



Beliefs and Perceptions of School Foodservice Personnel about Following a HACCP-based Program

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ABSTRACT

Implementation of HACCP systems in school foodservice was mandated in 2004 because of the volume of meals served and the risks associated with young children, who are susceptible to contracting a foodborne illness. To date, no research has been conducted to identify perceptions and beliefs of school foodservice personnel about following HACCP programs. Therefore, the purposes of this study were to determine the status of HACCP prerequisite programs in school foodservice, ascertain beliefs and perceptions of school foodservice personnel about complying with HACCP programs, and determine which constructs of the Health Belief Model influenced behavioral intentions to comply with HACCP-based food safety programs. A 33-item instrument measured six constructs — perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self efficacy, and behavioral intentions to follow a HACCP program. Statements were measured on a four-point Likert scale. The population included the 1,289 school foodservice directors and employees who had e-mail addresses in the states of Kansas, Missouri and Nebraska. The usable response rate was 16.9% (n = 218). Most operations had completely implemented HACCP prerequisite programs; the least implemented were for food allergy management and food safety training. For beliefs and perceptions, respondents noted that they were concerned about the possibility of a foodborne illness outbreak occurring at their school but indicated that they believed that following a HACCP program would reduce food safety problems. In contrast, they were not worried that children at their school would contract a foodborne illness. With regard to behavioral intentions, results indicated that child susceptibility, severity to children, benefits, and self-efficacy were significant. Overall results show that food safety training is critical to successfully following a HACCP program and that training should focus on how foodborne illnesses can impact children and on obtaining up-to-date knowledge and skills so that employees can follow HACCP programs.

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INTRODUCTION

Every day, millions of students eat breakfast or lunch in public schools. In 2005, the National School Lunch Program (NSLP) provided lunch to 29.6 million children and the School Breakfast Program (SBP) served 9.4 million (32). A major concern of the NSLP is food safety, because of the volume of meals and age of the clients served. Young children are at a higher risk for contracting a foodborne illness (FBI) (8) because they have not built up fully mature immune systems.

Reporting of FBI outbreaks in schools is sporadic; however, Daniels et al. (9) reported that between 1973 and 1997, there was a mean of 25 outbreaks, 2,271 illnesses, and 69 hospitalizations each year. For 2007, the Centers for Disease Control and Prevention (CDC) reported that of all reported cases, only 2.2% (25) of all foodborne outbreaks (1,097) and 4.6% (982) of illnesses with five hospitalizations were school related (4), which, compared with 2006 (3), indicates a decrease in reported outbreaks, cases, and hospitalizations.

In 2000 (29) and 2004 (30), the Food and Drug Administration (FDA) reported results of studies conducted to assess the most prevalent risk factors out of compliance with the Food Code. In elementary schools, for both years, the highest out-of-compliance rates were for improper holding/time and temperatures (39.5%, 30.8%), poor personal hygiene (25.8%, 16.3%), and inadequate cooking (5.6%, 3.0%). In 2004, there was an 83% in-compliance rate; the overall goal for 2010 is 85%.

The Government Accountability Office (GAO) (11, 12) investigated school related FBIs and found that nearly half of incidences involved improper food preparation and handling practices. Therefore, one of their recommendations was for the Food and Nutrition Service (FNS) to promote further training and certification of key foodservice personnel. In 2004, the Richard B. Russell School Lunch Act (5) was modified to require each school foodservice to implement a food safety program that complies with established Hazard Analysis Critical Control Point (HACCP) systems, a proactive, science-based food safety program that can decrease the number of FBI outbreaks associated with food (18). HACCP was mandated in food processing plants by

1998 (20), but not in foodservice until 2004 (5).

Schools had begun implementation of HACCP prior to its having been mandated. However, in 2001, a study found that 69% of 162 school foodservice managers responding were not familiar with HACCP (15), and a 2002 study indicated that a majority of school foodservice directors had not implemented HACCP and identified barriers to implementation as time, money, employees' attitudes, lack of adequate facilities, and lack of staff (9). In 2003, researchers (33) reported that 22% of school foodservice directors had a HACCP program and 90% had implemented some prerequisite programs that provide the basis for a HACCP system. Sneed and Henroid (14, 26) concluded that HACCP implementation is a large undertaking that requires commitment at all levels within a school district.

Because HACCP programs do require the commitment of all, studying attitudes, beliefs, and barriers of foodservice personnel about HACCP is critical to ensuring its success. The Health Belief Model (HBM) developed by Rosenstock (23) to identify preventative health behaviors included the following constructs: perceived susceptibility, perceived severity, perceived benefits, and perceived barriers.

Few studies have been found that examine aspects of food safety in foodservices using the HBM, but researchers (2, 13, 16, 24) have concluded that the HBM can be useful in identifying beliefs related to food safety. Riggins and Barrett (22) used the HBM to analyze benefits of and barriers to implementing HACCP-based food safety programs in childcare centers.

Because little research (1) has been published about following HACCP in school foodservice since it was mandated, the purposes of this research were to ascertain the status of prerequisite programs in school foodservices and to identify differences by state; to determine beliefs and perceptions of school foodservice personnel about benefits, barriers, and attitudes as they relate to following a HACCP-based food safety program, and examine differences based on educational level, certification status, and location of school; and to explain which constructs (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self efficacy) would influence be-

havioral intentions to follow a HACCP-based food safety program.

MATERIALS AND METHODS

Instrument development

This research used a revised instrument developed by Riggins (21) that includes four sections and that has been modified to focus on school foodservice rather than child care. The first section contained 33 items to measure six constructs (Table 1). Six items measured perceived susceptibility and focused on the likelihood of children contracting FBIs at the school. Perceived severity (eight items) focused on the severity of consequences to the children or to the school if a FBI were to occur. On the basis of research from other segments of the foodservice industry (19, 27, 28), perceptions of benefits and barriers were measured with four and nine items, respectively. Self efficacy (three items) was worded to assess general agreement about confidence, skills, and knowledge related to following a HACCP program. Three items measured behavioral intention and asked about plans to follow HACCP programs. All items were measured on a 4-point Likert scale, with one being not at all, two being slightly, three being mostly, and four being completely.

Part two requested information about whether prerequisite programs had been implemented completely, partially, or not at all. The third section asked about basic food safety knowledge, and section four obtained demographic information; both of these sections used a closed response format. The questionnaire and research protocol were reviewed and approved by the Human Subjects Committee for the Institutional Review Board (Kansas State University, Manhattan) and the Human Subjects Review Committee for the Human Subjects Protection Program (University of Central Missouri, Warrensburg).

The revised instrument was pilot tested by hospitality management and dietetic students ($n = 11$) who were familiar with HACCP. Minor revisions were made based on their comments. Cronbach's alpha obtained from tests run on the scaled items indicated a reliability of 0.69, which was similar to the values for the scales used in the previous study by Riggins and Barrett (22).

TABLE I. Beliefs and perceptions by certification status, education level and state

Factor	Statement ^b	Overall	Certification		Education	
		218 ^d Mean ± SD	Yes 172 ^d Mean ± SD	No 46 ^d Mean ± SD	≤ 4 year degree 50 ^d Mean ± SD	> 4 year degree 168 ^d Mean ± SD
Perceived Susceptibility ^a	When I think about FBI ^c occurring at my school, I feel concerned.	3.12 ±1.11	3.15 ±1.09	3.04 ±1.11	3.00 ±1.11	3.16 ±1.09
	A child has an increased chance of having complications from an FBI.	2.73 ±0.97	2.75 ±0.96	2.63 ±0.85	2.92 ±0.86	2.67 ±0.96
	Children, in general, have a greater chance of getting a FBI than adults.	2.53 ±0.96	3.56 ±0.97	2.39 ±0.91	2.68 ±0.87	2.48 ±0.98
	I worry a lot about some of the children at my school getting a FBI.	1.60 ±0.76	1.60 ±0.73	1.59 ±0.67	1.72 ±0.76	1.57 ±0.71
	The chance of children at my school getting a FBI is great.	1.51 ±0.53	1.50 ±0.56	1.57 ±0.50	1.60 ±0.57	1.49 ±0.54
	Within the next year, the children at my school will get a FBI.	1.22 ±0.54	1.23 ±0.51	1.15 ±0.42	1.20 ±0.40	1.22 ±0.52
		3.45	3.44	3.37	3.42	3.42
Perceived Severity ^b	A FBI could cause severe consequences for children.	±0.83 2.92	±0.85 2.93	±0.77 2.65	±0.79 2.82	±0.84 2.86
	Problems children would experience from a FBI could last a long time.	±0.91 2.82	±0.96 2.76	±0.92 2.96	±0.96 2.50	±0.96 2.89
	I am afraid to even think about the possibility of a FBI outbreak at my school.	±1.17 2.69	±1.18 2.64	±1.12 2.61	±1.17 ^e 2.42	±1.16 ^e 2.79
	If the children developed a FBI, it could be more serious than other diseases.	±0.85 2.50	±0.99 2.52	±0.83 2.30	±0.99 2.40	±0.94 2.49
	If children acquire a FBI, their whole life could change.	±0.96 2.44	±1.02 2.45	±0.81 2.33	±1.01 2.70	±0.98 2.34
	If the children at my school contracted a FBI, my job would be endangered.	±1.08 2.37	±1.10 2.31	±1.06 2.24	±1.10 ^e 2.46	±1.08 ^e 2.25
	The school's financial security would be in jeopardy if any child got a FBI.	±1.02 2.23	±1.10 2.20	±1.12 2.27	±1.03 2.68	±1.11 2.08
	A FBI outbreak would endanger the relationship I have with my fellow school foodservice employees.	±1.11 2.23	±1.14 2.20	±1.05 2.27	±1.13 ^f 2.68	±1.09 ^f 2.08
Perceived Severity ^b	Following a HACCP-based food safety program at work greatly reduces food safety problems at our school.	3.44 ±0.86	3.47 ±0.86	3.17 ±1.02	3.40 ±0.73	3.41 ±0.95
	A HACCP-based food safety program is important for maintaining food safety.	3.42 ±0.77	3.40 ±0.86	3.37 ±0.80	3.46 ±0.73	3.37 ±0.87
	Employees with food safety certification are more likely to use safe food handling practices.	3.41 ±0.73	3.42 ±0.70	3.30 ±0.87	3.38 ±0.73	3.40 ±0.82
	Food safety checklists locate a problem before it is discovered by regular health inspections.	3.15 ±0.86	3.12 ±0.91	3.13 ±0.81	3.24 ±0.66	3.08 ±0.94
	Following a HACCP based food safety program reduces my anxiety about a FBI occurring in our school.	3.02 ±0.97	3.03 ±0.95	2.91 ±0.91	3.12 ±0.90	2.97 ±0.97
		3.38	3.41	3.20	3.44	3.34
		±0.69 3.22	±0.95 3.24	±0.96 3.04	±0.81 3.24	±0.99 3.19
Perceived Benefits ^a	My school provides foodservice employees with food safety training.	±0.82 3.03	±0.86 3.05	±0.84 2.87	±0.85 3.00	±0.86 3.02
	My school has the resources to improve food safety.	±0.90 2.66	±0.96 2.63	±0.91 2.67	±0.88 2.54	±0.97 2.67
	My school has the time required to train employees properly in food safety.	±0.78 2.64	±0.86 2.66	±0.79 2.50	±0.73 2.64	±0.87 2.63
	At my school foodservice employees are comfortable with change.					

TABLE I. Beliefs and perceptions by certification status, education level and state (continued)

Factor	Statement ^b	Overall	Certification		Education	
			Yes	No	≤ 4 year degree	> 4 year degree
		218 ^d	172 ^d	46 ^d	50 ^d	168 ^d
		Mean	Mean	Mean	Mean	Mean
		± SD	± SD	± SD	± SD	± SD
Perceived Barriers ^c	My school has the funding to pay for additional food safety training.	±1.01	±1.07	±0.86	±1.06	±1.02
	At my school, I have the time to complete the additional paperwork	2.46	2.44	2.41	2.56	2.40
	^a HACCP-based food safety program requires.	±1.03	±1.03	±0.94	±0.86	±1.05
	At my school, completing HACCP-based food safety program requirements involved developing new habits, which was difficult.	2.43	2.43	2.39	2.54	2.39
		±0.87	±0.88	±0.98	±0.84	±0.91
		1.32	1.26	1.43	1.30	1.30
	Other than myself, the foodservice employees at my school do not care about food safety issues.	±0.72	±0.66	±0.73	±0.68	±0.67
Self Efficacy ^a		3.63	3.67	3.39	3.56	3.63
	I have the skills necessary to follow a HACCP-based food safety program.	±0.64	±0.62 ^e	±0.75 ^e	±0.79	±0.62
	I am confident that I can follow a HACCP-based food safety program.	3.56	3.55	3.43	3.42	3.56
	I need to learn more to be able to follow a HACCP-based food safety effectively.	±0.65	±0.72	±0.83	±0.79	±0.73
Behavior Intentions ^c		2.23	2.19	2.33	2.18	2.23
		±0.98	±0.97	±0.99	±0.98	±0.97
	I follow the school HACCP-based food safety program because it is the best thing to do.	3.54	3.53	3.50	3.44	3.55
	I follow the school HACCP-based food safety program because I want to.	±0.84	±0.85	±0.89	±0.97	±0.82
Behavior Intentions ^c		3.34	3.36	3.20	3.34	3.32
		±0.85	±0.88	±0.96	±0.96	±0.88
		2.70	2.66	2.61	3.52	2.69
Behavior Intentions ^c	I follow the school HACCP-based food safety program because I have to.	±1.17	±1.23	±1.26	±1.30	±1.21

^aBecause of reliability analysis results, eight factors were identified and not all statements are included.

^b4-point Likert scale with one being not at all, two being slightly, three being mostly, and four being completely.

^cFBI = Foodborne illness.

^dNumber of respondents in group.

^e $P \leq 0.05$.

^f $P \leq 0.001$.

Population and sample

The population for this study included school foodservice personnel who had e-mail addresses in the states of Kansas, Missouri, and Nebraska. An e-letter sent to the director of Child Nutrition programs in these three states explained the objectives of the research and asked them to provide an electronic listing of e-mail addresses for all foodservice employees in their states. After the information had been received, each employee was e-mailed to explain the research and was asked to complete the electronic survey. To encourage participation, reminder e-mails were sent two and five weeks after the initial mailing.

Data analysis

All data analysis procedures used the Statistical Package for Social Sciences

(SPSS) (version 15.0, SPSS, Inc., Chicago: IL). Descriptive statistics computed were frequencies, means, and standard deviations. Independent samples *t*-tests were used to determine the statistical differences in item mean scores based on level of education and food safety certification. One-way analysis of variance tested differences in mean scores by states. Chi-square tests were used to determine proportional differences in prerequisite programs. An alpha level of 0.05 was set as the level of significance.

Cronbach's alpha (7) determined construct reliability. Principal component factor analysis with varimax rotation determined item loading on factors. Multiple linear regression analysis examined relationships between the dependent variable (behavioral intention) and the independent variables (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy).

RESULTS

A total of 1,487 e-letters were sent to school foodservice personnel. Of those, 198 e-mails were returned as undeliverable, reducing the sample population to 1,289. The overall usable response rate was 16.9% ($n = 218$). Response rates by state were: Kansas, 19.9% ($n = 133$); Missouri, 11.6% ($n = 47$); and Nebraska (17.6%) ($n = 38$).

Demographics

Respondent demographics indicated that they were primarily directors or supervisors (91.4%), female (94.5%) and certified in food safety (77.5%), with 42.1% of those being certified by ServSafe® (42.1%). A majority of respondents were between the ages of 40 and 60 (77%), and only 22.9% had at least a college degree. A

TABLE 2. Prerequisite program implemented completely by state

Prerequisite Program	Overall		Kansas		Missouri		Nebraska		P value ^a
	n	%	n	%	n	%	n	%	
Personal Hygiene Program	188	86.2	120	90.2	35	75.0	33	86.8	0.000
Pest Control Program	191	87.6	119	89.4	38	81.3	34	89.5	0.000
Chemical Storage Procedures	193	88.5	121	90.9	37	79.2	35	92.1	0.000
Food Allergy Procedures	164	75.2	105	78.8	30	64.6	29	76.3	0.000
Equipment Cleaning and Sanitation Procedures	186	85.3	115	86.4	40	85.4	31	81.6	0.000
Purchasing Procedures	176	80.7	108	81.1	37	79.2	31	81.6	0.000
Standard Operating Procedures (SOPs)	165	75.7	108	81.1	27	58.3	30	78.9	0.000
Food Safety Training Program	158	72.5	115	86.4	24	52.1	19	50.0	0.000
Equipment Maintenance Program	142	65.1	92	68.9	25	54.2	25	65.8	0.000

^aP value represents testing for a state difference across the nine prerequisite programs by the χ^2 test (3 degrees of freedom).

high proportion of respondents were from Kansas (61%), 22% were from Missouri, and 17% were from Nebraska. Although the response rate was lower than in other studies with similar populations, the demographic information that could be compared (i.e., age and education) was similar (15).

Prerequisite program implementation

The most implemented aspect of the prerequisite programs were those related to chemical storage (88.5%), pest control (87.6%), and personal hygiene (86.2%). The least implemented programs were food allergy procedures (75.2%), food safety training (72.5%), and equipment maintenance (65.1%) (Table 2). These results are comparable to what Riggins and Barrett (22) found in childcare centers. When the implementation of prerequisite programs were compared by state, there was a significant difference ($P \geq 0.000$) among the states for all programs. Overall, Kansas had the highest percentage of implementation.

Overall item responses for beliefs and perceptions

For items measuring perceived susceptibility, respondents agreed that children are more likely to get a FBI than adults are (2.53 ± 0.96), but felt that it was unlikely that children at their school would contract a FBI (1.22 ± 0.54) (Table 2). For items measuring severity, respondents agreed that a FBI could cause severe consequences for

children (3.45 ± 0.83), but they were not very concerned about the consequences for their job (2.44 ± 1.08) or the school's financial security (2.37 ± 1.02). With regards to benefits, respondents felt that following a HACCP program reduces food safety problems (3.44 ± 0.86) and is important for maintaining a safe food environment (3.42 ± 0.77).

With regard to barriers, responses indicated that the barriers to HACCP implementation found in the literature (10, 15, 27, 28, 33) were not barriers to following a HACCP program for this group. Respondents indicated that food safety training is provided by schools to employees (3.38 ± 0.69); there is time for proper training (3.03 ± 0.90); and schools have the resources to improve food safety (3.22 ± 0.82). Respondents agreed that they have the confidence (3.56 ± 0.65) and skills (3.63 ± 0.64) necessary to follow a HACCP program, strongly felt that following a HACCP program is the best thing to do (3.54 ± 0.84), and indicated that they follow a HACCP program because they want to (3.34 ± 0.85) rather than because it is required (2.70 ± 1.17) (Table 2).

When *t*-tests and ANOVAs were run on the 33 items measuring beliefs and perceptions, few significant differences were found in certification status, in educational level, or by state. Based on certification status, the one significant difference was that those respondents who were certified felt that they had more skills to follow a HACCP-based food safety program than those who were not certified ($P \leq 0.05$). Based on education status, those respondents who had at least a four-year degree were not as concerned as were those who did not

have a degree about their jobs ($P \leq 0.05$) or relationships with co-workers ($P \leq 0.001$) if a foodborne outbreak were to occur in their school. There were significant differences based on state for the following: "My school provides foodservice employees with food safety training," where Kansas respondents agreed more than Nebraska or Missouri ($P \leq 0.000$); "At my school, foodservice employees are comfortable with change," where Missouri respondents disagreed with the statement more ($P \leq 0.05$); and "My school has the funding to pay for additional food safety training," because Kansas respondents had the higher mean score ($P \leq 0.05$).

Constructs influence on behavioral intention

To determine which constructs influenced behavioral intention, a reliability analysis was conducted with the original 33 items, and as a result, 6 items were deleted. A factor analysis was run with the remaining 27 items and they loaded as expected. The exceptions were susceptibility and severity, each of which split into two factors. The final eight factor names and reliability coefficients were: child susceptibility ($\alpha = 0.59$), school susceptibility ($\alpha = 0.81$), child severity ($\alpha = 0.85$), school severity ($\alpha = 0.79$), benefits ($\alpha = 0.68$), barriers ($\alpha = 0.75$), self-efficacy ($\alpha = 0.77$), and behavioral intentions ($\alpha = 1.00$).

Multiple linear regression found that child susceptibility ($t = -2.946$, $P < 0.004$), child severity ($t = 2.891$, $P < 0.004$), benefits ($t = 8.113$, $P < 0.000$), and self-efficacy ($t = -5.395$,

TABLE 3. Summary of regression analysis^a for variables predicting behavioral intentions

Variable	β	SE	B	t
Child Susceptibility	-0.16	0.05	-0.16	- 2.95 ^b
School Susceptibility	0.17	0.10	0.09	1.71
Child Severity	0.18	0.06	0.17	2.89 ^b
School Severity	-0.01	0.05	-0.01	- 0.25
Benefits	0.65	0.08	0.52	8.11 ^b
Barriers	-0.08	0.08	-0.06	- 1.02
Self-Efficacy	0.41	0.08	0.32	5.40 ^b

^aR² = 0.51^bP < 0.01

P < 0.000) each had significant direct effects on behavioral intentions separately and in combination (Table 3).

DISCUSSION

This research examined the status of HACCP prerequisite programs in school foodservice operations in three mid-western states and determined the beliefs and perceptions of school foodservice personnel regarding benefits, barriers, and intentions with regard to following HACCP-based food safety programs. Additionally, the research established which of the identified constructs had the most influence on intentions to follow HACCP-based programs. The response rate was lower than in other studies, which may have been due to the use of an e-mailed survey. However, demographic responses were similar to those reported in previous research (age and education) (33).

For prerequisite programs, chemical storage, pest control programs, and personal hygiene were completely implemented most often. However, 25% of operations had not implemented a food allergy program, which may be because the Food Allergy and Anaphylaxis Management Act (6) calling for a voluntary policy to be developed was passed only in 2008.

Overall, approximately 75% of schools had implemented a food safety training program. However, Missouri and Nebraska respondents indicated that only 50% of their schools had a formal

food safety training program. The overall results are similar to what Riggins (24) found in childcare, in which 65% of respondents had implemented a food safety training program.

For beliefs and perceptions, respondents agreed they were concerned about FBIs occurring at their school (3.12 ± 1.11) and the severe consequences for children (3.45 ± 0.83) and that following a HACCP program reduced food safety problems (3.44 ± 0.86). On the other hand, respondents indicated that they did not worry about children at their schools getting a FBI (1.60 ± 0.76). This belief may be based on the fact that respondents felt they did not need to learn more to follow a HACCP program (2.23 ± 0.98).

There were few significant differences in beliefs and perceptions by certification status, education, or state. For certification status, those who were certified in food safety had a higher mean score (*P* ≤ 0.05) for having the skills to follow a HACCP program than those who were not certified. Based on educational level, those respondents with less than a four-year college degree indicated that were more concerned about the possibility of a FBI outbreak at their school and felt their job and coworker relationships would be endangered if one occurred. However, there were no differences in skills or confidence to follow HACCP programs based on educational level.

Significant differences in beliefs and perceptions between states were found with regard to providing employees with

food safety training (*P* ≤ 0.001), having funding for additional food safety training (*P* ≤ 0.05), and employees being comfortable with change (*P* ≤ 0.05). In each instance, respondents in Kansas had higher mean scores than those in Missouri or Nebraska. These results indicate that Kansas may have allocated more resources for food safety training than either Missouri or Nebraska.

In predicting behavioral intention, the results indicated that child susceptibility, child severity, benefits, and self efficacy were the significant constructs. This would indicate that those who know that children are susceptible and suffer severe consequences of FBIs believe that there are benefits to following HACCP programs, and believe they have the skills to follow HACCP programs, are more likely to do so. One interesting note is that barriers were not significant in this study or in a previous study with childcare (22). However, in HBM studies unrelated to foodservice, the best predictor was found to be perceived barriers (17, 24). It may be that school foodservice personnel realize that following a HACCP program is critical for their customers and that barriers can be overcome.

CONCLUSIONS

Overall, the results of this study indicate that Kansas, Missouri, and Nebraska school foodservices have completely implemented most prerequisite programs, compared with results of earlier studies (26, 33). However, the pri-

mary concern is that only about 50% of schools in Missouri and Nebraska had implemented a food safety training program. It was significant that more Kansas respondents indicated that their schools provided employees with food safety training than respondents in Missouri or Nebraska. Because Kansas appears to have more prerequisite programs implemented, other states may want to benchmark Kansas's procedures to determine how they have conducted their training and to assess their program against objective national standards, as recommended by the School Nutrition Association (SNA) Keys to Excellence program (25).

The finding that respondents generally agreed that there was little chance of an FBI occurring in their school and that they did not need further food safety training supports previous research (22). However, in today's global environment, a FBI can occur in any type of foodservice operation, making food safety training critical to serving safe food. Understanding current food trends is equally important and can be done easily by using the FNS posts that update school foodservice personnel about new issues that may impact their operations (31).

Multiple regression results further confirmed that education (i.e., knowledge, skills, and confidence) are important aspects of the intention to follow a HACCP program. For HACCP to be successful, foodservice personnel must realize that a child can be severely affected by an FBI and that there are major benefits to following a HACCP program. Also, if one has the ability and confidence to do so, one is more likely to follow a HACCP program. However, if training is not occurring, then foodservice personnel may lack the knowledge, skills, and/or confidence to follow a HACCP program.

The results of this research are important to national, state, and local schools and foodservice administrators. Food safety training with certification is an important component of following a HACCP program and should be a priority not only because of the results of this study, but also because such training was one of the GAO recommendations in 2004 (11, 12). Rather than training solely for knowledge (i.e., internal temperatures of cooked foods), personnel should be trained to understand the possible consequences of FBIs and the

benefits of knowing how to successfully follow a HACCP program. This focus will empower employees, ensuring that they can provide the safest food possible. Therefore, it is recommended that FNS, SNA, and the Child Nutrition programs in these states work together to ensure that training focus on why employees should be concerned about FBIs and the benefits of having up-to-date knowledge and skills to follow HACCP programs.

Limitations of this research include the low response rate and the fact that only three states were studied, so that generalizations cannot be made to all school foodservices across the country. However, the results are comparable to those found by Riggins and Barrett (22) in childcare centers. Further research should be conducted with schools throughout the country to determine not only the problems and best practices associated with implementing prerequisite and HACCP programs, but beliefs and perceptions of personnel about the importance of food safety. Further, research using the HBM should be conducted with those who care for other high-risk populations, such as acute-care and long-term care facilities.

REFERENCES

1. Barrett, B., and L. Riggins. 2009. Beliefs and perceptions of school foodservice personnel about HACCP implementation. *J. Am. Diet. Assoc.* 109(9): Supplement A46.
2. Boone, K., K. Penner, J. C. Gordon, V. Remig, L. Harvey, and T. Clark. 2005. Common themes of safe food-handling behavior among mature adults. *Food Prot. Trends* 25:706–711.
3. Centers for Disease Control and Prevention, Enteric Disease Epidemiology Branch. Summary statistics for foodborne outbreaks, 2006. Available at: http://www.cdc.gov/outbreaknet/surveillance_data.html. Accessed 16 July 2010.
4. Centers for Disease Control and Prevention, Enteric Disease Epidemiology Branch. 2007. Summary statistics for foodborne outbreaks. Available at: http://www.cdc.gov/outbreaknet/surveillance_data.html. Accessed 16 July 2010.
5. Child Nutrition and WIC Reauthorization Act of 2004, Pub. L. No. 108–065, § 2, 118 Stat 729. Available at: <http://www.gpo.gov/fdsys/pkg/STATUTE-118/pdf/STATUTE-118-Pg729.pdf>. Accessed 16 July 2010.
6. Committee on Energy and Commerce. 2008. Food allergy and anaphylaxis management act of 2008 (to accompany H.R. 2063). 110–571 Part 1: 1.110–7. Available at: <http://purl.access.gpo.gov/GPO/LPS93208>. Accessed 16 July 2010.
7. Cronbach, L. J. 1951. Coefficient alpha and the internal structure of tests. *Psychometrika* 16:297–334.
8. Educational Foundation of the National Restaurant Association. 2008. ServSafe Essentials. Fifth Ed. Chicago, IL.
9. Daniels, N. A., L. MacKinnon, S. M. Rowe, N. H. Bean, P. M. Griffin, and P. S. Mead. 2002. Foodborne disease outbreaks in the U.S. *Ped. Infect. Dis. J.* 21:623–628.
10. Giampaoli, J., J. Sneed, M. Cluckey, and H. Koenig. 2002. School foodservice directors' attitudes and perceived challenges to implementing food safety and HACCP programs. *J. Child Nutr. and Mgmt.* 26(1). Available at: <http://www.schoolnutrition.org>. Accessed 16 July 2010.
11. Government Accountability Office. 2002. Food safety: Continued vigilance needed to ensure safety of school meals. GAO-02-669T. Available at: <http://www.gao.gov>. Accessed 16 July 2010.
12. Government Accountability Office. 2003. School meal programs: Few instances of foodborne outbreaks reported, but opportunities exist to enhance outbreak data and food safety practices. GAO-03-530. Available at: <http://www.gao.gov>. Accessed 16 July 2010.
13. Hanson, J. A., and J. A. Benedict. 2002. Use of the health belief model to examine older adults' food-handling behaviors. *J. Nutr. Educ. Behav.* 34(2):S25.
14. Henroid Jr., D., and J. Sneed. 2004. Readiness to implement hazard analysis critical control point (HACCP) systems in Iowa schools. *J. Am. Diet. Assoc.* 104:180–185.
15. Hwang, J. H., B. A. Almanza, and D. C. Nelson. 2001. Factors influencing Indiana school foodservice directors/managers' plans to implement a hazard analysis critical control point (HACCP) program.

- J. Child Nutr. Mgmt.* 25:24–29. Available at: <http://www.schoolnutrition.org>. 16 Accessed July 2010.
16. Jenkins-McLean, T., C. Skilton, and C. Sellers. 2004. Engaging food service workers in behavioral-change partnerships. *J. Environ. Health* 66:15–19.
 17. Kirscht, J. 1974. Research related to the modification of health beliefs. *Health Educ. Monographs* 2:128–143.
 18. National Advisory Committee on Microbiological Criteria for Foods (NACMCF). 1998. Hazard analysis and critical control point principles and application guidelines. *J. Food Prot.* 61:1246–1259.
 19. Oakley, C. B., M. M. Cody, and V. S. O’Leary. 2006. HACCP readiness in child nutrition programs: Temperature measurement and recording. *J. Am. Diet. Assoc.* 106:A–55
 20. Pathogen reduction; hazard analysis critical control point (HACCP) systems; final rule. 1996; 61(144): 38805-38855. 9 CFR Part 304, et al. Available at: <http://www.access.gpo.gov>. Accessed 16 July 2010.
 21. Riggins, L. 2006. Beliefs and perception about HACCP in childcare centers: an exploratory study. PhD dissertation, Kansas State University, Manhattan.
 22. Riggins, L., and B. Barrett. 2008. Benefits and barriers to following HACCP-based food safety programs in childcare. *Food Prot. Trends.* 28:37–44.
 23. Rosenstock, I. 1974. The health belief model and preventive health behavior. *Health Educ. Monographs* 2:27–59.
 24. Schafer, R., E. Schafer, G. Bultena, and E. Hoiberg. 2004. Food safety: An application of the health belief model. *J. Nutr. Educ.* 8(3):149–162.
 25. School Nutrition Association. 2009. Keys to Excellence. Available at: <http://www.schoolnutrition.org/Content.aspx?id=2406>. Accessed 13 August 2009.
 26. Sneed, J., and D. Henroid, Jr. 2003. HACCP implementation in school foodservice: Perspectives of foodservice directors. *J. Child Nutr. Mgmt.* 27. Available at: <http://www.schoolnutrition.org>. Accessed 16 July 2010.
 27. Sneed, J., C. Strohbehn, and S. A. Gilmore. 2004. Food safety practices and readiness to implement HACCP programs in assisted-living facilities in Iowa. *J. Am. Diet. Assoc.* 104:1678–1683.
 28. Strohbehn, C. H., S. A. Gilmore, and J. Sneed. 2004. Food safety practices and HACCP implementation: Perceptions of registered dietitians and dietary managers. *J. Am. Diet. Assoc.* 104:1692–1699.
 29. U.S. Department of Agriculture, Food and Drug Administration. 2000. Report of the FDA retail food program database of foodborne illness risk factors. Available at <http://www.fda.gov/downloads/Food/FoodSafety/RetailFoodProtection/FoodborneIllnessandRiskFactorReduction/RetailFoodRiskFactorStudies/ucm123546.pdf>. Accessed 16 July 2010.
 30. U.S. Department of Agriculture, Food and Drug Administration. 2004. FDA report on the occurrence of foodborne illness risk factors in selected institutional foodservice, restaurant, and retail food store facility types. Available at: <http://www.fda.gov/Food/FoodSafety/RetailFoodProtection/FoodborneIllnessandRiskFactorReduction/RetailFoodRiskFactorStudies/ucm096181.htm>. Accessed 16 July 2010.
 31. U.S. Department of Agriculture, Food and Nutrition Service. 2001. Accommodating children with special dietary needs in school nutrition programs. Available at: <http://www.fns.usda.gov/cnd/guidance/default.htm>. Accessed 16 July 2010.
 32. U.S. Department of Agriculture, Food and Nutrition Service, Office of Research Nutrition and Analysis. 2007. School nutrition dietary assessment study-III: Volume II: Student participation and dietary intakes. CN-07-SNDA-III:1-276. Available at: <http://www.fns.usda.gov/>. Accessed 16 July 2010.
 33. Youn, S., and J. Sneed. 2003. Implementation of HACCP and prerequisite programs in school foodservice. *J. Am. Diet. Assoc.* 103:55–60.