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Food Defense Best Practices Reported by Public School Food Authorities in Seven Northern U.S. States

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ABSTRACT

Purpose/Objectives

This study reported food defense planning, training and best practices implemented in public schools in Montana, Wyoming, South Dakota, North Dakota, Iowa, Minnesota, and Wisconsin.

Methods

An internet-administered survey was sent to 1,501 school food authorities or food service directors (FSDs) in public schools. Survey items included frequency of implementation of 31 food defense best practices adapted from the work of Yoon and Shanklin (2007) and Yoon (2007). Focus was on practices relating to employee management, utility security, facility security, and communication. Additional items requested information about food defense planning, food defense training, operational, and demographic characteristics.

Results

Response rate was 36% (543 usable responses). Most (67.2%) survey respondents reported district enrollment < 2,500 students. The majority reported onsite (54.3%) or combination onsite/commissary (33.0%) food production systems. Few (14.5%) had a food defense plan and 21.6% reported some food defense training. Of the 31 listed practices, 16 practices had mean frequencies of implementation between *most of the time* and *always* ($M > 4.0$ on a 5-point scale with 5 = *always*). Of these, 13 practices were the responsibility of the foodservice operation, such as inspecting food packages, restricting access to food storage and production areas, training employees about safe chemical use, monitoring food production areas, securing outside entrances and storage units, restricting access to central utility controls, and having procedures to follow if utilities were compromised. Six practices (19.4%) were implemented less than *some of the time* ($M < 3.0$): doing criminal background checks on employees periodically after hire, implementing a policy that all delivery trucks be locked when unattended, communicating with emergency responders about food defense and food safety, communicating with administrators about food defense, and monitoring drains and water lines for tampering.

Application to Child Nutrition Professionals

Food defense practices under the control of the foodservice operation had high rates of implementation. Practices that overlapped with district control, such as monitoring drains and water lines or doing criminal background checks on current employees, had low reported frequencies of implementation. There is a need to involve district administrators in food defense planning.

Keywords: food defense; food safety; school administration; emergency response

INTRODUCTION

Food tampering incidents in schools have been documented (Dalziel, 2009). An attack on food served in a school setting has the potential to achieve terrorist goals to create social disruption, cause distrust in the government, and to draw international media attention (Elad, 2005). Food served in schools often is prepared in large batches, which if contaminated would affect large numbers of children. In addition, the short time period between production and consumption of school meals allows little time to discover any harmful contamination before many children have been exposed.

Every school day an estimated 31 million children in 100,000 school buildings participate in the National School Lunch Program (United States Department of Agriculture-Food and Nutrition Service [USDA-FNS], 2013). It is important that best practices have been followed to protect food served in schools from intentional contamination; this is called food defense. Although the National Food Service Management Institute (NFSMI) and the USDA-FNS have developed food defense guidance and training for school foodservice personnel (NFSMI, 2012a, 2012b; USDA-FNS, 2004, 2012), it is not clear the extent that best practices have been implemented.

Previous research has assessed implementation of food defense practices in place at schools in the United States (Story, Sneed, Oakley, & Stretch, 2007; Yoon, 2007; Yoon & Shanklin, 2007) using recommendations from *A Biosecurity Checklist for School Foodservice Programs* (BCSFS)(USDA-FNS, 2007). Results consistently showed three categories of food defense practices to be weak in school districts: communication, facility security, and utility security.

In a national study, Yoon (2007) selected 12 food defense practices and asked district school food service directors (FSDs) to rate frequency of implementation using a 7-point Likert-type scale. The mean reported ratings for five measures were >6.0 (6 = *most of the time*): purchasing food from reputable suppliers, making security checks of employees prior to hiring, safely storing and using chemicals, assigning one person to verify and receive shipments, and inspecting packages for evidence of tampering. Practices implemented *many times* (M >5.0) were: clear identification of personnel, control of access to storage and production areas, and accounting for former employees' badges and uniforms. The practices with the lowest mean reported ratings (<4.0, or less frequently than *from time to time*) were: restricting access to air and utility systems, controlling access to the foodservice facility with alarms, cameras, and physical barriers, and maintaining an updated contact list of local authorities and training employees about food defense.

The purpose of this study was to assess perceived levels of implementation of recommended food defense practices in one geographic region of the U.S. Yoon (2007) made comparisons of food defense implementation between geographic regions using the configuration of regions employed by the USDA- Risk Management Agency. However, she received only 16 responses from the Northern region in her national sample of 1,100 FSDs. No responses were received from three of seven states in this region. Our study was designed to begin to fill a gap in knowledge about food defense practices in northern U.S. schools, particularly in rural districts and from states that share a border with Canada. This study updates results published in 2007 to more accurately reflect current practices.

METHODOLOGY

Population

The survey population consisted of all public school districts in the USDA-Risk Management Agency Northern Compliance Region, which includes Wisconsin, Minnesota, Iowa, North and South Dakota, Wyoming, and Montana (N = 1,531). This region was used to facilitate comparing data with results published by Yoon (2007). Names and email addresses of district FSDs and/or school food authorities (SFAs), the persons responsible within each district for administration of the child nutrition program, were requested from each of the seven state agencies that oversaw administration of the federal program. When addresses for FSDs were not provided, the survey was sent to SFAs. The information provided by state agencies varied from state to state, and two states did not make available data from private schools; for that reason private school districts were not included in the sample. To ensure as accurate representation from school foodservice directors as possible, the survey cover letter requested the survey be forwarded to the individual responsible for day to day direction of the district's child nutrition program.

Survey Instrument

The survey used in our study requested information about operational and demographic characteristics, food defense planning, and frequency of implementation of 31 items adapted from the BCSFS in categories of general food defense practices (n = 12), facility security (n = 9), utility security (n = 3), and communication (n = 7). Items were adapted, with permission, from the survey used by Yoon and Shanklin (2007). Respondents were asked to rate their districts' implementation of each checklist item using a 5-point Likert-type scale with additional options of *don't know* and *not under my authority*. The survey was reviewed by nine FSDs and two unit managers from Midwestern states not included in the study population. Minor modifications based on feedback were incorporated into the final survey. An example of a modification was to reduce from nine to seven the number of possible responses to items about frequency of implementation of food defense. The Institutional Review Board at Iowa State University exempted the study from full review in December, 2012. The Iowa State University Office of Distance Education and Education Technology coded and delivered the survey to the created list serve using SurveyGizmo® Professional Online Survey Development Software.

Data Collection

The survey was deployed in January and February of 2013. An initial invitation and a follow-up message were sent one week apart. The directors of federal child nutrition programs in each state were sent a message asking them to express support for the survey to their SFAs and FSDs. A prize drawing for one $50 gift certificate per state was offered as an incentive for participation.

Statistical Analysis

Stata ®version 11.0 (StataCorp, College Station, Texas) was used to analyze survey results. Ratings of food defense practices were given numerical values (5 = *always*, 4 = *most of the time*, 3 = *sometimes*, 2 = *rarely*, 1 = *never*). Frequencies of *don't know* and *not under my authority* responses were determined but not included when computing means and standard deviations. The average score for individual food defense practices and the overall average for each of the four categories (general food defense, utility security, facility security, and communication) were determined. One negatively phrased statement; "Our district allows the foodservice production

area to be used for special events by outside groups" was reverse coded when the overall mean for facility security practices was computed. Chi-square analysis was used to find relationships between categorical operational and demographic characteristics of school districts.

RESULTS AND DISCUSSION

Operational and Demographic Characteristics

Responses were received from 556 districts, slightly more than one third of the population (37%). Surveys that had a response to only one item were deemed unusable. The majority of surveys came from the three most populous states in the seven-state sample: Iowa, Minnesota, and Wisconsin (Table 1). The greatest number of surveys received was from Iowa (n=137), but the highest response rate was from South Dakota (58.3%). The majority (70.4%) of respondents were district-level foodservice administrators (Table 1). Most districts (67.7%) had enrollments of less than 2,500 students. An onsite production system was prevalent. The median reported daily average number of reimbursable lunches was 600, with a median of 150 breakfast meals served; this indicates respondents represented programs in small districts. Because almost 90% of responses (n = 481) were from individuals who identified themselves as FSDs or unit managers, there is confidence results of this study represent actual practices in school meals programs.

Food Defense Planning and Training

In this study, food defense plans were reported to be implemented in 79 (14.5%) of 543 responding districts. Of these, 26.5% (n = 21) had implemented the plan more than 5 years ago, 60.8% (n = 48) within the past 2-5 years, and 13% (n = 10) within the last year. That frequency of implementation of a food defense plan did not differ among states (n = 477, p = .8040) (Table 2). School districts in states bordering Canada were not more likely to have food defense plans than those in states in the interior United States.

The Chi-square test of independence was performed to examine if relationships existed between operational and demographic variables and implementation of a food defense plan (Table 2). Although large enrollments mean larger numbers of students might be affected by a food tampering incident, responding districts with enrollment >7,500 students were not more likely to implement a food defense plan (p = .887). While transportation of food between production and service sites may potentially introduce opportunities for food tampering, districts using a central kitchen or a combination onsite/commissary production system were no different in frequency of implementation of a food defense plan than districts using an onsite production system (p = .135). A central warehouse system where large quantities of food are purchased and then distributed internally within the district also introduces opportunities for food tampering; yet school districts having a central warehouse were not more likely to have a food defense plan (p = .897). These results suggest that districts in which intentional contamination of food would affect the largest number of children did not have a greater frequency of implementing a food defense plan compared to counterpart districts; thus greater risk did not mean greater implementation.

Table 1.
Demographic Characteristics of School Survey Respondents and Their School Districts (N = 543)

Demographic Characteristic	*n*	%
State		
Iowa	137	25.2
Wisconsin	116	21.4
Minnesota	86	15.8
South Dakota	81	14.9
Montana	29	5.3
Wyoming	18	3.3
North Dakota	17	3.1
Not reported	59	10.9
Reported title		
District foodservice director	382	70.4
District administrator	46	8.5
Unit manager	99	18.2
Other/missing	16	3.0
Reported district enrollment		
<2,500	368	67.8
2,501-5,000	50	9.2
5,001-7,500	21	3.9
7,501-10,000	10	1.8
10,001-20,000	12	2.2
>20,000	12	2.2
Not reported	70	13.4
Child nutrition program administration		
Self-operated	439	80.8
Outside contractor	38	7.0
Not reported	66	12.2
Type of production system		
Onsite kitchen	295	54.3
Centralized/commissary	8	1.5
Combination	179	33.0
Not reported	61	11.2
Operated central warehouse facility		
Yes	206	37.9
No	266	49.0
Not reported	71	13.1

Table 2.
Comparison of School Districts Implementing a Food Defense Plan to Those Not Implementing a Plan by Characteristics of School District Foodservice Operations

School Characteristic	Food Defense Plan %	No Food Defense Plan %	*N*	χ^2	*p*
District located in a border state (Minnesota, North Dakota, or Montana)	16.9	83.1	477	.5861	.444
District enrollment >7,500 students	15.5	84.9	468	.0202	.887
Use of central or commissary production system	18.0	82.0	475	2.2291	.135
Operation of a central warehouse facility	14.8	85.2	466	.0167	.897
District FSD received training about food defense	31.3	68.7	335	20.347	<.001

Note. A total of 79 respondents reported having a food defense plan. *Don't know* responses were not included in analysis. $p < .05$ denotes a significant relationship between variables.

Findings showed participation in food defense training was not common; only 21.6% of respondents reported training with food defense content. When those with training were asked to describe training events, a very diverse array of sponsors, program lengths, and overall program topics were listed. Most frequently, food defense was reported as included in training about implementation of HACCP (Hazard Analysis and Critical Control Point) procedures, food safety, or emergency planning. The Child Nutrition and WIC Reauthorization Act (2004) required school nutrition programs adopt a HACCP approach to food safety. Although food defense is not explicitly included as part of HACCP, the fundamental step of identification of physical, biological, and chemical hazards to food does invite inclusion of action steps to thwart intentional food sabotage.

Findings from this study also showed that food defense plan implementation was more likely if the district FSD reported having received training about food defense (p <.001). This result suggests that an increase in food defense training may lead to implementation of food defense plans by more districts. Characteristics of successful training programs may be a topic for future research. The small percent of respondents (14.5%) acknowledging the presence of a food defense plan is a concern. However, it is possible food defense controls are woven into the district's HACCP plan or embedded within the district's crisis management plan, and respondents were not aware these steps could be considered a food defense plan. Findings from this study suggest a need for further training within districts that crosses traditional lines of discipline and authority by including the maintenance department, custodial department, school safety officers (or school safety specialists), school risk managers, insurance providers, civil city personnel (police and fire), and food vendors.

Implementation of Food Defense Best Practices

The overall mean for each category of recommended food defense practices (general food defense, facility security, utility security, and communication) indicated a practice frequency between *sometimes* (3 on the 5-point scale) and *most of the time* (4 on a 5-point scale with 5 = always (Table 3).

Table 3.

Frequency of Implementation of Food Defense Practices Reported by School Districts

General food defense practices (α = .72)	**n**	***M*** [ab]	***SD***
Our district performs criminal background checks on all newly hired foodservice employees.	464	4.8	0.8
Our foodservice employees are trained to use chemicals properly to prevent food contamination.	499	4.7	0.7
Our employees inspect food packages prior to use for evidence of tampering.	503	4.7	0.6
Our district keeps track of keys provided to employees.	476	4.6	0.8
A foodservice employee receives all food deliveries.	506	4.6	0.8
Our foodservice operation restricts visitor access to the food storage areas.	501	4.2	1.1
Our foodservice operation restricts visitor access to the food production areas.	502	4.2	1.1
Our foodservice employees have been trained about detecting food tampering.	457	3.5	1.4
Our district keeps track of identification badges provided to employees.	400	3.4	1.7
Foodservice employees wear aprons or uniforms that are unique and not easily duplicated.	496	3.3	1.7
Our foodservice employees wear photo ID badges while at work.	488	2.6	1.7
Our district performs criminal background checks on current employees at specified intervals.	317	2.3	1.6
Overall category	510	4.0	0.6
Utility security (α = .60)	**n**	***M*** [ab]	***SD***
Our district restricts access to the central controls for utilities.	346	4.4	1.0

Our district has procedures to follow if they suspect utility sources have been compromised.	230	4.1	1.2
Our foodservice operation periodically monitors drains and water lines in food production areas for possible tampering	337	2.5	1.5
Overall category	407	2.8	1.42
Facility Security Practices (α = .76)	**n**	***M*** [ab]	***SD***
Outside refrigeration/storage units are kept secure.	377	4.7	0.8
Our foodservice employees monitor food production areas to prevent someone from intentionally contaminating food during preparation.	489	4.6	0.7
Outside entrances to the foodservice operation are kept secure.	483	4.3	1.0
Our operation controls access to food products by unauthorized individuals.	484	4.1	1.2
Our foodservice operation controls access to all chemical storage by unauthorized individuals.	449	4.0	1.2
Our district requires a foodservice staff member be present when the foodservice production area is used by outside groups.	416	3.6	1.5
Our district controls access points into the foodservice facility with security hardware (e.g. cameras).	460	3.5	1.7
Our district allows the foodservice production area to be used for special events by outside groups.[c]	489	3.1[c]	1.2
Our district follows a policy that all delivery trucks on the premises be locked when not being loaded or unloaded.	295	2.4	1.7
Overall category	498	3.9	0.7
Communication practices (α = .87)	**n**	***M*** [ab]	***SD***
A list of suppliers' contact information is readily available to foodservice staff.	475	4.2	1.2
Foodservice staff knows what to do in the event of a food tampering incident.	445	4.1	1.1
The FSD (or person in charge of daily foodservice operations) communicates with district administrators about food safety issues.	478	3.5	1.4
Expectations about food defense are included when negotiating contracts with vendors.	342	3.3	1.5

The FSD (or person in charge of daily foodservice operations) communicates with district administrators about food defense issues.	471	3.1	1.5
The FSD (or person in charge of daily foodservice operations) communicates with community resource officers (including emergency responders) about food safety issues.	438	2.4	1.5
The FSD (or person in charge of daily foodservice operations) communicates with community resource officers (including emergency responders) about food defense issues.	430	2.2	1.5
Overall category	491	3.3	1.1

[a] Rating scale: 1= *never*, 2 = *rarely*, 3 = *sometimes*, 4= *most of the time*, 5 = *always*.
[b] *Don't know* and *not under my authority* responses were not used when computing mean and standard deviation. [c]Reverse coding used to compute the overall mean

Practices frequently implemented. Of the 31 listed practices among the four categories, 16 practices had mean frequencies of implementation between *most of the time* and *always* ($M >$ 4.0 and $M <$5.0). Of these, 12 practices would likely be the responsibility of the foodservice operation, such as "our employees inspect food packages prior to use for evidence of tampering."

Practices implemented somewhat frequently. Survey results indicated that outside entrances were kept secure *most of the time* (M = 4.3 on a 5-point scale), but presence of district policies requiring delivery trucks be locked when unattended or for food defense expectations to be communicated with vendors were less frequent (M = 2.4, M = 3.3 on a 5–point scale, respectively). Training is needed to make personnel at all points in the flow of food aware of the risk of intentional contamination of food during transit, whether arriving from a vendor or from a centralized warehouse or production kitchen.

Practices implemented infrequently. Six practices (19.4%) were reported to be infrequently implemented having mean ratings <3.0 on the 5-point scale. Of the six, two could be considered district responsibilities and out of the control of the foodservice operation: doing criminal background checks on employees periodically after hire and implementing a policy that all delivery trucks be locked when unattended. It should be noted that doing criminal background checks for newly hired employees was a practice that received a mean score of implementation of 4.8, likely because in many states this is a requirement. The lower frequency of follow up monitoring could be due to administrative costs; however, it should be recognized that circumstances of employees' lives may change and the access given to current employees could be sought by food terrorists. The practice of foodservice employees wearing photo ID badges while at work (M = 2.6) could be considered a joint responsibility because the district must issue IDs, and the FSD must enforce their use. The frequency of communication between the FSD and emergency responders for food safety and food defense matters had means of 2.4 and 2.2, respectively on the five-point scale. This suggests FSDs are not fully involved in district crisis management plan development. The practice with the lowest reported mean level of implementation related to utility security was "our foodservice operation periodically

monitors drains and water lines in food production areas for possible tampering" ($M = 2.5$). Because most school districts have a maintenance department, it is likely this practice is considered the responsibility of that area rather than that of the nutrition program.

CONCLUSIONS AND APPLICATION

Twelve of 16 frequently implemented food defense practices were under the control of the foodservice operations. In contrast, best practices overlapping with district control had low reported frequencies of implementation. Practices that achieved district goals of physical security and loss prevention were frequently implemented. District administrators must be made aware of the threat of intentional food contamination and the risk of catastrophic consequences so that district security measures already in place can be effectively used for food defense. Food defense must be viewed as a district-wide safety precaution, as is fire safety or building security, with all appropriate school personnel collaborating in policy development and training.

Water and air supplies, chemical supplies, and food storage areas throughout the school buildings must be secure during all hours of the day to keep food safe from intentional contamination. When school employees are empowered to challenge unauthorized visitors, their monitoring can keep areas secure; however, employees are not always present and available to monitor storage areas, loading docks, and exterior entrances. Control of air and water supplies may not be the responsibility of foodservice employees; rather facility maintenance may have this oversight. Findings suggest there is a need for awareness regarding threats of intentional food contamination among all school staff areas. Further, the results of this study support previous research that showed food defense practices related to use and storage of chemicals were frequently implemented, and communication practices were infrequently implemented. There is a need to expand employee training about chemical use and storage to include the threat of chemicals being removed and *intentionally* added to food.

While it is clear FSDs communicate about food safety and food defense within their departments, as demonstrated by high frequency of performance of food defense practices under responsibility of the school nutrition program, communication about food safety and defense with stakeholders outside of the foodservice operation appeared to be less common. The ability to communicate with administrators and emergency responders about food defense issues must be recognized as an essential skill for district-level FSDs, and woven into job descriptions and performance reviews. Additionally, training programs are needed to help develop these competencies.

Food safety training programs and a district's HACCP-based food safety plan can prepare foodservice employees to maintain food defense within their realms of responsibility. Inclusion of food defense practices into an existing HACCP plan will allow for integration of efforts to protect the safety of food while in a district's custody and provide a communication tool with written standard operating procedures.

Based on these findings, we conclude that because food may be the vehicle for a terrorist attack, proactive steps must be taken by all school personnel; food defense is not just the responsibility

of the child nutrition program. Findings also lead us to conclude there is a clear need to increase involvement of all district decision makers in development of food defense management plans.

Limitations of the Study

Survey data were based on information reported by respondents; any self-reported data are limited by the respondents' understanding of the survey items, and the sincerity and truthfulness with which responses are made. A further limitation is that respondents represented a variety of position titles, having different degrees of knowledge, experience, and direct oversight of the foodservice operation. Survey recipients who did not hold the position of FSD were requested to forward the survey to the person responsible for day-to-day operation of the school foodservice. Even so, 58 responses were received from school district personnel not employed in the foodservice operation. In very small districts, the individual responsible for day-to-day operations may be a part-time employee with limited authority. The SFA receiving the survey may have felt more qualified than the person in charge of foodservice operations on a daily basis to answer the survey questions. Another limitation is the large number and percent of non-response or don't know responses for some survey items; this may be due to unit managers or others having limited knowledge about board policies or district-level procedures.

Recommendations for Further Research

This study points to a need to open avenues of communication between school administrators and FSDs to ensure greater awareness among all school staff with the purpose of achieving strong food defense with the least expenditure of resources. Foodservice employees are the main line of defense in the kitchen and storeroom settings; it is their vigilance that maintains food defense in these areas. Employees' understanding of food defense threats and practices that mitigate these threats, as well as their level of motivation to perform food defense practices is not known. Thus, research is needed to define the knowledge, skills, and attributes needed by production workers to implement food defense practices so that qualified and reliable workers may be hired.

In 2012, USDA published a guidance document entitled *Creating Your School Food Defense Plan* that included four components with checklists. Findings from this study suggest few districts have developed food defense plans. Research is needed to assess whether the document is being used and the frequency with which the checklist items are performed. Current levels of food defense implementation data are needed on a state by state basis with involvement of state child nutrition agencies to assure representation of schools of all sizes, organizational structures, and geographic locations.

Results from the current study suggest that food defense training is more prevalent than documented in earlier research; yet low incidence and frequency shows need for continued training for all district stakeholders. Food defense training was related to implementation of food defense plans; thus it is important to develop effective food defense training programs targeted specifically to a broader audience of school district personnel, including superintendents, school board members, custodians, and school nurses.

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