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Food Safety Programs Based on HACCP Principles in School Nutrition Programs: Implementation Status and Factors Related to Implementation

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Please note that this study was published before the implementation of Healthy, Hunger-Free Kids Act of 2010, which went into effect during the 2012-13 school year, and its provision for Smart Snacks Nutrition Standards for Competitive Food in Schools, implemented during the 2014-15 school year. As such, certain research may not be relevant today.

ABSTRACT

Purpose/Objectives
The objectives of this study were to assess the extent to which school nutrition (SN) programs have implemented food safety programs based on Hazard Analysis and Critical Control Point (HACCP) principles, as well as factors, barriers, and practices related to implementation of these programs.
Methods
An online survey was developed and administered using SurveyMonkey. Survey invitation letters were mailed to 14,682 SN directors participating in SN programs, who were asked to distribute an additional invitation letter to SN managers, for a potential sample size of 29,364. Data analyses include descriptive statistics, exploratory factor analysis, and chi-square tests.
Results
A total of 2,716 participants (9.2%) responded to the online survey. Although the majority of directors and managers reported that their districts and schools, respectively, had implemented food safety programs based on HACCP principles, further assessment revealed that implementation of programs was often incomplete. Directors who had worked in SN programs for more than 20 years, school districts in the Southwest region, and larger school districts were all more likely to have implemented these programs. The top barriers to implementation were related to time, costs, and negative perceptions of food safety programs based on HACCP principles. The top practices important in implementing these programs were related to restricting ill employees from work with food, positive role modeling regarding food safety, ensuring that role expectations are understood, providing necessary training and materials, ensuring that programs are practical to apply, and gaining employee "buy-in" to programs.
Applications to Child Nutrition Professionals
Because the implementation of food safety programs based on HACCP principles is incomplete in many SN programs, there is a continued need for education and training related to this issue. Barriers to implementation and practices supporting implementation identified in this study can be used to guide education and training initiatives designed to support implementation at the local school district level.

INTRODUCTION

Food safety is a critical component of a healthy school environment. Each school day in 2007, more than 30.5 million children received meals through the National School Lunch Program (United States Department of Agriculture [USDA], 2010a), and more than 10.1 million children received meals through the School Breakfast Program (USDA, 2010b). Although the meals provided in schools are generally safe, analysis of Centers for Disease Control and Prevention (CDC) data showed that there

were 195 outbreaks of foodborne illness, affecting about 12,000 people, reported in schools from 1990 to 1999 (United States General Accounting Office [USGAO], 2003). The CDC data do not distinguish between illness due to foods from federal school meal programs and illness due to foods from other sources, such as students' homes. However, a follow up survey of state health officials indicated that of the 59 outbreaks involving 50 or more people, 40 outbreaks, affecting about 5,500 people, could be attributed to school meals (USGAO, 2003). Nineteen of the 40 outbreaks due to school meals resulted from improper food preparation and handling practices within the schools. To improve the safety of school meals, Section 111 of the Child Nutrition and WIC Reauthorization Act of 2004 (Public Law 108-265) required that school food authorities fully implement a food safety program for the preparation and service of school meals based on Hazard Analysis and Critical Control Point (HACCP) principles by the end of the 2005-2006 school year.

HACCP is "a preventative system to reduce the risk of foodborne illness through appropriate food handling, monitoring, and recordkeeping" (National Food Service Management Institute [NFSMI], 2006). HACCP programs include seven principles: 1) identify hazards, 2) identify critical control points, 3) establish critical limits, 4) establish monitoring procedures, 5) establish corrective actions, 6) establish verification procedures, and 7) establish recordkeeping procedures. The USDA has provided guidance to assist school food authorities in developing food safety programs based on HACCP principles (USDA, 2005). The USDA guidance document, titled "*Guidance for School Food Authorities: Developing a School Food Safety Program Based on the Process Approach to HACCP Principles (USDA Guidance)*," outlines requirements of a school food safety program, lists steps for developing a school food safety program, and provides sample materials, including sample standard operating procedures (SOPs), a sample food safety program, and sample forms for recordkeeping. School food safety programs that conform to the requirements outlined in the *USDA Guidance* are consistent with HACCP principles.

Although few studies are available documenting the extent of implementation of food safety programs based on HACCP principles in school nutrition programs, the available research suggests that implementation prior to the new law was limited. Early studies document HACCP implementation rates in schools to be in the range of 14% to 30%. For example, a study by Hwang, Almanza, and Nelson (2001) showed that 14% of Indiana school foodservice directors and managers had implemented a HACCP program. Similarly, Youn and Sneed (2002) found that 22% of school foodservice directors surveyed, representing both a national and Iowa sample, reported that they had implemented a comprehensive HACCP plan. Finally, Giampaoli, Sneed, Cluskey, and Koenig (2002) reported that 30% of a national sample of foodservice directors indicated that they had established HACCP programs. The most recent study identified, conducted by the NFSMI, found that 65% of a national sample of foodservice managers reported that their schools had begun implementing HACCP (NFSMI, 2005). No research was identified investigating the extent of HACCP implementation in schools after the 2006 implementation deadline.

The main purpose of this study was to assess the extent to which school nutrition (SN) programs have implemented food safety programs based on HACCP principles, as required by Section 111 of the Child Nutrition and WIC Reauthorization Act of 2004 (Public Law 108-265). In addition, implementation dates and factors related to implementation status were investigated. Finally, barriers and practices related to the implementation of school food safety programs based on HACCP principles were explored.

METHODOLOGY

Sample

The sample for this study consisted of SN directors and managers participating in SN programs. A mailing list for all SN directors (N = 14,848) participating in SN programs was purchased from Market Data Retrieval. Email addresses were not available, so survey invitation letters were mailed via the postal service to all SN directors. Each SN director was asked to self-select an SN manager in his or her district and distribute an additional survey invitation letter to this manager, resulting in a

potential sample size of 29,696. After 166 survey invitation letters were returned as undeliverable, the resulting final potential sample size was 29,364.

Research Instrument

The survey instrument for this research study was developed by the researchers based on the content of the*USDA Guidance* (USDA, 2005) and relevant publications in the professional literature (Giampaoli et al., 2002; Hwang, et al., 2001; NFSMI, 2005; Sneed & Henroid, 2003; Youn & Sneed, 2002, 2003). In addition, four USDA representatives provided input on survey scope, content, and wording on an ongoing basis during the survey development process. The survey was designed to be administered electronically and was developed using principles outlined by Dillman (2007) for Web survey development. SurveyMonkey, a web-based survey tool, was used to create and administer the survey. The initial online survey was pilot tested by eight USDA and state agency representatives. Only minor wording changes were made to the online survey instrument, based on the evaluations by pilot study participants.

The final online survey included six sections consisting of closed-ended questions and required approximately 20 minutes for participants to complete. Due to space limitations, the current paper reports on only part of the data collected in the complete survey. The survey began with a forced choice initial routing item asking that participants identify themselves as either an SN director or SN manager based on the title that best describes their professional position. From that item, participants were routed to a version of the survey designed for either directors or managers. The two versions of the survey contained the same six sections, with item wording and answer choices modified only minimally to be appropriate for either SN directors at the school district level or SN managers at the school level. Because the main research objective was to assess the extent to which SN programs had implemented food safety programs based on HACCP principles, the survey items assessing implementation status, which were the first items on the survey, required a response. Otherwise, the survey administration was structured such that participants could skip survey items that they chose not to answer but could not return to previous survey pages to modify submitted responses.

For the data presented in the current paper, SN directors and managers were asked to provide information about the implementation status of food safety programs based on HACCP principles at either the district or school level. Follow-up survey items requested information about the academic year when these programs had been implemented, whether implementation was complete, and the motivations for developing and implementing these programs. Motivations were assessed by asking participants to choose all that apply from a list of nine potential factors. Participants were also asked to rate their level of agreement with a set of 28 potential barriers to the development and implementation of food safety programs based on HACCP principles. Then, participants were asked to rate their level of agreement with 24 statements identifying practices important in the development and implementation of these programs. Finally, participants were asked to provide information about themselves and their districts or schools.

Data Collection

Survey invitation letters were mailed to SN directors, and each director was asked to distribute an additional letter to an SN manager in the district. Survey invitation letters provided instructions for completing the online survey, and included a Web address for accessing the secure online survey, with instructions for typing the Web address into the address field of a Web browser. A reminder postcard was sent to SN directors one week after the survey invitation letters were mailed. Participants were asked to complete the online survey within a three week time period; however, the survey remained open in SurveyMonkey for a four week period. No identifying information was collected during survey administration. The University of Southern Mississippi Institutional Review Board approved the study protocol and survey.

Data Analysis

Data were analyzed using the statistical package SPSS Version 17.0 for Windows. Descriptive statistics were computed for all appropriate variables, including means, standard deviations, and frequencies of total responses. Exploratory principal components factor analysis was performed on barriers to and practices important in implementing food safety programs based on HACCP principles, to determine if each set of items could be reduced to a smaller number of factors to allow

for comparisons in SN directors' and managers' perceptions. These factor analyses did not yield similar factors for directors and managers; thus, these data were analyzed using only descriptive statistics. Pearson chi-square tests were used to determine if selected program and personal characteristics for SN directors and school districts were associated with implementation status of food safety programs based on HACCP principles.

RESULTS AND DISCUSSION

Sample Characteristics

Survey invitation letters were mailed to 14,682 SN directors, after accounting for letters returned as undeliverable. Each SN director was asked to distribute an additional survey invitation letter to an SN manager in his or her district, resulting in a potential sample size of 29,364. A total of 2,716 participants responded to the online survey, for a response rate of 9.2%. Of the 2,716 respondents, 1,610 (59.3%) were SN directors and 1,106 (40.7%) were SN managers. Program and personal characteristics of SN directors and managers are provided in Table 1. The majority of directors and managers were female (88.3% and 96.9%, respectively), were 50 years of age or older (61.0% and 55.7%, respectively), and were ServSafe® certified (63.9% and 65.5%, respectively). The largest percentage of directors and managers had worked in SN programs for more than 20 years (28.8% and 23.2%, respectively).

Table 1. *Program and Personal Characteristics of School Nutrition Directors and Managers*

	Directors (n = 1,610)	**Managers (n = 1,106)**
Item	**Frequency (%)**	**Frequency (%)**
Certifications/Credentials[a,b]	n = 1,225	n = 649
ServSafe® certified	783 (63.9%)	425 (65.5%)
School Nutrition Association certified	457 (37.3%)	224 (34.5%)
Not certified/credentialed	238 (19.4%)	150 (23.1%)
State Department of Education certified	216 (17.6%)	65 (10.0%)

School Nutrition Specialist	199 (16.2%)	36 (5.5%)
Registered Dietitian	147 (12.0%)	8 (1.2%)
Licensed Dietitian/Nutritionist	70 (5.7%)	10 (1.5%)
Certified Dietary Manager	57 (4.7%)	41 (6.3%)
Dietetic Technician, Registered	16 (1.3%)	2 (0.3%)
Years Worked in School Nutrition Programs	n = 1,265	n = 690
< 1 year	34 (2.7%)	12 (1.7%)
1-5 years	188 (14.9%)	97 (14.1%)
6-10 years	231 (18.3%)	151 (21.9%)
11-15 years	227 (17.9%)	151 (21.9%)
16-20 years	221	119

	(17.5%)	(17.2%)
> 20 years	364 (28.8%)	160 (23.2%)
Years in Current Position	n = 1,266	n = 692
< 1 year	85 (6.7%)	39 (5.6%)
1-5 years	399 (31.5%)	238 (34.4%)
6-10 years	341 (26.9%)	165 (23.8%)
11-15 years	190 (15.0%)	142 (20.5%)
16-20 years	123 (9.7%)	54 (7.8%)
> 20 years	128 (10.1%)	54 (7.8%)
Age	n = 1,263	n = 690
< 20 years	0 (0.0%)	0 (0.0%)
20-29 years	22 (1.7%)	8 (1.2%)

30-39 years	122 (9.7%)	57 (8.3%)
40-49 years	349 (27.6%)	241 (34.9%)
=50 years	770 (61.0%)	384 (55.7%)
Sex	n = 1,249	n = 688
Female	1103 (88.3%)	667 (96.9%)
Male	146 (11.7%)	21 (3.1%)
Highest Level of Education Completed	n = 1,267	n = 694
Less than high school diploma	5 (0.4%)	15 (2.2%)
High school diploma or GED	246 (19.4%)	337 (48.6%)
Some college	288 (22.7%)	228 (32.9%)
Associate or two year degree	140 (11.0%)	64 (9.2%)
Bachelor’s degree	275	32

	(21.7%)	(4.6%)
Some graduate work	92 (7.3%)	6 (0.9%)
Master's degree	201 (15.9%)	11 (1.6%)
Doctorate degree	20 (1.6%)	1 (0.1%)
USDA Region[b]	n = 1,267	n = 690
Midwest	336 (26.5%)	170 (24.6%)
Mountain Plains	207 (16.3%)	156 (22.6%)
Southwest	184 (14.5%)	97 (14.1%)
Southeast	178 (14.0%)	104 (15.1%)
Western	136 (10.7%)	64 (9.3%)
Mid-Atlantic	115 (9.1%)	42 (6.1%)
Northeast	112	57

	(8.8%)	(8.3%)
Formal Food Safety Team(s)	n = 1,260	n = 675
No	1006 (79.8%)	454 (67.3%)
Yes, district food safety team	141 (11.2%)	127 (18.8%)
Yes, school food safety team(s)	113 (9.0%)	94 (13.9%)
District Schools/Schools Receive = 2 Inspections Per Year	n = 1,260	n = 689
Yes	1170 (92.9%)	649 (94.2%)
No	90 (7.1%)	40 (5.8%)
Type of Food Production Systems in District/School[a,b,c]	n = 1,267	n = 693
Conventional On-Site	1116 (88.1%)	559 (80.7)
Base Kitchen	323 (25.5%)	76 (11.0%)
Satellite (Receiving) Kitchen	314 (24.8%)	17 (2.5%)

Central Kitchen	178 (14.0%)	41 (5.9%)
District Enrollment[d]	n = 1,267	NA
= 2,799	711 (56.1%)	NA
2,800-29,999	505 (39.9%)	NA
= 30,000	51 (4.0%)	NA
School Enrollment[e]	NA	n = 692
< 300	NA	136 (19.7%)
300-599	NA	233 (33.7%)
600-899	NA	137 (19.8%)
=900	NA	186 (26.9%)
Average Lunches/Day[e]	NA	n = 693
< 300	NA	210 (30.3%)

300-399	NA	137 (19.8%)
400-499	NA	73 (10.5%)
500-599	NA	72 (10.4%)
600-699	NA	52 (7.5%)
700-799	NA	36 (5.2%)
800-899	NA	28 (4.0%)
900-999	NA	15 (2.2%)
=1000	NA	70 (10.1%)

Note. USDA = United States Department of Agriculture.

[a]Percentages for this item total greater than 100% due to multiple responses selected.

[b]Responses presented in descending order for school nutrition directors.

[c]Food production systems were defined as follows: conventional on-site – food is cooked and served at same location; central kitchen – food is distributed to other serving sites; base kitchen – food is cooked and served on site and food is distributed to other sites for service; satellite (receiving) kitchen – food is received from another kitchen for service at this site.

[d]Item was answered only by school nutrition directors; NA = not applicable for school

nutrition managers.

[e]Item was answered only by school nutrition managers; NA = not applicable for school nutrition directors.

Implementation Status of Food Safety Programs Based on HACCP Principles

Table 2 provides information regarding the implementation status of food safety programs based on HACCP principles at the district and school levels, as reported by SN directors and SN managers, respectively. The vast majority of directors reported that all schools in the district had written SOPs for food safety (92.5%). In addition, the vast majority indicated that all schools in the district had implemented food safety programs based on HACCP principles (93.0%). However, additional questions regarding the status of food safety programs based on HACCP principles revealed that only 63.5% of districts had completed the implementation process for its schools. An additional 26.2% of districts were still in the process of implementing these programs, while the remaining 10.3% of districts had not begun the implementation process. Those directors who reported that implementation was complete for their districts indicated the time period when the food safety programs based on HACCP principles were implemented. The largest percentage of directors reported that implementation was completed during the 2005-2006 school year (26.6%), followed closely by the 2006-2007 school year (26.0%). Directors who reported that their districts had at least begun the process of developing food safety programs based on HACCP principles reported their motivations for doing so. The main motivations included “requirement of the state agency (78.9%),” “improvement in safety of foods served (73.2%),” “awareness of HACCP as the best approach to food safety (62.2%),” and “awareness of risk/consequences of foodborne illness (58.1%).” Only 56.1% reported “requirement of federal law” as a motivation.

Table 2. *District and School Implementation of Food Safety Programs Based on HACCP Principles*

	Directors	**Managers**
Item	**Frequency (%)**	**Frequency (%)**
Schools in district with written SOPs for food safety[a]	n = 1,538	NA
All schools	1,422 (92.5%)	NA
Some schools	58 (3.8%)	NA
None of the schools	58 (3.8%)	NA
School has written SOPs for food safety[b]	NA	n = 1,045

Yes	NA	985 (94.3%)
No	NA	60 (5.7%)
Schools in district that have implemented food safety programs based on HACCP principles[a]	n = 1,542	NA
All schools	1,434 (93.0%)	NA
Some schools	59 (3.8%)	NA
None of the schools	40 (2.6%)	NA
Don’t know	9 (0.6%)	NA
School has implemented food safety program based on HACCP principles[b]	NA	n = 1,042
Yes	NA	965 (92.6%)
No	NA	40 (3.8%)
Don’t know	NA	37 (3.6%)

Status of food safety programs based on HACCP principles in district or school	n = 1,550	n = 1,053
Development not begun	36 (2.3%)	37 (3.5%)
In process of developing	84 (5.4%)	53 (5.0%)
Developed but not implemented	40 (2.6%)	25 (2.4%)
In process of implementing	406 (26.2%)	198 (18.8%)
Implementation complete	984 (63.5%)	740 (70.3%)
When district or school implemented food safety programs based on HACCP principles[c]	n = 967	n = 724
Prior to 2005-2006 school year	164 (17.0%)	181 (25.0%)
During 2005-2006 school year	257 (26.6%)	157 (21.7%)
During 2006-2007 school year	251 (26.0%)	179 (24.7%)
During 2007-2008 school year	212 (21.9%)	142 (19.6%)

During 2008-2009 school year	79 (8.2%)	54 (7.5%)
During 2009-2010 school year	4 (0.4%)	11 (1.5%)
Motivation for developing food safety program based on HACCP principles[d,e]	n = 1,480	n = 790
Requirement of state agency	1,167 (78.9%)	585 (74.1%)
Improvement in safety of foods served	1,084 (73.2%)	589 (74.6%)
Awareness of HACCP as the best approach to food safety	920 (62.2%)	568 (71.9%)
Awareness of risk/consequences of foodborne illness	860 (58.1%)	498 (63.0%)
Requirement of federal law	831 (56.1%)	360 (45.6%)
Way to reduce liability	603 (40.7%)	327 (41.4%)
Way to save money	204 (13.8%)	165 (20.9%)
Way to save time	184 (12.4%)	157 (19.9%)

Previous incident of foodborne illness in district	66 (4.5%)	51 (6.5%)

Note. HACCP = Hazard Analysis and Critical Control Point; SOPs = standard operating procedures.

[a]Item was answered only by school nutrition directors; NA = not applicable for school nutrition managers.

[b]Item was answered only by school nutrition managers; NA = not applicable for school nutrition directors.

[c]This item includes only those districts or schools with implementation complete.

[d]Responses presented in descending order for school nutrition directors.

[e]Percentages for this item total greater than 100%, because participants could select multiple responses.

Results at the school level, as reported by SN managers, were very similar to the district results reported by SN directors (Table 2). The vast majority of managers reported that their schools had written SOPs for food safety (94.3%) and that their school had implemented food safety programs based on HACCP principles (92.6%). Again, however, additional questions regarding the status of food safety programs based on HACCP principles revealed that only 70.3% of schools had completed the implementation process for its schools. An additional 18.8% of schools were still in the process of implementing these programs, while the remaining 10.9% of schools had not begun the implementation process. The largest percentage of managers indicated that implementation of food safety programs based on HACCP principles was completed prior to the 2005-2006 school year (25.0%), followed closely by during the 2006-2007 school year (24.7%). The main motivations reported by managers for developing and/or implementing food safety programs based on HACCP principles included “improvement in safety of foods served (74.6%),” “requirement of the state agency (74.1%),” “awareness of HACCP as the best approach to food safety (71.9%),” and “awareness of risk/consequences of foodborne illness (63.0%).” Only 45.6% of managers reported “requirement of federal law” as a motivation.

Implementation rates for food safety programs based on HACCP principles in the current study are much higher than those reported in the previous literature (Giampaoli et al., 2002; Hwang, et al., 2001; NFSMI, 2005; Youn & Sneed, 2002). This result was expected, as all of the prior studies identified took place prior to the 2006 implementation deadline outlined in the new federal guidelines. Results from the most recent previous study, conducted by NFSMI (2005), indicated that 65% of school foodservice managers had begun implementing HACCP in their schools. In the current study, 92.6% of SN managers reported that food safety programs based on HACCP principles had been implemented in their schools. As noted previously, however, a more detailed assessment indicated that the implementation process was complete in only 70.3% of schools. Thus, although implementation rates have clearly increased with the enactment of the new guidelines, there is a need for continued efforts in this area.

Chi-square tests were performed to determine if selected program and personal characteristics of SN directors and school districts were associated with district implementation of food safety programs based on HACCP principles. Factors examined included education level, years worked in SN programs, USDA region, and district enrollment. A food safety program based on HACCP principles was considered to have been implemented if the implementation process was reported as

complete; otherwise, the district was considered to have not implemented the program. SN directors' education level was not significantly associated with implementation status. Years worked in SN programs was significantly associated with implementation status (X^2 = 11.8, p = .04), with those directors having worked in SN programs 11-15 years being less likely and those having worked in SN programs more than 20 years being more likely to have implemented food safety programs based on HACCP principles in their districts. In addition, USDA region was also significantly associated with implementation status (X^2 = 16.2, p = .01), with districts in the Northeast region being less likely and districts in the Southwest region being more likely to have implemented food safety programs based on HACCP principles in their schools. Finally, district enrollment was significantly associated with implementation status (X^2 = 16.8, p < .001), with small districts (enrollment = 2,799) being less likely to have implemented and medium districts (enrollment 2,800-29,999) and large districts (enrollment = 30,000) being more likely to have implemented food safety programs based on HACCP principles in their schools. Youn and Sneed (2003) also examined the relationship between characteristics of school foodservice directors and reported a positive relationship between the number of students in the district and the number of food safety procedures and practices implemented.

Barriers to the Implementation of Food Safety Programs Based on HACCP Principles

Participants were provided with a set of 28 potential barriers to the development and implementation of food safety programs based on HACCP principles and were asked to indicate their level of agreement that each was a barrier, using a scale of 4 *(strongly agree)* to 1 *(strongly disagree)*. Table 3 presents the means and standard deviations for SN directors' and managers' agreement ratings for each of the barriers, in descending order of agreement for directors. Both SN directors and managers "agreed" to "strongly agreed" that all factors assessed were barriers to implementation of food safety programs based on HACCP principles, with mean agreement ratings for individual barriers ranging from 2.6 to 3.0 for directors and from 2.7 to 3.0 for managers. In addition, no respondent gave any potential barrier a rating of 1 *(strongly disagree*). Thus, there was very little variability in the responses to these items. For both SN directors and managers, the top barriers were related to time, costs, and negative perceptions of food safety programs based on HACCP principles.

Table 3. *School Nutrition Directors' and Managers' Perceptions of Barriers to Implementation of Food Safety Programs Based on HACCP Principles*

	Directors	**Managers**
Statement[a,b]	**Mean[c] ± SD**	**Mean[c] ± SD**
Time required to develop the food safety program	3.0 ± 0.7	2.9 ± 0.8
Perception of a food safety program based on HACCP principles as creating additional work burdens	3.0 ± 0.7	2.9 ± 0.8
Costs of additional labor	2.9 ± 0.8	2.9 ± 0.8
Costs required to update facilities	2.9 ± 0.8	2.9 ± 0.8
Costs required for new/additional equipment/supplies	2.9 ± 0.7	2.9 ± 0.7
Time required for training employees	2.9 ± 0.7	2.9 ± 0.7
Time required to implement the food safety program	2.9 ± 0.7	2.9 ± 0.8
Burden of monitoring required with a food safety program based on HACCP principles	2.9 ± 0.7	2.8 ± 0.8

Burden of documentation/record keeping required with a food safety program based on HACCP principles	2.9 ± 0.7	2.9 ± 0.8
Costs associated with training on the food safety program	2.8 ± 0.7	2.8 ± 0.8
Burden of overseeing the implementation of the food safety program	2.8 ± 0.7	2.8 ± 0.8
Lack of employee knowledge/skill	2.8 ± 0.7	2.8 ± 0.8
Burden of ongoing training	2.8 ± 0.7	2.8 ± 0.8
Negative attitudes of employees toward the food safety program	2.7 ± 0.8	2.8 ± 0.8
Lack of employee support/motivation to adopt the food safety program	2.7 ± 0.8	2.8 ± 0.8
Facility limitations	2.7 ± 0.7	2.8 ± 0.8
Lack of administrative support	2.7 ± 0.8	2.8 ± 0.8
Need to utilize part-time employees	2.7 ± 0.7	2.8 ± 0.8
High employee turnover	2.7 ± 0.8	2.7 ± 0.8
Equipment limitations	2.7 ± 0.7	2.8 ± 0.8
Lack of affordable materials/opportunities for training	2.7 ± 0.7	2.7 ± 0.8
Lack of familiarity with HACCP principles	2.7 ± 0.7	2.8 ± 0.8
Perception of HACCP principles as not valuable and/or unnecessary	2.7 ± 0.8	2.8 ± 0.8
Lack of understanding of benefits of food safety programs based on HACCP principles	2.7 ± 0.7	2.8 ± 0.8
Lack of adequate number of employees	2.6 ± 0.8	2.8 ± 0.8
Lack of available materials/opportunities for training	2.6 ± 0.7	2.7 ± 0.8
Lack of food safety/HACCP resources	2.6 ± 0.8	2.7 ± 0.8
Lack of training resources for diverse audiences (for example, materials in languages other than English)	2.6 ± 0.8	2.7 ± 0.8

Note. HACCP = Hazard Analysis and Critical Control Point

[a]The total n varies depending on number of responses for each individual statement.

[b]Responses presented in descending order for school nutrition directors.

[c]The response scale was a 4-point Likert-type scale ranging from 4 (*strongly agree*) to 1 (*strongly disagree*).

Barriers identified in the current study are consistent with those reported in previous literature. Hwang et al. (2001) reported time and cost issues as the main obstacles to HACCP implementation, while Giampaoli et al. (2002) identified employee attitudes as being among the most important factors in HACCP implementation. Youn and Sneed (2002) reported both employee and resource factors, including time and money issues, as the main barriers to implementing food safety practices. Similarly, Sneed and Henroid (2003) reported time and cost issues, as well as employee attitudes, as challenges when developing and implementing a HACCP program.

Practices Important in Implementing Food Safety Programs Based on HACCP Principles

Participants were asked to rate their level of agreement with a set of 24 statements identifying practices potentially important in the development and implementation of food safety programs based on HACCP principles, using a scale of 4 (*strongly agree*) to 1 (*strongly disagree*). Table 4 presents the means and standard deviations for SN directors' and managers' agreement ratings for each of the practices, in descending order of agreement for directors. As was the case with perceived barriers, both SN directors and managers "agreed" to "strongly agreed" that all practices assessed were important in implementing food safety programs based on HACCP principles, with mean agreement ratings for individual factors ranging from 3.2 to 3.7 for directors and from 3.4 to 3.7 for managers. There was little variability in the responses to these items. For both SN directors and managers, the top practices important in implementing food safety programs based on HACCP principles were related to restricting ill employees from work with food, positive role modeling regarding food safety, ensuring that role expectations are understood, providing necessary training and materials, ensuring that programs are practical to apply, and gaining employee "buy-in" to programs. Sneed and Henroid (2003) also indicated that HACCP programs should be practical to apply and that employee attitudes must be considered.

Table 4. *School Nutrition Directors' and Managers' Perceptions of Practices Important in Implementation of Food Safety Programs Based on HACCP Principles*

	Directors	**Managers**
Statement[a,b]	**Mean[c] ± SD**	**Mean[c] ± SD**
Ensuring ill employees do not work with food	3.7 ± 0.5	3.8 ± 0.5
Serving as a positive role model with respect to food safety	3.7 ± 0.5	3.7 ± 0.5
Ensuring that all employees know their role in the food safety program	3.6 ± 0.5	3.7 ± 0.5
Training all employees on HACCP principles	3.6 ± 0.5	3.7 ± 0.5
Making available the tools, equipment, and supplies necessary to promote food safety	3.6 ± 0.5	3.7 ± 0.5
Ensuring that the food safety program is practical to apply	3.6 ± 0.5	3.6 ± 0.5

Gaining employee commitment to food safety and HACCP principles	3.6 ± 0.5	3.6 ± 0.5
Providing ongoing food safety training for all employees	3.6 ± 0.5	3.6 ± 0.6
Providing effective supervision of employees regarding food safety	3.5 ± 0.6	3.6 ± 0.6
Giving verbal reminders and praise to employees with respect to food safety tasks	3.5 ± 0.6	3.6 ± 0.6
Considering food safety program implementation an ongoing process	3.5 ± 0.6	3.6 ± 0.6
Ensuring that the food safety program is employee-focused	3.5 ± 0.6	3.5 ± 0.6
Requiring new employees to complete food safety training before handling food	3.4 ± 0.7	3.5 ± 0.6
Requiring food safety certification for management and supervisory employees	3.4 ± 0.7	3.5 ± 0.7
Setting a realistic timeline for implementation of the food safety program	3.4 ± 0.6	3.5 ± 0.6
Implementing the food safety program in stages consisting of small, achievable steps	3.4 ± 0.7	3.5 ± 0.6
Using signs/notices in key areas to serve as reminders of safe food handling practices	3.4 ± 0.6	3.5 ± 0.6
Making food safety practices part of employee evaluation	3.4 ± 0.7	3.5 ± 0.7
Selecting or updating equipment to support food safety	3.3 ± 0.7	3.5 ± 0.6
Developing education programs to address barriers to implementing the food safety program	3.3 ± 0.7	3.4 ± 0.6
Developing tools for self-assessment of food safety programs	3.3 ± 0.7	3.4 ± 0.7
Taking disciplinary action with employees who do not follow food safety policies and procedures	3.3 ± 0.7	3.5 ± 0.6
Designing, selecting, or modifying facilities to promote food safety	3.2 ± 0.7	3.4 ± 0.7
Working with school district/administrators to develop a strong food safety policy	3.2 ± 0.8	3.5 ± 0.6

Note. HACCP = Hazard Analysis and Critical Control Point

[a]The total n varies depending on number of responses for each individual statement.

[b]Responses presented in descending order for school nutrition directors.

[c]The response scale was a 4-point Likert-type scale ranging from 4 (*strongly agree*) to 1 (*strongly disagree*).

CONCLUSIONS AND APPLICATION

The primary objective of this research was to assess the extent to which SN programs have implemented food safety programs based on HACCP principles, as required by Section 111 of the Child Nutrition and WIC Reauthorization Act of 2004 (Public Law 108-265). Results indicated that although the vast majority of SN directors and managers surveyed reported that their districts and schools, respectively, had implemented food safety programs based on HACCP principles, additional questions revealed that the implementation process was often not complete. The main motivations reported for implementing these programs included meeting state agency requirements and improving the safety of foods served. Thus, it appears that a perceived state agency requirement, rather than awareness of the federal law, was often driving the adoption of these programs. Finally, several characteristics of SN directors or school districts were found to be associated with implementation status of food safety programs based on HACCP principles. Directors who had worked in SN programs for more than 20 years, school districts in the Southwest region, and larger school districts were all more likely to have implemented food safety programs based on HACCP principles.

Barriers and practices related to the implementation of school food safety programs based on HACCP principles also were investigated. For both SN directors and managers, the top barriers to implementation were related to time, costs, and negative perceptions of food safety programs based on HACCP principles. The top practices important in implementing food safety programs based on HACCP principles were related to restricting ill employees from work with food, positive role modeling regarding food safety, ensuring that role expectations are understood, providing necessary training and materials, ensuring that programs are practical to apply, and gaining employee “buy-in” to programs.

In conclusion, although SN programs were required by law to implement food safety programs based on HACCP principles by the end of the 2005-2006 school year, many districts and schools have still not completed the implementation process. Study results identified motivations, characteristics, barriers, and practices related to the implementation of school food safety programs based on HACCP principles. Understanding these factors will be helpful in achieving greater implementation of food safety programs based on HACCP principles in SN programs.

A limitation to this research study was the overall response rate to the online survey. At 9.2%, the response rate was much lower than desired, although it is typical for online surveys to receive much lower response rates than surveys administered on paper (Nulty, 2008). The use of an online survey, which requires internet access in addition to a degree of technology skill, may have prevented some SN directors or managers from participating in the study. In addition, accessing the online survey in the current study required that participants manually type the survey Web address into the address field of a Web browser, adding further complexity to the task of survey completion. Finally, the majority of the SN directors participating in the study were from small school districts; there was very little representation from large school districts. All of these issues may cause concern for the ability to generalize the results.

Recommendations for education and training based on study results include the need for a continued focus on the implementation of food safety programs based on HACCP principles in SN programs, as implementation of these programs was often not complete. Education and training programs and materials could be geared toward those programs with less likelihood of having implemented these programs, such as smaller school districts. Study results could be helpful in developing and promoting resources and training programs specifically for use at the local school

district level. In addition, existing resources and training programs must be assessed when new regulations emerge and be removed or modified if they are not consistent with new guidelines. It is important to have a process in place for developing, assessing, and updating resources that support local school districts when regulations change.

Barriers to implementation of food safety programs based on HACCP principles and practices supporting implementation identified in this study can be used to guide education and training initiatives designed to support implementation at the local school district level. Barriers that must be addressed included time constraints, cost issues, and negative perceptions about food safety programs based on HACCP principles. Role modeling and training are important practices when implementing these programs. SN directors and managers must serve as positive role models with respect to food safety. Employees must understand their expected roles in food safety programs and have the knowledge and skills necessary to fulfill these roles.

Findings from this study also suggest the need for additional research. Additional data from large school districts is needed, as the respondents in the current study were primarily from small and medium districts. Although there are fewer large districts, their enrollment is great, with the potential to positively or negatively influence food safety issues nationwide.

In addition, research examining how state agencies have supported and promoted the implementation of food safety programs based on HACCP principles would be helpful. Agencies which have been successful at promoting implementation of these programs can offer insight and strategies that would be useful in supporting further implementation efforts. Also of interest is which strategies and resources have proved most helpful for school districts of various sizes, since implementation status of programs varies by district size.

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