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Associations among School Characteristics and Foodservice Practices in a Nationally Representative Sample of U.S. Schools

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Abstract

Objective—Determine school characteristics associated with healthy/unhealthy foodservice offerings or healthy food preparation practices.

Design—Retrospective analysis of cross-sectional data.

Setting—Nationally representative sample of public and private elementary, middle and high schools.

Participants—526 and 520 schools with valid data from the 2006 School Health Policies and Practices Study (SHPPS) Food Service School Questionnaire.

Main Outcome Measure(s)—Scores for healthy/unhealthy foodservice offerings and healthy food preparation practices.

Analysis—Multivariable regression to determine significant associations among school characteristics and offerings/preparation practices.

Results—Public schools and schools participating in USDA Team Nutrition reported more healthy offerings and preparation than private or non-participating schools, respectively. Elementary schools reported less unhealthy offerings than middle or high schools; middle schools reported less unhealthy offerings than high schools. Schools requiring foodservice managers to have a college education reported more healthy preparation while those requiring completion of a foodservice training program reported less unhealthy offerings and more healthy preparation than schools without these requirements.

Conclusions and Implications—Results suggest the school nutrition environment may be improved by requiring foodservice managers to hold a nutrition-related college degree and/or

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successfully pass a foodservice training program, and by participating in a school-based nutrition program, such as USDA Team Nutrition.

Keywords

schools; food services; nutrition policy

INTRODUCTION

Childhood obesity has reached epidemic proportions in the United States (US) putting our nation's children at serious physical, metabolic, and psychological risk. Behavioral, environmental, genetic, and hormonal factors play significant roles in the development of childhood obesity¹. However, behavior and the environment appear to be the most significant but modifiable risk factors², implying that childhood obesity is largely preventable. Because the majority of children five years of age or older spend at least six hours per day in school and consume one, often two, and sometimes as many as three meals there³, the school environment is a natural choice for childhood obesity prevention efforts. Research from the US Department of Agriculture (USDA) Food and Nutrition Service suggests that schools have made significant strides in offering healthy meals that meet USDA requirements⁴. However, there is still room for improvement in increasing the dietary quality of these meals and protecting the nutritional integrity of schools⁴⁻⁶.

Engaging the cooperation of school foodservice (FS) personnel is essential to the success of school-based efforts to reduce childhood obesity. Foodservice managers are generally responsible for coordinating the daily operations of school cafeterias, ordering food, overseeing food preparation and distribution, and training employees. Hence, they are an important aspect of the school food environment and should be involved as collaborators in efforts to change this environment⁷. Despite this, little is known about how FS manager characteristics, such as education and training, may be associated with school nutrition environments.

School-based nutrition interventions have the potential to improve the nutritional health and dietary behaviors of children. Characteristics of successful school-based nutrition education programs include a behavioral focus, theory-driven strategies, family involvement, multi-component strategies, modifications of the school environment, teacher training, and are developmentally appropriate⁴. The USDA Team Nutrition initiative has these qualities. Team Nutrition is a comprehensive and integrative initiative that provides training and technical assistance for school personnel and nutrition education for children and their caregivers⁸. Schools are the focal point of Team Nutrition components; however, the initiative also involves parents and the community to improve school meals and advance the health education of children. While Team Nutrition has been used to evaluate children's eating habits⁹, little attention has been given to evaluating its effects on the school nutrition environment in terms of cafeteria or food preparation practices.

Despite the knowledge that the school food environment can have a significant impact on children's nutritional health, few studies have taken a comprehensive approach to assessing this environment. Therefore, the aim of this study was to determine school characteristics that were associated with healthy and unhealthy FS practices or healthy food preparation practices in a nationally representative sample of schools.

METHODS

School Health Policies and Practices Study

The School Health Policies and Practices Study (SHPPS) is a national survey periodically conducted by the Centers for Disease Control and Prevention to assess school health policies and practices at the state, district, school, and classroom levels ¹⁰. The most recent SHPPS survey was conducted in 2006 (SHPPS 2006), before the implementation of school wellness policies as required by the Child Nutrition and WIC Reauthorization Act of 2004 ¹¹. The school-level data used for this study was collected between February and May 2006 by computer-assisted personal interviews with designated faculty or staff in a nationally representative sample of public and private elementary, middle, and high schools. Respondents were the faculty or staff member with primary responsibility for or most knowledgeable about the respective school health program component ⁶. Questionnaires were designed to describe school-level policies and practices specific to each health program component, with an emphasis on practices ¹⁰. A more detailed description of SHPPS 2006 methodology can be found elsewhere ¹². This study involved secondary data analysis of publicly available de-identified datasets and therefore no institutional review board for human subjects was needed.

SHPPS assesses eight components of school health: health education, physical education and activity, health services, mental health and social services, nutrition services, healthy and safe school environment, faculty and staff health promotion, and family and community involvement. For this study, the nutrition services component was analyzed using individual items from the SHPPS 2006 Food Service School Questionnaire. The questionnaire is composed of 88 questions divided into eight categories: FS organization, menu planning and food ordering, food preparation, food variety and availability, school cafeterias, promotion, collaboration, and FS manager. The FS component questions demonstrated almost perfect reliability ¹³.

Data Analysis

All statistical analyses were performed using SAS® software, version 9.2 (SAS Institute Inc., Cary, NC, 2008). Factor analyses were run to determine if the chosen nutrition-related items represented a single dimension or if there were sources of variance representing different characteristics of the nutrition environment. The principal factors method with an oblique (promax) rotation was used to allow for correlation among factors, and retention of factor items was based upon item loadings > 0.30 ¹⁴ and Kaiser's Measure of Sampling Adequacy (MSA) > 0.50 ¹⁵. Internal consistency of the scales was assessed using Cronbach's α coefficients ¹⁶. Multivariable regression was conducted using the scores of the five scales resulting from the factor analyses as outcome variables and school characteristics as explanatory variables. School characteristics included level (elementary, middle, or high); type (public or private); enrollment number; participation in the National School Lunch Program (NSLP) (yes or no); participation in Team Nutrition (yes or no); group with primary responsibility for ordering food and for cooking food (district, school, or other [FS management company, fast food company, someone else, or no primary group]); FS manager (yes or no); minimum level of education for newly hired FS managers (none, high school/general equivalency diploma, or college [associate's degree, undergraduate degree, or graduate degree in nutrition or related field]); and successful completion of state-provided/sponsored FS training program (hereafter referred to as FS training program) for newly hired FS managers (yes or no). Initially, all school characteristics were entered simultaneously into each of the five scale models along with interaction terms for school type with enrollment, participation in NSLP and Team Nutrition, group primarily responsible for ordering food, FS manager education, and requirement for FS training

program. Variables were iteratively removed from the models (backward selection) until only those significant at the 0.05 level were retained in the final models. For significant explanatory variables with more than two levels, post hoc comparisons were made using Bonferroni correction factors to control overall significance at the 0.05 level. Survey procedures were used to compute frequencies, means, and their associated confidence intervals, and to perform the regression analyses. These procedures are tailored to account for the complex sampling design used in SHPPS 2006. Hence, results were based on weighted data and should be considered nationally representative of public and private elementary, middle, and high schools.

RESULTS

Factor Analysis

Based upon recommendations for Likert-type items¹⁶, factor analyses were run to determine if scales could be created from selected items on the Food Service School Questionnaire. Due to the content and format of the questions (yes/no versus never/rarely/sometimes/almost always or always), factor analysis was run on two separate sets of questions (Table 1). The first set consisted of 17 FS practice questions and included items 15-22, 42, 43, and 62b-d. Results based upon a scree plot suggested that two factors accounting for 53.3% and 44.4% of the variance were significantly distinct. Using the rotated factor solution, the first factor consisted of five items dealing with fried foods, salt, and butter and was labeled the Unhealthy Offerings Scale (Table 1). The second factor consisted of ten items dealing with fruits, vegetables, and the variety of foods offered and was labeled the Healthy Offerings Scale (Table 1).

The second set of items consisted of 22 healthy food preparation questions and included multi-part items 32-35. Results based upon a scree plot suggested the presence of two distinct factors accounting for 68.2% and 22.1% of the variance. Using the rotated factor solution, the first factor consisted of 11 items dealing with general low fat/low sodium food preparation practices (Table 1). The second factor consisted of eight items dealing with generally meat specific food preparation practices. These two factor solutions were considered subscales of a larger scale consisting of all 22 original items. This larger scale, labeled Healthy Preparation, was created because the initial factor solution indicated that all items were loading onto a single factor. Three of the items had relatively low factor loadings (0.24-0.27); however, they were retained because their individual MSA's were high (0.80). The first subscale was labeled Low Fat to designate its low fat/low sodium practices, while the second subscale was labeled Lean Meat to designate its meat specific practices.

Scale Scores

The three scales and two subscales created were scored by dividing the sum of the individual scale item responses by the total number of corresponding scale items to obtain average responses. For all scales and subscales, higher scores were indicative of a healthier food environment. The Healthy Offerings items consisted of yes/no responses coded 1/0 so that higher scores corresponded to higher occurrence of healthy practices. The Unhealthy Offerings items consisted of yes/no responses coded 0/1 so that higher scores corresponded to lower occurrence of unhealthy practices. The Healthy Preparation items consisted of never/rarely/sometimes/almost always or always responses coded 1/2/3/4 so that higher scores corresponded to greater frequency of use for healthy food preparation practices. All but one of the scales and subscales had sufficient internal consistency (Cronbach's $\alpha \geq .70$)¹⁶ with Cronbach's $\alpha = .75, .66, .85, .79$, and $.74$ for Healthy Offerings, Unhealthy Offerings, Healthy Preparation, Low Fat, and Lean Meat, respectively.

Multivariable Regression

Of the 944 schools who answered at least one question on the SHPPS 2006 Food Service School Questionnaire (70.6% response rate), nine state-administered schools were excluded from the analyses because they are not representative of a typical school environment due to the removal of the school administrators. Five schools were excluded because they did not offer lunch, and 121 schools were excluded because the questionnaire respondent was other than FS personnel (i.e. not a FS manager, commercial FS provider, or other school FS staff member). An additional 11 schools were excluded from Healthy Preparation and its subscales because the questionnaire respondent indicated he/she was unable to answer questions about food preparation procedures at the school. Other exclusions occurred due to missing values for items used to create the three scales. Hence, the final sample sizes were 526 schools for Healthy and Unhealthy Offerings and 520 schools for Healthy Preparation and its subscales. The following statistics are reported for the 520 school set only since the values were similar (< 5% difference) to the 526 school set. Of these schools, 75.5% were public and 24.5% were private with mean enrollments of 556 and 304 students, respectively. For school level, 45.7% were elementary, 31.3% were middle, and 23.0% were high schools. Overall, 87.1% of schools participated in NSLP with 98.5% and 51.5% of public and private schools participating, respectively. More than half of the schools (51.9%) participated in Team Nutrition, while 98.0% of the schools indicated they had a FS manager. Over three-fourths of the schools (80.2%) required a high school/general equivalency diploma for newly hired FS managers, 9.2% had no requirement, and 10.6% required a nutrition-related college degree. Over half of the schools (59.9%) required newly hired FS managers to successfully complete a FS training program. Approximately one-third (32.3%) of district and 44.7% of school staff were primarily responsible for ordering food while in 23.0% of schools the responsibility was given to some other group. Over three-fourths of the schools (82.5%) indicated their staff had primary responsibility for cooking food, while 17.5% indicated some other group had this responsibility. The Healthy Offerings and Unhealthy Offerings mean values were 0.77 and 0.65, respectively, indicating that on average, eight (0.77×10 items) of the ten healthy and only two [$5 - (0.65 \times 5)$] of the five unhealthy FS practices were evident in the schools (Table 2). The Healthy Preparation, Low Fat, and Lean Meat mean values were 3.06, 2.81, and 3.27, respectively, indicating that on average, healthy food preparation practices were being followed “sometimes” (Table 2).

The results of the multivariable regression analysis are presented in Table 2. Public schools scored significantly higher than private schools on Healthy Offerings and Low Fat. Unhealthy Offerings decreased significantly across all three school levels, indicating the occurrence of these unhealthy practices increased with increasing school level. Higher enrollment was significantly associated with higher Healthy Offerings (increase in score per 100 students = 0.01; data not shown). Schools participating in NSLP scored significantly higher on Unhealthy Offerings and Healthy Preparation, while schools participating in Team Nutrition scored significantly higher on Healthy Offerings, Healthy Preparation, and Lean Meat compared to schools not participating in these programs. Schools in which the district or some other group had primary responsibility for ordering food scored significantly higher on Healthy Offerings than schools in which their staff had this responsibility. Similarly, schools in which some other group had primary responsibility for cooking food scored significantly higher on Healthy Preparation and both its subscales than schools in which their staff had this responsibility. The presence of a school FS manager was not significant for any of the scales or subscales (data not shown), likely due to the overwhelming majority of schools with nutrition managers (98.0%). Schools requiring FS managers to have a college education scored significantly higher on Healthy Preparation and Lean Meat compared to schools with lower or no educational requirements. Schools requiring FS

training for their FS managers scored significantly higher on all but Healthy Offerings compared to schools without this requirement.

DISCUSSION

This is the first study to assess school characteristics associated with healthy and unhealthy FS practices or healthy food preparation practices in a nationally representative sample of both public and private US schools. Public schools reported more Healthy Offerings and higher frequencies of Healthy Preparation, particularly low fat/low sodium practices, than private schools. While this finding is interesting, no supporting data could be found in the literature. The more healthful nutrition environment observed in this study for public schools was not a surrogate for school size since this variable was independently significant for Healthy Offerings. It may be that private schools are not held to the same standards as public schools, not only in terms of academics, but also the nutrition environment. Also, lack of kitchen facilities or FS equipment at private schools may lead to more outsourcing of school meals to local restaurants and fast food franchises which could greatly impact FS and food preparation practices.

Elementary schools reported less Unhealthy Offerings than middle or high schools, while middle schools reported less Unhealthy Offerings than high schools. Others have also reported that the school food environment becomes progressively less healthy as children move from elementary to middle to high school because a larger variety of unhealthy items are offered^{17, 18}. One study reported that FS personnel believe their role at the middle and high school levels is to prepare students for the “real world” by education only through food choice (both healthy and unhealthy) and ultimately allowing students to make their own meal time decisions¹⁹. However, at the elementary level, there is less consideration of student choice and more concern with providing nutrition education and ensuring healthy eating¹⁹. Research has shown that students will choose to replace healthy foods such as fruits, vegetables, and milk with unhealthy foods such as high sugar/fat snacks and sugar-sweetened beverages when such items are available²⁰⁻²³. Hence, approaching nutrition education solely through offering a variety of healthy and unhealthy options at higher school levels may be insufficient and suggests the need for more formalized, less passive methods. Therefore, regardless of grade level, FS personnel should be trained to actively provide nutrition education (e.g. display posters and flyers that advertise healthy food choices, offer taste tests for new or unfamiliar foods) so that students may be empowered to make healthy choices during meal services.

Schools participating in NSLP reported less Unhealthy Offerings and higher frequencies of Healthy Preparation while schools participating in Team Nutrition reported more Healthy Offerings and higher frequencies of Healthy Preparation, particularly meat specific practices, than non-participating schools. These associations were not unexpected. Schools participating in NSLP are required to perform either nutrient content analysis of their lunches or use a food-based meal pattern for menu planning to ensure that they meet the nutritional requirements of this program⁸. The program’s upper limits for fat and saturated fat may be positively impacting unhealthy FS practices such as deep fried foods served at lunch and preparation practices such as skimming/draining fat from meat. This may also partially explain why public schools reported higher frequencies of Healthy Preparation than did private schools since NSLP participation was higher in public schools. Further, given that Team Nutrition involves an integrated approach to improve schools’ nutritional health through involvement of students, caregivers, school personnel, and the community it is not surprising that in the present study, schools participating in Team Nutrition reported the presence of eight healthy FS practices in their cafeterias while non-participating schools reported only seven.

Schools for which their district or some other group had primary responsibility for ordering food reported more Healthy Offerings than schools whose staff had this responsibility. Similarly, schools for which some other group had primary responsibility for cooking food reported higher frequencies of Healthy Preparation than schools whose staff had this responsibility. It is not clear why these differences were found and no supporting literature could be identified. Possible explanations could involve educational differences and buying power. Nutrition personnel in FS management companies and those at the school district level are often required to hold advanced degrees in food-related fields while this is less likely at the school level. Indeed, almost twice as many districts (19.1%) compared to schools (10.1%) required their FS managers to hold an associate's degree or higher in 2006⁶. Additionally, school districts and FS management companies are generally larger and thus have more buying power than individual schools. Hence, it may be more economical for these larger entities to purchase healthful foods. Further studies are needed to determine the cause for such disparity.

Schools requiring FS managers to have a college education reported higher frequencies of Healthy Preparation, particularly meat specific practices, than schools with lower or no education requirements. Schools requiring FS managers to successfully complete a FS training program reported less Unhealthy Offerings and higher frequencies of Healthy Preparation than schools without this requirement. The positive associations among a healthier school nutrition environment and FS manager education and training were also expected. Advanced dietary knowledge and training are likely to positively impact both the healthfulness of foods ordered and preparation practices followed. For example, research suggests educating school FS personnel about the health benefits of, how to identify, and strategies to promote and market whole-grain foods to children will facilitate the purchase and inclusion of such products in school meals^{24, 25}.

Limitations of this study include the cross-sectional and self-report nature of the data. Associations, but not causation, can be determined with cross-sectional data. As with all self-report data, the possibility of under- or over-reporting exists, particularly if the respondent lacked knowledge of the practices being addressed. We tried to minimize this limitation by including only those schools whose respondent was FS personnel in the analyses. Because of these exclusions and due to missing data, the datasets may no longer be nationally representative. Additionally, while urbanicity (rural or urban) and poverty (high or low) data were collected for the majority of the schools, it was missing for 216 private schools that were not assigned to a district (Brener N, oral communication, 2010). The lack of information concerning the presence of competitive foods in the schools is also a limitation. Finally, it is possible that US school nutrition environments are now healthier than they were when the most recent SHPPS data were collected due to the 2004 Child Nutrition and WIC Reauthorization Act¹¹. This act requires that all school districts with a federally-funded school meals program develop and implement wellness policies that address nutrition and physical activity by the start of the 2006-07 school year (after SHPPS 2006 was conducted).

IMPLICATIONS FOR RESEARCH AND PRACTICE

Results from this study suggest that public and private schools can improve their nutritional environment by requiring FS managers to hold a nutrition-related college degree and/or successfully complete a training program, and also by participating in a comprehensive school-based nutrition intervention program such as Team Nutrition. These modifications may be particularly relevant for private schools with formal FS programs as many do not qualify for federally assisted meal programs or the educational resources, assistance, and training associated with these initiatives. However, one of the greatest challenges for

improving school nutrition programs is increasing the professional qualifications of individuals who manage these programs⁶. Fortunately, the Child Nutrition Reauthorization Act of 2010 includes a provision that should help to ensure the nation's school nutrition programs are being managed by qualified personnel. Section 306 of this act requires that the Secretary of Agriculture "establish a program of required education, training, and certification for all school food service directors responsible for the management of a school food authority"²⁶. It is at the Secretary of Agriculture's discretion to establish the effective date for these requirements. Hence, until these federal standards are established and put into effect, school administrators should consider voluntarily setting minimum education and training standards for school nutrition personnel, in particular, the managers of these programs. Finally, for private schools without a formal FS program or an onsite FS manager, consulting with a registered dietitian regarding foods and beverages outsourced from local restaurants or vendors, coupled with a comprehensive nutrition education program, may be a viable and economical method to improve the school nutrition environment.

In summary, future investigations focused on improving school nutrition environments should consider targeting educational and training standards for FS personnel as well as encouraging participation in comprehensive school-based nutrition education programs. It remains to be determined which of these modifications will have the greatest impact on improving the nutritional environment of the nation's schools.

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REFERENCES

1. Ebbeling CB, Pawlak DB, Ludwig DS. Childhood obesity: public-health crisis, common sense cure. *Lancet*. 2002; 360:473–82. [PubMed: 12241736]
2. Dehghan M, Akhtar-Danesh N, Merchant AT. Childhood obesity, prevalence and prevention. *Nutrition Journal*. 2005; 4:24. [PubMed: 16138930]
3. US Department of Agriculture Food and Nutrition Service. [Accessed January 3, 2012] Child and Adult Care Food Program. <http://www.fns.usda.gov/cnd/care/CACFP/aboutcacfp.htm>
4. Story M. The third School Nutrition Dietary Assessment Study: findings and policy implications for improving the health of US children. *J Am Diet Assoc*. 2009; 109:S7–13. [PubMed: 19166675]
5. Martin CK, Thomson JL, LeBlanc MM, et al. Children in school cafeterias select foods containing more saturated fat and energy than the Institute of Medicine recommendations. *J Nutr*. 2010; 140:1653–60. [PubMed: 20668251]
6. O'Toole TP, Anderson S, Miller C, et al. Nutrition services and food and beverages available at school: Results from the School Health Policies and Programs Study 2006. *J Sch Health*. 2007; 77:501–21.
7. Budd GM, Volpe SL. School-based obesity prevention: Research, challenges, and recommendations. *J Sch Health*. 2006; 76:485–95. [PubMed: 17096821]
8. US Department of Agriculture Food and Nutrition Service. [Accessed January 3, 2012] National School Lunch Program. <http://www.fns.usda.gov/cnd/governance/regulations.htm>
9. Raidl MA, Spain K, Johnson S, et al. Team Nutrition classes can be used to determine children's eating habits. *J Nutr Educ Behav*. 2004; 36:101–2. [PubMed: 15068760]
10. National Center for Chronic Disease Prevention and Health Promotion, Division of Adolescent and School Health. School Health Policies and Practices Study (SHPPS). Accessed
11. Child Nutrition and WIC Reauthorization Act of 2004. 2004. p. S2507

12. Kyle TM, Brener ND, Kann L, et al. Methods: School Health Policies and Programs Study 2006. *J Sch Health*. 2007; 77:398–407. [PubMed: 17908100]
13. Brener ND, Kann L, Smith TK. Reliability and validity of the School Health Policies and Programs Study 2000 questionnaires. *J Sch Health*. 2003; 73:29–37. [PubMed: 12621721]
14. Costello AB, Osborne JW. Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research and Evaluation*. 2005; 10:1–9.
15. Kaiser HF, Rice J. Little Jiffy, Mark IV. *Educational and Psychological Measurement*. 1974; 34:111–7.
16. Gliem, JA.; Gliem, RR. Calculating, interpreting, and reporting Cronbach's alpha reliability coefficient for Likert-type scales. Midwest Research-to-Practice Conference in Adult, Continuing, and Community Education; Ohio State University, Columbus, Ohio. Midwest Research-to-Practice Conference in Adult, Continuing, and Community Education; 2003.
17. Delva J, O'Malley PM, Johnston LD. Availability of more-healthy and less-healthy food choices in American schools. A national study of grade, racial/ethnic, and socioeconomic differences. *Am J Prev Med*. 2007; 33(suppl 4):S226–39. [PubMed: 17884570]
18. Finkelstein DM, Hill EL, Whitaker RC. School food environments and policies in US public schools. *Pediatrics*. 2008; 122:e251–9. [PubMed: 18595970]
19. Nollen NL, Bafort CA, Snow P, et al. The school food environment and adolescent obesity: Qualitative insights from high school principals and food service personnel. *Int J Behav Nutr Phys Act*. 2007; 4:18. [PubMed: 17511873]
20. Cullen KW, Zakeri I. Fruits, vegetables, milk, and sweetened beverages consumption and access to a la carte/snack bar meals at school. *Am J Public Health*. 2004; 94:463–7. [PubMed: 14998815]
21. Gordon AR, Crepinsek MK, Nogales R, et al. School Nutrition Dietary Assessment Study-III. 2007; Vol. 1: School Foodservice, School Food Environment, and Meals Offered and Served www.fns.usda.gov/oane/MENU/published/cnp/FILES/SNDIII-Vol1.pdf. Accessed.
22. Kubik MY, Lytle LA, Hannan PJ, et al. The association of the school food environment with dietary behaviors of young adolescents. *Am J Public Health*. 2003; 93:1168–73. [PubMed: 12835204]
23. Templeton SB, Marlette MA, Panemangalore M. Competitive foods increase the intake of energy and decrease the intake of certain nutrients by adolescents consuming school lunch. *J Am Diet Assoc*. 2005; 105:215–20. [PubMed: 15668677]
24. Chu YL, Orsted M, Marquart L, et al. School foodservice personnel's struggle with using labels to identify whole-grain foods. *J Nutr Educ Behav*.
25. Roth-Yousey L, Barno T, Caskey M, et al. Whole-grain continuing education for school foodservice personnel: keeping kids from falling short. *J Nutr Educ Behav*. 2009; 41:429–35. [PubMed: 19879500]
26. Healthy, Hunger-Free Kids Act of 2010. 2010. 42 USC

Table 1

SHPPS 2006 Food Service School Questionnaire Items Included in the Factor Analyses

No.	Description	Scale
<i>Foodservice Items¹ (n=17)</i>		
20	Deep fried foods sold at lunch	UO
42a	Students able to get butter/margarine in serving line	UO
42b	Students able to get butter/margarine if ask for it	UO
43a	Salt available to students in serving line/tables	UO
43b	Salt available to students if ask for it	UO
Each day for lunch are students offered:		
15	1 appealing fruit	HO
16	1 appealing non-fried vegetable	HO
18	3 types of milk	HO
19a	2 entrees/main courses	HO
19b	2 non-fried vegetables	HO
19c	2 fruits or types of 100% fruit juice	HO
21	Students able to select a low-fat dressing	HO
22	Students offered 5 foods containing whole grain each week	HO
During past 12 months, has school		
62b	Provided students with nutrition information/caloric content of foods	HO
62c	Promoted healthy eating habits in cafeteria using posters/other material	HO
Each day for lunch are students offered:		
17	1 appealing low-fat/non-fat dairy product	None
During past 12 months, has school		
62d	Promoted healthy eating habits in school using posters/other material	None
<i>Healthy Food Preparation Items² (n=22)</i>		
During past 30 days, how often:		
32a	Non-stick spray/pan liners used instead of grease/oil	HP
32b	Vegetable oil used instead of shortening/butter/margarine	HP
35a	Potatoes boiled/mashed/baked rather than fried/deep fried	HP
32c	Part-skim/low-fat cheese used instead of regular	HP/LF
32d	Skim/low-fat/soy/non-fat dry milk used instead of whole	HP/LF
32e	Ground turkey/lean ground beef used instead of regular	HP/LF
32f	Cooked dried/canned/soy beans used instead of meat	HP/LF
32g	Low-sodium canned vegetables used instead of regular	HP/LF
32h	Other seasonings used instead of salt	HP/LF
32i	Low-fat/non-fat yogurt/mayonnaise/sour cream used instead of regular	HP/LF
33a	Amount of sugar reduced/low-sugar recipes	HP/LF
33b	Amount of fats/oils reduced/low-fat recipes	HP/LF
33c	Amount of salt reduced/low-sodium recipes	HP/LF
35c	Vegetables prepared without butter/margarine/cheese/creamy sauce	HP/LF
34a	Meat roasted/baked/broiled rather than fried	HP/LM

No.	Description	Scale
34b	Meat/poultry roasted on rack to drain fat	HP/LM
34c	Fat drained from browned meat	HP/LM
34d	Fat trimmed from meat/lean meat used	HP/LM
34e	Skin removed from poultry/skinless poultry used	HP/LM
34f	Solid fat spooned from chilled meat/poultry broth	HP/LM
34g	Fat skimmed off warm broth/soup/stew/gravy	HP/LM
35b	Other vegetables steamed/baked	HP/LM

SHPPS indicates School Health Policies and Practices Study; UO, Unhealthy Offerings; HO, Healthy Offerings; HP, Healthy Preparation; LF, low fat/low sodium HP subscale; LM, meat specific HP subscale.

¹Response categories = yes (0) or no (1) for UO; no (0) and yes (1) for HO.

²Response categories = never (1), rarely (2), sometimes (3), or almost always/always (4).

Table 2
Multivariable Regression Models for SHPPS 2006 Food Service School Questionnaire Scales

Overall				
Scale	n	Mean	95% CI	Range
HO	526	0.77	0.75 0.80	0 - 1
UO	526	0.65	0.61 0.69	0 - 1
HP	520	3.06	3.00 3.12	1 - 4
HP-LF	520	2.81	2.73 2.89	1 - 4
HP-LM	520	3.27	3.19 3.35	1 - 4

Public Schools					
Scale	n	Mean	95% CI	n	P
HO	442	0.80 a	0.78 0.83	84	0.65 b 0.70 <0.001
UO	442	0.68	0.64 0.72	84	0.54 0.47 0.62 NS
HP	419	3.13	3.08 3.19	101	2.83 2.68 2.98 NS
HP-LF	419	2.90 a	2.83 2.97	101	2.54 b 2.37 2.70 <0.001
HP-LM	419	3.33	3.25 3.41	101	3.08 2.89 3.27 NS

Private Schools					
Scale	n	Mean	95% CI	n	P
HO	170	0.76	0.72 0.79	186	0.78 0.75 0.81 170 0.80 0.76 0.83 NS
UO	170	0.76 a	0.70 0.81	186	0.59 b 0.54 0.64 170 0.49 c 0.45 0.53 <0.001
HP	150	3.06	2.97 3.15	173	3.04 2.95 3.13 197 3.08 3.00 3.16 NS
HP-LF	150	2.82	2.70 2.94	173	2.80 2.71 2.90 197 2.81 2.71 2.90 NS
HP-LM	150	3.27	3.13 3.40	173	3.23 3.11 3.35 197 3.33 3.22 3.44 NS

Elementary Schools					
Scale	n	Mean	95% CI	n	P
HO	482	0.78	0.75 0.81	41	0.70 0.62 0.78 NS
UO	482	0.67 a	0.63 0.71	41	0.42 b 0.35 0.49 <0.001
HP	458	3.09 a	3.03 3.16	58	2.83 b 2.61 3.05 0.039
HP-LF	458	2.86	2.78 2.94	58	2.52 2.27 2.76 NS
HP-LM	458	3.29	3.20 3.38	58	3.13 2.85 3.41 NS

Scale	Participation in USDA TN (Yes)			Participation in USDA TN (No)			P
	n	Mean	95% CI	n	Mean	95% CI	
HO	250	0.82 a	0.79 0.85	211	0.71 b	0.67 0.75	<0.001
UO	250	0.69	0.63 0.74	211	0.63	0.58 0.68	NS
HP	247	3.18 a	3.10 3.25	221	2.96 b	2.87 3.06	0.015
HP-LF	247	2.95	2.86 3.03	221	2.71	2.59 2.83	NS
HP-LM	247	3.40 a	3.29 3.51	221	3.16 b	3.04 3.29	0.003

Primary Responsibility for Ordering Food

Scale	District			School			Other			P
	n	Mean	95% CI	n	Mean	95% CI	n	Mean	95% CI	
HO	203	0.82 a	0.79 0.86	217	0.70 b	0.66 0.73	106	0.84 a	0.80 0.87	<0.001
UO	203	0.74	0.69 0.80	217	0.60	0.55 0.65	106	0.61	0.53 0.68	NS
HP	182	3.16	3.07 3.26	226	2.95	2.85 3.05	112	3.12	3.03 3.21	NS
HP-LF	182	2.97	2.87 3.08	226	2.68	2.57 2.79	112	2.84	2.71 2.98	NS
HP-LM	182	3.32	3.19 3.46	226	3.17	3.04 3.29	112	3.39	3.24 3.54	NS

Primary Responsibility for Cooking Food

Scale	School			Other			P
	n	Mean	95% CI	n	Mean	95% CI	
HO	446	0.76	0.73 0.79	80	0.83	0.79 0.88	NS
UO	446	0.66	0.62 0.70	80	0.60	0.51 0.69	NS
HP	436	3.03 a	2.96 3.10	84	3.19 b	3.08 3.29	<0.001
HP-LF	436	2.79 a	2.71 2.88	84	2.90 b	2.74 3.07	0.015
HP-LM	436	3.22 a	3.13 3.31	84	3.49 b	3.34 3.64	0.003

Food Service Manager Education

Scale	None			High School/GED			College			P
	n	Mean	95% CI	n	Mean	95% CI	n	Mean	95% CI	
HO	39	0.74	0.67 0.82	371	0.79	0.76 0.82	43	0.81	0.75 0.88	NS
UO	39	0.59	0.46 0.71	371	0.67	0.63 0.72	43	0.60	0.52 0.69	NS
HP	37	2.95 a	2.72 3.18	368	3.07 a	3.00 3.14	48	3.24 b	3.13 3.35	<0.001
HP-LF	37	2.63	2.32 2.94	368	2.85	2.77 2.94	48	2.88	2.71 3.06	NS
HP-LM	37	3.23 a	2.99 3.48	368	3.25 a	3.15 3.34	48	3.61 b	3.48 3.74	<0.001

Food Service Manager Training									
Scale	State Program (Yes)				State Program (No)				<i>P</i>
	<i>n</i>	Mean	95% CI		<i>n</i>	Mean	95% CI		
HO	312	0.79	0.76	0.82	193	0.75	0.72	0.79	NS
UO	312	0.69 a	0.64	0.74	193	0.59 b	0.54	0.65	0.0118
HP	310	3.12 a	3.05	3.19	193	2.95 b	2.85	3.06	0.0137
HP-LF	310	2.89 a	2.81	2.98	193	2.68 b	2.55	2.82	0.0024
HP-LM	310	3.33 a	3.23	3.43	193	3.16 b	3.03	3.28	0.0273

SHPPS indicates School Health Policies and Practices Study; CI, confidence interval; NS, not significant at the 0.05 level (dropped from regression model); HO, Healthy Offerings (10 items; higher scores indicate more practices reported); UO, Unhealthy Offerings (5 items; higher scores indicate less practices reported); HP, Healthy Preparation (22 items full scale; higher scores indicate practices used with higher frequency); HP-LF, low fat/low sodium HP subscale (11 items; higher scores indicate practices used with higher frequency); HP-LM, meat specific HP subscale (8 items; higher scores indicate practices used with higher frequency); NSLP, National School Lunch Program; TN, Team Nutrition; GED, general equivalency degree.

^{a/}Mean values and 95% confidence intervals are weighted, non-adjusted estimates; mean values with different letters are significantly different from one another using Bonferroni-adjusted significance levels; mean values without letters were not compared to one another due to the non-significance of the effect in the model.