competitive foods and participation in the NSLP. The US Department of Agriculture (USDA) reported that à la carte revenue was inversely related to NSLP participation rates in a national sample of public schools from 2001.<sup>11</sup> Other studies have found that the availability of competitive foods is associated with negative nutritional choices, such as reduced consumption of milk, fruit, and vegetables and increased consumption of sweetened beverages and fried vegetables.<sup>12-14</sup> Conversely, national data from 2005 show that, compared to nonparticipants, NSLP participants are more likely to consume milk, fruit, and vegetables, and less likely to consume competitive foods, which are frequently calorie-dense and low in nutrients.<sup>7,15</sup>

Interventions aimed at improving the nutritional quality of competitive foods have had mixed results. Simply increasing availability of healthy choices may increase consumption of those items but may not significantly improve student diet overall if unhealthy competitive foods remain available in the school

environment.<sup>16-18</sup> Local and statewide policy changes restricting access to unhealthy competitive foods and increasing the availability of healthy alternatives have been effective at reducing consumption of unhealthy à la carte foods and potentially increasing NSLP participation.<sup>19-22</sup>

Despite the potential success of policy changes limiting the availability of unhealthy competitive foods, these changes have faced some resistance due to calls for local control of school policy and concern that improving the nutritional quality of competitive foods could lead to a reduction in food service revenue. Evaluating these concerns, a recent review by Wharton and colleagues suggests that lost revenue restricting the sale of unhealthy competitive foods may be offset by additional revenue from increased NSLP participation rates.<sup>23</sup>

The federal Child Nutrition and Women, Infants, and Children (WIC) Reauthorization Act of 2004 required that local school districts address nutrition guidelines for all foods available at school in their wellness policies by the beginning of the 2006-2007 school year with the objective of reducing childhood obesity. A review of more than 100 policies from around the country enacted by the 2006 deadline found that less than half included standards for à la carte foods and only 66% included standards for vending machine sales.<sup>24</sup> At the state level, a June 2006 review of the state policies addressing competitive foods conducted by the Center for Science in the Public Interest (CSPI) found that 45% of states had no policies on competitive foods beyond the minimal federal standards and that many other states had weak policies.<sup>25</sup> However, there is some evidence that school wellness policies are having an impact on participation in the NSLP and consumption of competitive foods. A national survey of food service directors conducted in 2007 by the School Nutrition Association found that improved nutrition standards for NSLP and competitive foods included in local school wellness policies resulted in either increased or unchanged NSLP participation rates and in reduced consumption of à la carte or vending food.<sup>26</sup>

Connecticut's Healthy Food Certification (HFC) seeks to improve school nutrition through the use of monetary incentives to encourage local school districts to adopt voluntary state nutrition standards for all food sold to students. As a result of Connecticut legislation that went into effect on July 1, 2006,

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The Yale Rudd Center for Food Policy and Obesity and the Robert Wood Johnson Foundation's Healthy Eating Research program provided support for this research. Susan Fiore and Avis Kelly at the Connecticut State Department of Education provided timely access to data and support for the food service survey; Ms. Fiore also provided significant editorial recommendations to the manuscript. Christopher Wharton, Ph.D., Sarah Novak, Ph.D., and other members of the Rudd Center for Food Policy and Obesity research team assisted with the fielding of the food service survey.

**Table 1. Comparison of Connecticut Healthy Food Certification (HFC) and Alliance for a Healthier Generation (Alliance) Snack Food Standards<sup>27,29,30</sup>**

	Portion Size	Fat*	Saturated Fat	Trans Fat	Sugar by Weight <sup>†</sup>	Sodium
<b>Snacks and Low-Fat and Fat-Free Dairy</b>						
HFC <sup>‡</sup>	1.25-8 oz (depending on item)	<35% of calories and 7 g per package	<10% of calories and 2 g per package	0 g	<35% and 15 g per package	<500 mg
Alliance	Elementary: 150 kcal Middle: 180 kcal High: 200 kcal (For snacks: If contains at least 1 of the following: 2 g fiber; or 5 g protein; or 10% daily value (DV) Vitamin A, C, E, folate, calcium, magnesium, potassium, or iron; or 1/2 serving (1/4 cup) fruit or vegetables)	<35% of calories	<10% of calories	0 g	<35%	<230 mg for snacks <480 mg for dairy
<b>Soups</b>						
HFC	1 cup	<7 g per serving	<2 g per serving	0 g	<15 g per serving	<1000 mg
Alliance	150 kcal (If contains at least 1 of the following: 2 g fiber; or 5 g protein; or 10% DV Vitamin A, C, E, folate, calcium, magnesium, potassium, or iron; or 1/2 serving (1/4 cup) fruit or vegetables)	<35% of calories	<10% of calories	0 g	<35%	<480 mg
<b>Fruit and Vegetables</b>						
HFC	½ cup minimum for quality fruits and vegetables (prepared and packaged without added fats sugars, or sodium) ½ cup maximum for vegetables or fruits with added fats 1.5 oz maximum for dried fruit	<35% of calories and 7 g per serving	<10% of calories and 2 g per package	0 g	<35% and 15 g per package	<500 mg
Alliance	150 kcal (If contains at least 2 of the following: 2 g fiber; or 5 g protein; or 10% DV Vitamin A, C, E, folate, calcium, magnesium, potassium, or iron; or 1/2 serving [1/4 cup] fruit or vegetables)	<35% of calories	<10% of calories	0 g	<35%	<480 mg
<b>À la Carte Entrée</b>						
HFC <sup>§</sup>	No larger than would normally be served as part of NSLP menu	<18 g per serving	<5 g per serving	0 g	<15 g per serving	<500 mg
Alliance	Meet NSLP menu item requirements	<35% of calories	<10% of calories	0 g	<35%	<480 mg

\*Both the HFC and Alliance standards exempt nuts, nut butters, and trail mix from the fat requirements. Zero trans fat allows products with ≤.5 g serving. HFC bans chemically altered fat substitutes.

<sup>†</sup>HFC standards apply to added sugar by weight and Alliance standards apply to total sugar by weight (exempting dried fruit without added sugar). HFC bans artificial sweeteners from all categories.

<sup>‡</sup>Includes salty snacks (chips, crackers, pretzels), cookies, cereals, nuts and nut butters, trail mix, jerky, baked items, frozen desserts, pudding, yogurt, smoothies, and cheese.

<sup>§</sup>Entrées served as part of the National School Lunch Program (NSLP) reimbursable on that day are exempt from additional requirements listed here.

school districts in the state that implement HFC are eligible to receive additional funding (10 cents per lunch, based on the total number of reimbursable lunches [paid, free, and reduced] served in the district in the prior school year) if the district certifies that all

food sold to students separately from reimbursable school meals (including à la carte, school stores, vending machines, fundraisers, etc) complies with the Connecticut Nutrition Standards.<sup>27</sup> By law, local boards of education or other appropriate governing

bodies for all districts in the state participating in the NSLP must vote each year to decide whether they will or will not follow the standards. Districts must file compliance forms with the Connecticut State Department of Education (SDE), which reviews nutrition information for all foods sold and conducts site visits in all participating districts to ensure compliance.<sup>28</sup> The Connecticut Nutrition Standards include specific limits on fat, sugar, and portion sizes for 5 food categories, including entrées, soups, fruits and vegetables, cooked grains, and snacks and desserts, which are similar to other competitive food standards, such as those published by the Alliance for a Healthier Generation (Table 1).<sup>27,29,30</sup>

The HFC statute originated in Public Act 06-63, An Act Concerning Healthy Food and Beverages in Schools, which is now codified as Sections 10-215 (a, b, e, and f) and 10-221p of the Connecticut General Statutes (CGS). This legislation also addressed the sale of beverages in Connecticut public schools (CGS Section 10-221q).<sup>27</sup> In contrast to the voluntary nature of HFC, these beverage standards are mandatory and apply to all districts in the state, limiting beverage sales at school to water (with no added sugar, sweeteners, artificial sweeteners, or caffeine), milk (with no artificial sweeteners and limits on sugar), nondairy milk (with no artificial sweeteners and limits on sugar, fat and saturated fat), 100% juice (with no added sugar, sweeteners, or artificial sweeteners), and beverages containing only water and juice (with no added sugar, sweeteners, or artificial sweeteners). Portion sizes of all beverages are limited to 12 fluid ounces, except for water.

This legislation went into effect on July 1, 2006 and HFC was launched during the 2006-2007 school year. Prior to this, a pilot study had been conducted from 2003 to 2005, in which 5 intervention schools implemented the Connecticut Nutrition Standards for snack foods, while 3 control schools made no changes in their snack offerings.<sup>31</sup> The change in snack foods was associated with an increase in NSLP participation (particularly among paid meal participants). Further, students in the pilot schools reported a decrease in consumption of low-nutrition foods at school without any compensatory increase in their consumption of those foods at home.<sup>32</sup>

This study was designed to evaluate the implementation and impact of the first year of statewide school nutrition legislation. Specifically, this research examines the relationship between district participation in HFC and changes in (a) categories of unhealthy snack à la carte competitive foods sold and (b) NSLP participation from the 2005-2006 (Baseline) to the 2006-2007 (Year 1) school year.

## METHODS

### Subjects

All public school sponsors in Connecticut which represent school districts or single schools and which participate in the NSLP or other federal school meal programs ( $n = 151$ ) were included. Private schools, charter schools, vocational schools, and Residential Child Care Institution sponsors were excluded from the study due to lack of demographic data and lack of geographic representation. During the first year of HFC in 2006-2007, 74 school districts meeting study criteria certified compliance with the Connecticut Nutrition Standards and received additional funding from the state; thus 74 certifying districts and 77 noncertifying districts were included in the analyses.

### Instruments

Surveys assessing the categories of healthy and unhealthy foods and beverages sold in both vending machines and in à la carte offerings were sent to the food service directors of the 151 school districts included in the study before and after implementation of HFC. The surveys were accompanied by a letter from the SDE explaining the purpose of the study. Food categories included in the survey were coded as healthy or unhealthy based on whether or not foods in the categories met the Connecticut Nutrition Standards. The survey included questions assessing availability of the following categories of unhealthy food in vending machines and à la carte separately at the elementary, middle, and high school levels: (1) candy; (2) cookies, crackers, cakes, pastries, or other baked goods not low in fat; (3) salty snacks that are not low in fat, eg, regular potato chips; (4) ice cream or frozen yogurt that is not low in fat. The survey items are similar to those used in an à la carte checklist recently validated by Hearst et al, which was based on food categories in the Centers for Disease Control and Prevention's (CDC's) School Health Policy and Practices survey.<sup>33</sup>

Although HFC certification required districts to eliminate the sale of unhealthy snacks in both vending and à la carte, this article focuses on the program's effect on availability of unhealthy à la carte snacks based on previous research that found a relationship between à la carte sales and NSLP participation and no relationship between unhealthy vending offerings and NSLP participation.<sup>34,35</sup> Unhealthy à la carte foods have also been found to be more widely available than vending snacks and to have a negative impact on student diet throughout the day.<sup>13,36-38</sup> Additionally, the districts in our sample had substantially lower availability of unhealthy vending snacks compared to widespread availability of unhealthy à la carte snacks at baseline.

Data on the number of students per school district eligible for free, reduced, or paid meals as well as the total number of lunches sold (lunch counts) in each

category during the Baseline year and Year 1 were obtained from the SDE. Annual percent participation in each program was calculated by dividing lunch counts by the number of potential meals, which was calculated as the number of students enrolled in the program in October of each school year times the state-mandated 180 operating days. Change in percent participation was calculated by subtracting the Baseline year percent participation from Year 1.

A composite district-level demographic variable created by the SDE was used to examine demographic factors that may influence food service operations and student food choices. The SDE classifies districts into 9 District Reference Groups (DRGs) from low-need (A) to high-need (I) districts. Factors included in the composite DRG measure include median family income, percentage of families below the poverty level, percentage of parents with a bachelor's degree, percentage of families in white collar or managerial positions, percentage of children living with a single parent, percentage of children whose parents speak a language other than English at home, percentage of children eligible for free- or reduced-price meals, and district enrollment.<sup>39</sup> District-level demographics were also secured from the SDE and the US Census. For the present analyses, DRG was divided into tertiles: the lowest 3 categories were grouped together, as were the middle 3, and the highest 3. Groupings were created to simplify interpretation of analyses.

### Procedure

The first round of surveys mailed in spring 2006 (Baseline year) generated 151 responses out of 151 districts surveyed. A follow-up survey sent in spring 2007 (Year 1) with a reminder sent in the fall to nonrespondents, resulted in 104 responses (69% response rate). Year 1 survey responders and

nonresponders did not differ on measures of district-level demographics or the number of categories of unhealthy food sold in schools the year prior to HFC implementation; however, responders were more likely to have participated in HFC than nonresponders ( $\chi^2 = 6.12$ ,  $DF = 1$ ,  $p = .013$ ).

### Data Analysis

Sample sizes for each set of analyses varied due to (a) less than 100% response rate for the food service director survey at Year 1; (b) some districts not containing schools at 1 or more of the school levels; (c) exclusion of school districts that did not sell any à la carte items at either time period; and (d) missing data from the state on NSLP participation. Final sample sizes for each analysis are noted where appropriate.

Demographics of districts participating in HFC and not participating in HFC were compared using *t*-tests. For these comparisons, total  $N = 151$  districts.

Mean changes in the number of categories of unhealthy foods sold à la carte were compared by participation in HFC using repeated measures analysis of variance with time (Baseline—Year 1), HFC participation, and DRG (tertiles) as factors; analyses were conducted separately for elementary ( $n = 77$ ), middle ( $n = 74$ ), and high school levels ( $n = 70$ ). DRG is included to explore any potential interaction effects of socioeconomic status with HFC's impact over time.

Repeated measures multivariate analysis of variance was used to assess the effect of HFC on NSLP free, reduced, and paid meal participation data over time. A 2 (HFC vs non-HFC)  $\times$  3 (DRG tertile)  $\times$  2 (Baseline vs Year 1) design was used with the 3 meal participation outcome variables; analyses were conducted separately for elementary ( $n = 133$ ), middle ( $n = 95$ ), and high school ( $n = 95$ ) levels. DRG is included to explore any potential interaction effects of

**Table 2. Comparison of District-Level Demographics and Baseline (2005-2006) Competitive Foods Offered by Participation in Healthy Food Certification**

	HFC Participants (n = 74) Mean (SD)	HFC Nonparticipants (n = 77) Mean (SD)
DRG <sup>†</sup>	4.78 (2.16)	4.44 (2.02)
Median family income	\$69,840 (15,811)	\$76,147 (26,018)
Percentage of the total population that falls below the poverty line, 2000	5.0 (3.8)	4.0 (3.8)
Percentage of adults without a high school diploma, 2000	14.1 (6.1)	12.9 (6.3)
Percentage of students eligible to receive free or reduced lunch, 2005-2006	17.4 (19.0)	13.7 (14.8)
Percentage of students who are white, 2005-2006	80.2 (23.4)	85.4 (17.2)
Total district enrollment, 2005-2006	3526 (3977)	3594 (3843)
Total district expenditure per pupil, 2005-2006	\$11,503 (1495)	\$11,615 (1874)
Unhealthy à la carte snack categories offered-Elementary, 2005-2006 <sup>‡</sup>	1.14 (0.93)	1.39 (1.08)
Unhealthy à la carte snack categories offered-Middle School, 2005-2006	1.54* (1.15)	1.98 (1.17)
Unhealthy à la carte snack categories offered-High School, 2005-2006	1.84* (1.03)	2.28 (1.11)

\*Difference between groups significant at  $p < .05$ .

<sup>†</sup>The Connecticut State Department of Education classifies districts into 9 District Reference Groups (DRGs) from low need (A) to high need (I), based on a composite measure of district demographics. For purposes of analysis, we have quantified these levels as 1 (low-need) through 9 (high need).

<sup>‡</sup>Food service directors responded to a survey asking if they served any of 4 unhealthy snack categories, including (1) candy; (2) cookies, crackers, cakes, pastries, or other baked goods not low in fat; (3) salty snacks that are not low in fat, eg, regular potato chips; and (4) Ice cream or frozen yogurt that is not low in fat.

socioeconomic status with change in NSLP participation over time.

## RESULTS

### Participation in HFC

Participating and nonparticipating districts did not differ in the Baseline year on measures of socioeconomic status, percentage of minority students, or district size (Table 2); however, participating districts reported offering on average 20% fewer categories of unhealthy à la carte snacks prior to HFC participation.

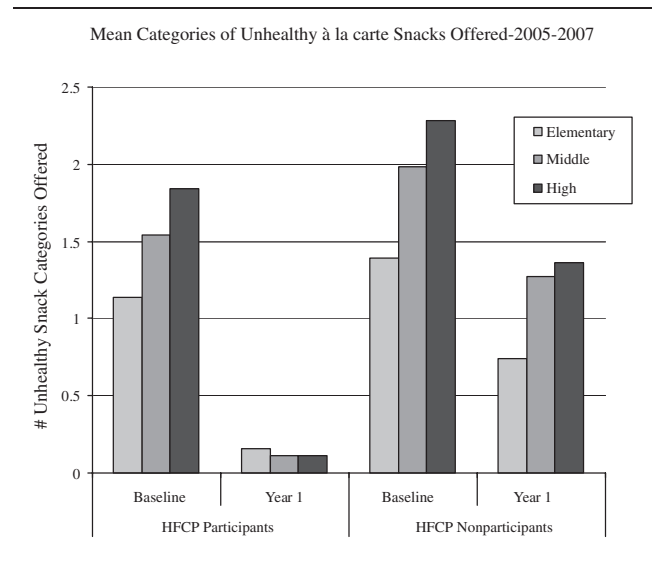
### Availability of à la Carte Snacks

The majority of elementary (77%), middle (80%), and high (83%) schools sold à la carte snacks during the 2 years assessed. None of the schools responding to the survey during both periods offered candy à la carte. Full-fat ice cream and frozen yogurt was the most commonly available unhealthy à la carte snack category in elementary schools, while both the ice cream and cookies, crackers, cakes and pastries categories were available in most middle and high schools at Baseline. On average, all districts reported a reduction in the number of unhealthy à la carte snack categories offered from the Baseline year to Year 1,  $F(1,71) = 41.127$ ,  $F(1,68) = 61.390$ , and  $F(1,64) = 89.310$ , for elementary, middle, and high schools, respectively,  $p < .001$  for all levels. However, HFC participation was related to a significantly greater decline in unhealthy categories offered in elementary and high schools (Figure 1),  $F(1,71) = 4.642$ ,  $p = .035$  and  $F(1,64) = 7.338$ ,  $p = .009$ , respectively. Middle schools showed a trend in this same direction,  $F(1,68) = 2.919$ ,  $p = .09$ . There were no additional significant interactions of HFC or DRG with time.

### NSLP Lunch Participation

NSLP participation increased generally from Baseline to Year 1 (Table 3), multivariate  $F(3,125) = 3.423$ ,

Figure 1. Mean Number of Categories of Unhealthy à la Carte Snacks Offered in Connecticut Schools



$F(3,87) = 9.226$ ,  $F(3,87) = 19.073$  for elementary, middle, and high schools, respectively,  $p < .02$  for all levels. These effects were most pronounced for paid meals  $F(1,125) = 6.996$ ,  $p = .009$  (elementary),  $F(1,87) = 13.067$ ,  $p < .001$  (middle), and  $F(1,87) = 51.352$ ,  $p < .001$  (high), except in middle schools where we observed the effect for reduced-price meals,  $F(1,87) = 14.488$ ,  $p < .001$ , and free meals,  $F(1,87) = 4.108$ ,  $p = .046$ , as well. While there were no consistent differences in the change in NSLP percent participation by HFC participation, the mean change in NSLP percent participation for paid meals in middle school was significantly greater in districts implementing HFC compared to those that were not,  $F(1,87) = 5.522$ ,  $p = .021$ . There were no interactions of DRG with change in NSLP participation over time.

Regardless of HFC status, NSLP participation rates were substantially lower among older students and

Table 3. Baseline and Year 1 District-Level National School Lunch Program (NSLP) Participation Rate by Participation in Healthy Food Certification

	HFC Participating Districts		Nonparticipating Districts	
	Baseline Mean (SD)	Year 1 Mean (SD)	Baseline Mean (SD)	Year 1 Mean (SD)
<b>Elementary (N = 133)</b>				
Free	85.95 (9.43)	83.55 (10.64)	81.87 (8.26)	82.94 (8.55)
Reduced	75.83 (12.76)	76.38 (12.43)	73.88 (9.58)	77.03 (10.11)
Paid	49.38 (12.13)	51.62 (11.07)	47.45 (10.65)	48.38 (10.81)
<b>Middle School (N = 95)</b>				
Free	80.01 (9.74)	81.09 (10.82)	77.10 (11.91)	81.17 (8.82)
Reduced	71.70 (14.77)	75.08 (11.87)	63.72 (17.19)	70.96 (13.60)
Paid	46.53 (15.09)	50.40 (13.12)	41.65 (14.79)	42.43 (14.97)
<b>High School (N = 95)</b>				
Free	64.15 (11.98)	64.87 (12.36)	62.32 (12.10)	63.18 (12.35)
Reduced	55.01 (13.94)	58.17 (13.56)	52.10 (14.73)	54.29 (15.96)
Paid	29.64 (13.13)	33.67 (14.03)	25.92 (12.58)	29.64 (13.63)

**Table 4. Correlation Between Number of Unhealthy Snack Offerings and National School Lunch Program (NSLP) Percent Participation**

	Pearson's <i>r</i> for Year 1 Unhealthy Snack Offerings and NSLP Participation	N	Pearson's <i>r</i> for Year 2 Unhealthy Snack Offerings and NSLP Participation	n
<b>Elementary</b>				
Free	0.04	69	-0.11	73
Reduced	-0.09	65	0.15	62
Paid	-0.11	73	-0.23*	72
<b>Middle School</b>				
Free	-0.05	53	-0.05	53
Reduced	-0.14	52	-0.21	50
Paid	-0.14	59	-0.40**	58
<b>High School</b>				
Free	0.08	56	-0.12	57
Reduced	-0.04	50	-0.27*	50
Paid	-0.02	61	-0.20	60

\*\*Significant at  $p < 0.01$ ; \* $p < 0.10$ .

among students required to pay for meals. In the 2006-2007 school year, 84% of eligible elementary school students participated in the free meal program, compared to 81% of eligible middle school students and only 64% of eligible high school students. Similarly, 77% of eligible elementary school students participated in the reduced-price meal program, compared to 73% of eligible middle school students and 56% of eligible high school students. Among students required to pay for the full cost of the school meal, only 50% of eligible elementary school students participated in the meal program, compared to 47% of eligible middle school students and 32% of eligible high school students.

In general, offering fewer unhealthy à la carte snack categories in a school district was correlated (Table 4) with higher participation in the district-level NSLP, but the relationship was generally not statistically significant. However, there was a significant correlation between greater unhealthy à la carte snack offerings and lower NSLP participation for paid meals in middle school during Year 2 and marginally significant correlations for paid meals in elementary school and reduced-price meals in high school in Year 2.

## DISCUSSION

Connecticut's voluntary program to reduce the sale of unhealthy competitive foods in its public schools achieved 50% participation among local school districts in its first year of operation. Although participating districts were on average slightly higher-need and offered slightly fewer unhealthy snack categories prior to joining, the program achieved broad representation among districts within the state. The balanced demographic and operational attributes of districts

allowed this study to quasi-experimentally evaluate the impact of HFC on competitive food offerings and NSLP participation.

Based on the survey of food service directors, the majority of districts continue to offer à la carte snack foods to their students, including students in elementary school. As such, HFC's focus on improving the health quality of à la carte foods targets a very prevalent and often detrimental aspect of the childhood food environment. The survey found that participation in HFC was significantly related to a greater decrease in the number of unhealthy à la carte snack categories offered to students in the cafeteria. Importantly, the average number of categories of unhealthy à la carte snacks offered also declined in districts that did not participate in HFC and did not receive financial incentives to reduce availability of unhealthy snack foods, although to a lesser degree than districts receiving financial incentives.

The decrease in unhealthy à la carte snack categories offered by school districts regardless of financial incentives offered under HFC may reflect changes in broader cultural attitudes about the school food environment and may be partially explained by the introduction in Year 1 of the study period of school wellness policies mandated by the federal government that address the quality of all food available at school. These broader cultural and policy changes may explain the average statewide increase in NSLP percent participation and may also explain why this study did not find a consistent difference in the change in NSLP percent participation based on HFC participation.

Increases in NSLP participation were most pronounced for paid meals at all school levels, with participation for free and reduced-price meals significant only at the middle school level. Of note, NSLP participation was higher at baseline among districts participating in HFC (potentially a result of the financial incentive structure), which may have created a ceiling effect in our analyses of year-over-year change. Middle schools saw the only significant time X HFC interaction effect on NSLP participation, which was specific to paid meals, and greater unhealthy snack offerings were associated with lower meal participation in middle school paid meals. Previous research has noted a negative nutritional transition during middle school, with Cullen et al. highlighting the potential influence of increasing availability of à la carte snacks in middle schools.<sup>12</sup> Gordon et al report a substantial drop in the proportion of NSLP participants nationally who report liking NSLP meals from elementary to middle school (from 56% to 35%), which remained stable from middle school into high school (32%).<sup>4</sup> Importantly, Cutler et al found that dietary patterns in adolescence remain relatively stable from middle to high school.<sup>40</sup> Taken together with our results, these findings suggest that the middle school setting represents an important

opportunity to prevent negative changes in dietary patterns that may persist into young adulthood by reducing availability of unhealthy à la carte snack foods and improving the quality of NSLP offerings.

### Limitations

This study faced challenges that may limit its ability to assess the role of HFC in changing the food environment in Connecticut's schools. While the study achieved 100% participation in the Baseline food service director survey, the study received responses from only 69% of directors in Year 1. Because HFC participants were more likely to respond to the second round of the survey than nonparticipants, the results regarding the greater reduction of unhealthy food categories offered by HFC participants may be biased. To test for the effect of nonresponse, the number of unhealthy snack categories offered in Year 1 among nonrespondents was imputed using Baseline responses. While the reductions in unhealthy snack categories were attenuated using imputed values, the decline in the number of unhealthy snacks offered by HFC participants remained significantly ( $p < .05$ ) greater than the decline in the number of unhealthy snack categories offered by HFC nonparticipants.

Also, although the survey measure of unhealthy snack categories captures the major types of unhealthy foods sold in schools, it masks potentially wide variability in the degree of change in the types of foods offered and the number of foods offered within each category. While major changes in the types of competitive foods sold may have increased consumption of NSLP meals, minor changes may have had little effect on competitive food sales. Also, although the survey captures changes in availability of à la carte snack items, it does not capture nutritional quality of à la carte entrees or side dishes. Additionally, the analysis assumes an average of 180 operating days to calculate NSLP participation, while the number of potential lunch periods in a school year varies somewhat between districts and school levels (elementary, middle, and high school), which may have reduced the accuracy of the measure of participation. This may in part explain the large standard deviations observed in our test of the effect of HFC participation on change in NSLP participation.

Future research should include sales data from competitive foods to determine whether students continue to buy the healthier foods from the schools or are substituting unhealthy foods from outside the school, which may limit the dietary impact of improvements in the quality of competitive food and reduce income to school food service programs. Researchers should also consider whether schools allow students to leave campus for lunch and how open campus policies interact with the proximity of fast food and other

retail food outlets to influence NSLP participation and à la carte sales in the lunch room. Our findings suggest focusing particularly on middle schools may be fruitful.

### Conclusion

This study found that Connecticut achieved a significant reduction in the availability of unhealthy à la carte snack foods with its voluntary HFC; however, districts not involved in HFC also reduced the availability of unhealthy à la carte snack foods. The study observed a statewide increase in NSLP participation consistent with the hypothesized effect of the reported improved health quality of à la carte foods. Participation in HFC had either a positive or neutral effect on NSLP participation. These results are consistent with emerging evidence that reducing the availability of unhealthy competitive foods can have a positive impact on revenue by increasing NSLP reimbursement.

### IMPLICATIONS FOR SCHOOL HEALTH

A recent CDC report tracking changes in the availability of unhealthy food and beverages in schools by state found that in the period after implementation of HFC and its mandatory beverage policy, Connecticut became one of the most effective states in the country at removing unhealthy food from secondary school environments.<sup>41</sup> Finding that soda and other sugar-sweetened beverages as well as unhealthy snack foods are still widely available nationally, the CDC called on schools to redouble efforts to reduce access to unhealthy food and beverages in schools. This report on Connecticut's efforts provides important information to state and federal policymakers, school officials, and public health professionals regarding the positive impact on state-level school nutritional environments that can be achieved by combining voluntary district-level nutrition standards with financial incentives tied to compliance.

### Human Subjects Approval Statement

This study was approved by the Yale institutional review board.

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