

SCHOOL COOKS' MOTIVATIONS TO ENGAGE IN PROTECTIVE ACTION AGAINST FOOD TAMPERING

Carol J. Klitzke, PhD, RD, SNS^{1*}; Ali Burtraw, BS, RD²; Caitlyn Nienow, BS, RD³; Christine Nichols, BS, RD⁴;
Kara Kerrigan, BS, RD, CLC⁵; Marni Shumaker, BS, RD⁶; Marla Mulcahy, BS, RD⁷; Eliza Short, BS, RD⁸; Kirsten Arm⁹;
Judy K. Anderson, PhD, RN¹⁰

¹Professor, Nutrition and Dietetics, Viterbo University, La Crosse, WI, USA

²Medical Nutrition Specialist, Adult & Pediatric Specialists, Colorado Springs CO, USA

³Graduate, Viterbo University, La Crosse, WI, USA

⁴Master of Public Health Candidate, University of Wisconsin - Madison, Madison, WI, USA

⁵WIC Director, Fond du Lac County, Fond du Lac, WI, USA

⁶Clinical Dietitian, Mercy Health System, Janesville, WI, USA

⁷Breastfeeding Coordinator, Fond du Lac County, Fond du Lac, WI, USA

⁸Clinical Dietitian, Upper Peninsula Health system, Marquette, MI, USA

⁹Senior student, Viterbo University, La Crosse, WI, USA

¹⁰Professor Emerita, School of Nursing, Viterbo University, La Crosse, WI, USA

ABSTRACT

Food defense depends on restricting access of unauthorized persons to food production and storage areas. In school foodservice operations, cooks are available to challenge visitors, but little is known about their motivations to do so. Food production and meal service were observed at twelve schools and implementation of select food defense practices was noted. Two cooks from each school were interviewed about their perceptions of the threat of food tampering at their worksite. Although cooks expressed confidence in their ability to control access to work areas, they were less sure which stakeholder groups should be prohibited from entry.

Keywords: food defense, food tampering, school nutrition programs, bioterrorism

Acknowledgments: This project was funded by the Viterbo University Summer Undergraduate Research Fellowship

INTRODUCTION

Food tampering is contamination of food with chemical, biological, or physical agents with the intention to cause harm to those who consume it (New York State Department of Health, 2005). Contamination may occur at any time as food flows from producer to consumer. Dalziel (2009) reported 11 confirmed incidents of food tampering in school and university settings worldwide between 1979 and 2005; four of these occurred in the United States. Food tampering is a significant concern because approximately 31 million school lunches are served daily in the United States (United States Department of Agriculture, Food and Nutrition Service [USDA-FNS], 2013). The large quantities of food produced for school meals make it possible for one act of contamination to affect many children. The time between preparation of the food and its consumption is short, posing a risk that many children may be exposed to the contaminant before it is detected.

Protective practices designed to reduce the threat of intentional food contamination are collectively called *food defense*. Restriction of access to food production and storage areas is a key practice in maintaining food defense. It has been noted that few schools in the upper Midwest have food defense plans in place (Klitzke, 2013). If a

food defense plan is in place, it was most likely developed by a district-level administrator who is not directly involved in production and storage activities. In practice, implementation of many aspects of a food defense plan will depend on the actions of the employees working in the kitchen. Production employees (cooks) are employees most likely to observe entry of unauthorized persons to vulnerable areas, yet little is known about their perceived ability or motivation to challenge intruders or implement other aspects of food defense.

On at least one occasion school foodservice employees prevented an attempted contamination of school food with *Salmonella*. In the 1984 Rajneeshee bioterror attack, a large community outbreak of *Salmonella* Typhimurium infections in September 1984 in The Dalles, Oregon prompted the local county public health department to request an investigation by the U.S. Centers for Disease Control (Torok, et al., 1997). The event occurred in September and October 1984, when members of a local religious sect contaminated salad bars on multiple occasions in ten restaurants. Their motivations were to influence a local election, the outcome of which they perceived would allow expansion of their physical facilities. The Centers for Disease Control identified salad bars as the source of the infections, but ruled out restaurant employees and food handling practices as causes. A year passed before criminal investigations by the U.S. Federal Bureau of Investigation linked the foodborne illnesses to the religious group. Grand jury testimony, reported in Carus (1998), quoted one woman who was directed to distribute *Salmonella* in two schools, but was unsuccessful. She related,

What happened is ... I didn't put [*the bacteria*] in [*the food*] because it –thank god for the fact that those ladies were really watching you see. So I could at least get in the car and dump the stuff out on the street (p.56).

Guidelines for food defense in school foodservice operations have been developed by USDA-FNS (2012) and the National Food Service Management Institute (2005), but have not given advice on motivating their implementation (Yoon, 2007). Limited research has been published about implementation of food defense practices in schools (Yoon, 2007; Klitzke, Strohbehn, & Arendt, 2014; Klitzke & Strohbehn, 2015). However, little is known about the motivations of the kitchen workers who have the most influence on access to food storage, preparation and service areas during the workday. Therefore, the research questions guiding this study included:

*Corresponding Author: Phone: (608) 796-3661; E-mail: cjklitzke@viterbo.edu

- What are school cooks' perceptions of the threat of food tampering in their schools?
- Do school cooks feel they can be effective at preventing unauthorized persons from tampering with food during storage, preparation, and service?
- What procedures are in place to prevent unauthorized persons from entering food production and storage areas in school settings?

METHODS

Research Design

The study used a holistic case study design as described by Yin (2009). Twelve school sites were studied, with observation and interview data collected at all sites. This study was funded as part of a summer undergraduate research fellowship. Data collection took place during the spring/summer of 2014 and 2015. The goal for the first summer was to recruit two cooks at each of twelve schools; however only six schools and 12 cooks were recruited; the decision was made to extend data collection to a second summer. The first research group consisted of four upper division students and one faculty advisor. One student and the faculty member continued into the second year; in addition four new students and a second faculty advisor were added to the team. The returning student researcher assumed the role of student team leader, training and coaching the new student researchers so that data was collected consistently in both summers. This study was approved by the Institutional Review Board at Viterbo University.

Sample: A convenience sample of 24 public schools from Wisconsin, Minnesota, and Michigan were invited to participate; from these 12 schools and 24 cooks were recruited. Reasons for non-participation included lack of interest, busy time of year (near the end of the school year), kitchen was short-staffed, kitchen staff did not want to be observed, or health and safety policy would not permit researchers to have access to the kitchen. District enrollments ranged from 600 to 22,000 students and schools were located in municipalities with populations ranging from 1,600 to 99,000 (Table 1). Two school cooks, those with the longest and shortest employment at each school, were invited to participate in interviews.

Data Collection

Interview: Merriam (2009) asserted that a structured interview guide or schedule helps new researchers gain confidence in interviewing. The interview guide was developed by the first group of student researchers. It included 16 defined answer items selected to measure perceptions of the severity and likelihood of food tampering at their school and their ability to prevent or respond to such an

incident. The items were derived, with permission, from items used by Yoon (2007) to assess threat appraisal and protection motivation of a national sample of school and healthcare foodservice directors. The diction was simplified to be appropriate for a spoken format intended for a general audience. For example, Yoon's item *if someone intentionally contaminates food in my operation, my employees or customers will suffer from the attack* was adapted to *if someone tampers with the food in my school, my coworkers or students will suffer*. *Food tampering* was used rather than *intentional food contamination* because the phrase is more commonly used. As part of their training on the research protocol, the first summer research team engaged in role-playing an interview using the guide; from this they identified follow-up questions to evoke responses beyond the Likert scale options. The interview guide is shown in Appendix A. Interviews were audio-recorded, with prior permission of the interviewee.

One student researcher participated in both rounds of data collection and was assigned a leadership role in the second year. As group leader, she was instrumental in training the second cohort of researchers to follow the study protocol. She accompanied each member of the second group on their first school visits to provide support and assure consistent data collection procedures. Her efforts minimized variation in data collection procedures between the two years.

The six senior-level student researchers had completed a college course on motivational interviewing prior to this study. Their interviewing skills were assessed as part of their education program. Training for data collection included role-playing using the interview guide.

Observation: Researchers observed breakfast production and stayed until lunch service was completed. An instrument was developed to guide the observation period and to serve as a form for recording field notes (Appendix B). Fourteen food defense practices were selected from an assessment tool prepared for use in school food defense planning (USDA-FNS, 2012). Practices were identified from three sections: Inside Security, Foodservice Operation Security, and Personnel Security and Training. Items were selected if they were practices that focused on restricting access to production and storage sites and if they could be easily observed by the researchers. Team members of the first research group were trained to observe in the kitchen at a local school where they had previous work experience. To assure inter-rater reliability, team members made individual field notes at the training site and then compared observations until all were in agreement. To ensure consistent observation and interview

Table 1: School District Characteristics of Participating Schools

	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H	Site I	Site J	Site K	Site L
Student enrollment ^a	3,400	3,200	2,000	600	1,600	21,700	5,500	5,500	1,200	3,500	5,100	3,600
Primary production System ^b	CO	OS	OS	OS	OS	CE	OS	OS	OS	OS	OS	OS
Population of city ^c	21,000	28,000	6,000	1,620	3,000	99,000	18,000	18,000	5,000	9,000	11,000	9,000
Proportion of city population below U.S. federal poverty level 2009-2013 ^d	26%	21%	8%	NA ^e	NA ^d	19%	16%	16%	10%	5%	8%	7%

^aRounded to protect identity

^bCO = combination, OS = On-site, CE = Central

^cPopulation: Obtained from 2010 Census; rounded to protect identity; <http://www.census.gov/en.html>

^dData from 2010 United States Census

^eNA = data not available; central production systems have no facilities to serve meals to students; on-site production systems prepare and serve meals at the same

practices during the second summer, the student team leader accompanied each new researcher to her first school visit. Handwritten field notes were scanned and uploaded to QSR International's Nvivo 10 qualitative research software immediately upon return from the school visits.

Photographs: Permission was obtained to take photographs at all sites. Photographs of physical barriers and signs were taken to document implemented or absent best practices related to access to food storage, production, and service areas. Examples of photographs are shown throughout.

Data Analysis

Interview data: Recordings of interviews were transcribed by a transcriptionist trained in protection of human subjects in research. All team members read all of the transcripts obtained during their round of data collection. One student and both faculty mentors read all transcripts from both rounds of data collection. Team members individually identified themes from the transcripts, which were then discussed, defined, and refined during group discussion. The entire group agreed upon the phrases that were coded to each theme. Transcripts were uploaded into QSR International's Nvivo 10 qualitative research software and one member of the research team used the software to code quotes from the transcripts to themes according to the group decisions. After all transcripts were coded, a report showing the quotes assigned to each theme was printed. The second group of researchers reviewed all quotes coded to each theme and compared them to the definition assigned to each theme, revising the list as needed until all were in agreement.

RESULTS AND DISCUSSION

During May and June of 2014 and 2015, 12 schools were visited (Table 1). Observation was made of all meals served on the day of the visit and two cooks were interviewed at each site ($n = 24$). Photos were taken at five schools.

Analysis of the transcripts from the first round of data collection resulted in preliminary identification of six themes and 12 subthemes.

Seven themes were finalized after the second round of data collection and the number of subthemes was reduced (Table 2).

Cognitive Aspects

The theme of Cognitive Aspects reflected the thinking processes that emerged from the interviews. Sub-themes were Awareness and Insight, Misunderstanding, and Experience.

Awareness and Insight: Awareness emerged as a superficial understanding of the possibility of food tampering, which most interviewees dismissed as unlikely to happen at their site. If tampering were to occur, it would be more likely to occur prior to the arrival of the food at the school, during processing, packaging, or transportation. A disgruntled employee or angry student were identified as possible offenders. Insight reflected a deeper thinking process and recognition of the potential threat, up to and including the possibility of a terrorist act. Sample comments included:

I feel like it's urban myths, but there could be like glass in things that could hurt people in their food.

You might get a student who's mad and you try not to make enemies with these kids because you don't want them to just maliciously do something to their friend because they're mad at the foodservice.

Misunderstanding: This theme reflected the poor distinction made between intentional food tampering and contamination indicative of food safety issues. Most responses were focused on contamination as the result of unsafe food handling practices.

I'm not really afraid [of tampering] but one concern you would have is when the kids come through and they're not using the tongs or the utensils that are provided. If they have a cut on their hand or an open wound or other things and don't have clean hands, they're passing it on to others...

Experience: Only two food tampering incidents were reported: cooks from two different sites each mentioned a food tampering

Table 2: Comparison of Themes Identified From Interviews of School Cooks Over Two Rounds of Data Collection

Themes and Subthemes	
Spring 2014	Spring 2015
Knowledge	Cognitive
Experience	Awareness/insight
Confusion	Experience
Training	Misunderstanding
Consequences	Consequences
Sickness and death	Discipline
Loss of reputation	Sickness and death
	Reputation
Authorization	Authorization
Those authorized to be in the kitchen	(no subthemes)
Authorization is situational	
Physical Security	Physical Security
	(no subthemes)
Job Priorities	Job Priorities
False sense of security	(no subthemes)
Food defense is not my responsibility	
Worker Confidence	Worker Confidence
Confidence in ability to ask unauthorized visitors to leave the kitchen	(no subthemes)
Trust in coworkers and students to follow the rules	
	Physical Aspects
	(no subthemes)

situation that involved a student putting their used chewing gum into a container of fruit on a self-service line. This is fewer than the six food tampering incidents reported by school employees in a study of five school districts made by Klitzke (2014).

Consequences

Cooks identified possible physical, emotional and financial consequences of a food tampering incident at their school. Three subthemes emerged: Sickness or Death, Loss of Reputation, and Discipline (Table 2).

Sickness or Death: Sickness was most frequently stated as a consequence, mentioned by 13 of the 24 cooks. Cooks identified that tampering could lead to death: “someone could get sick or possibly die” and “we might get sick, get very, very ill, end up in the hospital.” Two cooks elaborated on symptoms that could be expected, “It would affect their body in one way or another with sickness, vomiting, diarrhea, that type of thing. And if it went further, it could be death. Nasty.” Another explained that “somebody could get very sick, choke, poisoned.”

Loss of Reputation: Cooks also identified personal consequences that could result from food tampering. They expressed beliefs that a food tampering incident would lead to a loss of reputation, which then would cause them to lose work time.

Yes, not only are there consequences to yourself but consequences to the entire school because then the news gets hold of it and letters go out to parents and now you're in front of everybody so now you have earn back that trust of the community and parents because they're going to want to send food to school with their kids versus eating at school because they're going to be afraid.

Somebody gets sick or die and then the reputation [of the program is harmed]. Totally lose the program and then out of a job.

Discipline: A theme emerged that an incident of food tampering would have disciplinary consequences and possibly bring in outside investigators.

I would think they [student perpetrators] would be expelled from school ... I'm sure the cops would be called in and there'd be an investigation, all that fun stuff they don't want to go through.

Authorization

All cooks were asked who was allowed, or authorized, to enter the kitchen area. Only two cooks flatly stated that no one was allowed in the kitchen except for the cooks. Fourteen (58%) of the cooks identified at least one stakeholder group given access to the kitchen, including principals, students, teachers, parents, custodians, and delivery personnel. Principals were perceived as having access to any part of the school building: “I would have to say principals can come in because they're allowed to come into any classroom. They have the authority.”

In certain situations cooks deemed it acceptable for non-foodservice employees to be in the kitchen. Several cooks noted necessity in authorizing delivery personnel to be in the kitchen.

‘Cause you'll have your deliveries coming in or your towel guy, it like ‘go in this area. Don't park it right here.’ We

kinda work with them and they know where to stay outta our way and vice versa.

Cooks identified the need for building maintenance staff to access the kitchen for repairs or to collect the garbage. The presence of teachers was tolerated, and even welcomed, if teachers needed to get food for students with special needs.

We have a couple of teachers come in and get coffee and generally, well you saw (name) walk into the kitchen. She came in and got a cup of coffee.

Teachers and other staff members are definitely allowed in here because ... we have a lot of diabetics who are struggling with keeping their blood sugar compliant so I want them to be able to come and get [snacks].

Parents were viewed as unauthorized visitors, with the caveat that parents selling concessions for school events may need access.

I guess the only people I have not seen in here, because I'm new, is parents. Parents don't get to come in here but everyone else pretty much does.

Observation field notes documented a variety of circumstances when unauthorized persons were allowed entry to the kitchen. Students filming for a class project entered the kitchen and were asked to leave. At another site students were observed to enter the service area and peek under lids to see what was for lunch, but they were not asked to leave. Coffee service attracted many teachers, a retired kitchen employee, and a bus driver. At two different sites the children of foodservice employees waited in the kitchen until it was time to be taken to a different school.

Physical Security Measures

Signs were used to control access to facilities (Photo 1). One cook doubted that signs were effective in preventing entry of unauthorized persons saying, “I know there's people back there even after posting the note.”

Many schools had storage areas located in areas distant from the kitchen, making access control difficult. Only one school had a security procedure in place to alert if the door to the distant freezer was opened. Chemical storage areas were observed to be unlocked and accessible to students in four schools (Photo 2). Dry storage



Photo 1. Example of sign restricting access to production area.



Photo 2. The open door on the left leads to a chemical storage area. The freezer is at the end of this hallway, in a remote location.

areas were observed to be unlocked during the school day at most sites (Photo 3).

Even when keyed areas were locked, poor control of keys reduced physical security. Periodically changing the locks had limited success in maintaining access control.

Well, we already tried re-keying certain areas that only certain people have [access to] but pretty soon copies start being made and handed out to this person or that person... or they said we've got authorization to the custodial [staff] and they don't know any better and they don't want to get caught up in the hassles. They usually let them in.

A cook reported that food service employees at the school do not have control over what goes on in the kitchen and storage areas outside of the normal work hours, "with the building open until 10:00-11:00 [at night], you've got people in here roaming around, the custodians are in here cleaning and go to do something else and somebody wanders in. Out of our control."

Physical Aspects

Observation data and interviews with the cooks presented elements of kitchen and storage layouts that were both obstacles and protective mechanisms. As an example, windows in the main kitchen office allowed managers to view production and service of meals (Photo 4). A layout feature with a negative effect was a dry storage area located next to an unlocked custodial closet (Photo 5).



Photo 3. Access to dry storage areas was unrestricted in five of the schools visited.

Although cooks expressed confidence that they could detect entry of visitors to the kitchen, observation showed that this was true while they were working in the kitchen, but not while they were working at serving breakfast and lunch. At four sites observers reported that activity in the kitchen was not visible from the cashier or the serving positions, and that there were not enough employees to monitor both kitchen and service areas. During observation at one school a cook reported that students sometimes stole food from the serving line because neither she nor the employee in the kitchen was able to



Photo 4. Office of foodservice director has large windows and clear view of service area.



Photo 5. The custodial closet and dry storage room are adjacent and both unlocked.

see and monitor the entire service line.

Physical features of the kitchen layout contributed to cooks' confidence that they could protect food from intentional contamination. Locks, counters acting as barriers, and an unobstructed line of site contributed to the perception that it was not difficult for cooks to keep unauthorized visitors out of their workspaces (Photo 6).

I don't feel that it's difficult to keep them from getting in. We're all in too many different areas and we have the



Photo 6. A physical barrier limits access but allows monitoring of service area after hours.

visibility to see if there is something going on so I don't think it is that difficult to keep them out because we're all in different areas, we can see if there's someone who popped up, it throws us a red flag right away.

Job Priorities

Foodservice production employees ranked day-to-day tasks as more important than keeping unauthorized people out of the kitchen and storage areas. Food defense was viewed as a manager's responsibility. One stated, "I feel it's the responsibility of the person in charge of the kitchen to make sure things are stored properly, they are cooked properly, and handled properly."

Cooks identified the need to handle food properly and maintain safe temperatures as taking precedence over food defense practices. Cleanliness, handwashing, preventing cross contamination, producing food on time, being organized, and maintaining safe conditions were prioritized above food defense.

It would be ... your handling of the food, your cleanliness, everything that's connected with keeping the food safe. That would be the most important thing. And then that would be naturally after that but you want to make sure everything, your work area is clean, your hands are covered, your hair is covered and what you're working with, everything is safe.

[*More important*] than keeping someone out of there? Doing my specific jobs that I do and then helping out the others when they need it just to make sure meals are prepared properly and get everything ready for the students for the day.

Worker Confidence

Cooks indicated varying levels of confidence in their ability to take action to keep unauthorized persons out of the production and storage areas if necessary. Some expressed strong confidence: "I can if I want to" and "No [I haven't been trained]; I have a big mouth, though," or "they gotta get past me first." Some were less sure they could keep out unauthorized visitors: "I'm not sure if I've run into that too much, but I would say no, I can't" and "if they want to fight me, I can't." For some, keeping students out of the kitchen was not an issue because the students know they are not allowed in those areas and adhere to the rules, stating "Our kids are pretty good here. They stay out."

Cooks reported occasional experience confronting unauthorized persons: "Well in the morning, once in a while the kids get kind of wild out there and then it's like they'll come in and pester but I say no, you kids have to back up," and "I've told people to get out of the area. Go on the other side of the serving line or whatever." Visitors may challenge cooks' authority: "Like [you tell them] no, you can't just come through the kitchen and then you get that look like who do you think you are. Ya, I've had that happen before."

CONCLUSIONS AND APPLICATIONS

The cooks interviewed in this study expressed a desire to prepare safe food for the children they serve. Their job priorities show a commitment to food safety that can be expanded on to include greater awareness of the threat of food tampering and implementation of food defense practices to mitigate it. Training programs for cooks planned to increase their awareness of this threat may increase their confidence in controlling access to school kitchens and storerooms. Knowledge of food defense threats and prevention falls under an essential function listed under Competency 4.2 of the

competencies for district-level school nutrition professionals put forth by the National Food Service Management Institute (2009).

The confidence to keep unauthorized persons out of the kitchen is a major component in maintaining food defense. Cooks tended to trust those with whom they worked, and held confidence that staff and students would follow the rules. The frequency with which cooks mentioned parents and students as unauthorized persons suggests cooks are certain that these groups should not be in the kitchen, however cooks may be less certain about the need to restrict teachers from the kitchen. Teachers were allowed in the kitchen if they had to obtain food needed for students with special needs; these visits could be eliminated if food items needed for medical or behavioral purposes were managed by the school nutrition program, but kept in another location, such as the health aide's office.

It may be necessary for custodial staff to have free entry to kitchen and storage areas, yet they may not be aware of the policies in place in order to prevent food tampering, suggesting they, too, should be involved in training for food defense. Cooks facing time pressures depend on delivery personnel to store food; however food defense can be improved if delivery personnel show credentials, make deliveries at pre-determined times, and arrange to have delivery entrances unlocked just prior to delivery.

Public school buildings in established communities may have been built more than 50 years ago, at the height of the baby boom. These facilities were built at a time when food was prepared from raw ingredients on site; the amount of refrigerator and freezer space needed then was much less than today. To cope, school foodservice operations may have had to locate storage facilities according to where they fit, not according to where they would be secure. The resulting hodgepodge of storage facilities should be assessed for security and priority given to restricting access to these areas, particularly areas where chemical supplies are stored. Observation data showed signs, locks, doors, and cameras were used as protective measures, but not always enforced. Locks tended to be left unlocked, and doors allowed to stand open for the sake of convenience. Key security was an issue because keys were given out to an array of people for deliveries and custodial needs. In those school districts where planning is underway for new construction, consultation with foodservice personnel trained in food defense practice would be beneficial in designing an environment suited for safety.

School foodservice operations in recent years have experienced reductions in staff to control costs at the same time they are adjusting to new, more stringent, regulations. One can understand why locks are available, but not used. There is a need for new and affordable technology that streamlines the process of locking and unlocking cupboards or doors.

The responsibilities of building custodial and maintenance staff are entwined with the foodservice operation because of the need to have access after-hours for cleaning and trash removal. Custodial staff should receive food defense training and processes be developed to promote collaboration between the physical plant and foodservice operations. Working together, cooks, custodians, and their managers could create practical, workable, low-cost strategies to restrict access to sensitive areas.

This study provides evidence that school cooks perceive food tampering as a dangerous threat, but one that is unlikely to happen. They express motivation to keep students safe; training about the threat of food tampering may be effective in giving them confidence

to keep unauthorized persons from kitchen and storage areas. Cooks assert that they can restrict students and parents from the kitchen, but observation revealed that unauthorized persons are allowed to enter production areas. Physical layouts that foster visibility are effective at promoting food defense, whereas locks and signs tend to be disregarded.

Limitations

Data was collected in two summers by eight researchers who were participants in a summer undergraduate research program. The number of researchers in this study was both a limitation and a strength. The large number of researchers was of value in recruiting the sample for this study. Many students had success recruiting their former high schools to participate in the study.

The large number of researchers provided strength in the coding and analysis of the interview data because all were actively involved, and served to establish trustworthiness of the data through the iterative discussions. Each student researcher was assigned one to two school visits; the small number of visits reduced the fatigue that might be associated with multiple day-long observation periods.

The small convenience sample of 12 schools and 24 cooks is a limitation of this study. Eleven of the twelve schools had an enrollment of 5,500 students or less and only one large school district was sampled. Ten out of the twelve sites were on-site production facilities; only one was a central kitchen production facility. These demographics limit the generalizability of these findings to larger school districts, or those with central or commissary production systems. Even so, small size does not make a community immune to bioterrorism: Torok, et al. (1997) reported that the population of The Dalles, Oregon, at the time of the intentional contamination of salad bars described earlier, was 10,500, with a countywide population of 21,000.

The observation and interview data was collected in May, very near the end of the school year. During this time of the year, some aspects of the foodservice operation may have been atypical. During all site visits meals were being produced as usual, but fewer food deliveries were likely being made because managers would want to end the year with as little food in storage as possible. This would limit the opportunities to observe cooks' reactions to visitors. In contrast, more students may have been visiting the kitchen during this time because they needed to clear up outstanding balances to their lunch accounts.

Although demographics relating to the school districts were collected, no effort was made to collect demographics of the cooks who were interviewed. The research protocol was to choose the most long-term and most recently hired cooks to interview. Cooks perceive that they hold relatively low status within the school; we did not want to ask for personal information that might strain the interview situation. Our sample was not large enough to allow difference tests based on demographics. In the geographic area represented by this study there is little ethnic or racial diversity among the population.

REFERENCES

- Carus, W. S. (2001). *Bioterrorism and biocrimes: The illicit use of biological agents since 1900*. Retrieved from the Federation of American Scientists website: <https://fas.org/irp/threat/cbw/carus.pdf>
- Dalziel, G. R. (2009). *Food defence incidents 1950-2008: A chronology and analysis of incidents involving the malicious contamination of the food supply chain*. Retrieved from Nanyang Technological University website: http://www3.ntu.edu.sg/rsis/cens/publications/reports/RSIS_Food%20Defence_170209.pdf

- Klitzke, C. J. & Strohbehn, C. H. (2015). Food defense best practices reported by public school food authorities in seven Northern U.S. states. *Journal of Child Nutrition and Management*, 39(1). Retrieved from [https://schoolnutrition.org/uploadedFiles/5_News_and_Publications/4_The_Journal_of_Child_Nutrition_and_Management/Spring_2015/Manuscript%20866%20Print%20Ready%202-10-15%20\(1\).pdf](https://schoolnutrition.org/uploadedFiles/5_News_and_Publications/4_The_Journal_of_Child_Nutrition_and_Management/Spring_2015/Manuscript%20866%20Print%20Ready%202-10-15%20(1).pdf)
- Klitzke, C. J., Strohbehn, C. H., & Arendt, S. W. (2014). Implementation of food defense best practices in Northern U.S. school nutrition programs: A case study. *Journal of Food Service Management Education*, 8(1):21-28. Retrieved from <http://fsmec.org/wp-content/uploads/2015/01/8-1-Klitzke.pdf>
- Klitzke, C. J. (2013). *Food defense practices of school districts in northern U.S. states*. (Doctoral Dissertation). Available from ProQuest Dissertations and Theses Database. (UMI 3610655).
- National Food Service Management Institute. (2009). *Competencies, knowledge, and skills for district-level school nutrition professionals in the 21st Century*. Retrieved from <http://www.nfsmi.org/documentlibraryfiles/PDF/20090514085653.pdf>
- National Food Service Management Institute. (2005). *Food defense: Developing a biosecurity management plan*. Retrieved from <http://www.nfsmi.org/ResourceOverview.aspx?ID=69>
- New York State Department of Health. (2005, September). *How to prevent food tampering -A guide for food service establishment operators*. Retrieved from <http://www.health.ny.gov/publications/7080/>
- NVivo 10 for Windows [Computer software]. Burlington, MA: QSR International (Americas) Inc.
- Torok, T. J., Tauxe, R. V., Wise, R. P., Livengood, J. R., Sokolow, R., Mauvais, S., Birkness, K. A. ... Foster, L. R. (1997). A large community outbreak of Salmonellosis caused by intentional contamination of restaurant salad bars. *Journal of the American Medical Association*, 278, 389-395.
- United States Department of Agriculture, Food and Nutrition Service. (2004). *A biosecurity checklist for school food service*. Retrieved from <http://foodbiosecurity.nfsmi.org/index.php>
- United States Department of Agriculture, Food and Nutrition Service. (2012, July). *Creating your school food defense plan*. Retrieved from <http://www.fns.usda.gov/creating-your-school-food-defense-plan-pdf>
- Yin, R. K. (2009). *Case study research; Design and methods* (4th ed.). Thousand Oaks, CA: Sage.
- Yoon, E. (2007). *Food defense management plan implementation intention: An application of protection motivation theory*. (Doctoral Dissertation). Available from ProQuest Dissertations and Theses Database. (AAT 3291401).

**APPENDIX A
Interview Guide**

Site Code:	Participant Code:
Date of Interview:	Interview start time:

Obtain Informed Consent. Keep signed copy and hand interviewee an unsigned copy for them to keep.

Establish Rapport: Talk about weather, your memories of school, the season or other general topics.

I would like to know your opinions about food tampering. The definition of food tampering is: the contamination of food with chemical, biological or physical agents with the intention to cause harm to those who consume it. Contamination may occur during storage, preparation or service of food.

I want to keep my school safe.

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

The top priority in my school is keeping students safe.

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

It is unnecessary to worry about food tampering.

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

I want to have more information about preventing food tampering.

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

If someone tampers with the food in my school, my coworkers or students will suffer.

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

Follow up:
(If response is agree or strongly agree): What would be the consequences of a food tampering incident?

If someone intentionally contaminates food in my school, it will damage the reputation of our program.

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

It is likely that a student will contaminate food in my school.

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

Follow up:

- Have you ever had an incident where food was contaminated by students?
- Can you describe what happened?
- Have you personally experienced food tampering?
- Is it possible that someone other than a student would tamper with food in your school?

Food tampering is frightening.

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

Follow up:

- What are you afraid might happen?
- How frightening is food tampering compared to other food safety issues?

Next I have a few questions about who **is** and **is not** allowed in the kitchen.
Who in your school **is not** allowed in the kitchen? Are students allowed? Principals? Custodians? Parents? Teachers?
We will call those not allowed in the kitchen **unauthorized** people

The following statements come in pairs, so they sound a lot alike. The first statement refers to the kitchen. The second statement in the pair refers to the storage rooms, refrigerators, and freezers.

Keeping unauthorized people out of the kitchen disturbs my work routine.				
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Follow-up: (If response is agree or strongly agree) Can you give an example?				
Keeping unauthorized people out of the storage areas disturbs my work routine.				
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Follow-up: (If response is agree or strongly agree) Can you give an example?				
I am able to keep unauthorized people out of the kitchen.				
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Follow-up: Have you ever had to do this? What are you trained to do?				
I am able to keep unauthorized people out of the storage areas.				
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Follow-up: Have you ever had to do this? What are your trained to do?				
It is important to keep unauthorized people out of the kitchen.				
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Follow up: Among your job duties, what is more important than keeping unauthorized people out of the kitchen?				
It is important to keep unauthorized people out of storage areas.				
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Follow up: Among your job duties, what is more important than keeping unauthorized people out of the storage areas?				
It is difficult to keep unauthorized people from entering our kitchen.				
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Follow up: What would make is less difficult?				
It is difficult to keep unauthorized people from entering our storage areas.				
Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Follow up: What would make is less difficult?				

Thank you for participating in our study. Your participation is very important. The results of our study will be used to plan training programs about food tampering for school cooks like you. Do you have any questions you would like to ask me?

End of interview. State the time.

**APPENDIX B
Observation Form**

Site Code:	Date:
Observation Period: _____ to _____	
IRB Approval No.:	
Food Defense Practices:	Data Collection:
Limiting Access to Production and Storage Areas	
Visitors are restricted to specific areas or accompanied by school personnel	Describe restrictions or controls you experienced as a visitor to the school.
Access to foodservice production areas is restricted to foodservice or other authorized employees.	Record observations of any person, who is not a foodservice employee, who enters production or storage areas.
Access to food storage areas, including cold and dry storage areas, is limited (e.g., by locked door/gate or other) to essential employees.	Record observations of employees or others who enter dry storage rooms, walk-in freezers or walk-in coolers. Photograph signs, locks, or other methods of restricting access to these areas.
Unsupervised access, either during work hours or off hours, by giving keys, codes, etc. to suppliers/vendors, is not allowed.	Ask kitchen manager when deliveries are received. If deliveries are made outside of normal production areas, ask how the delivery personnel gain access to production and food storage areas.
Our school foodservice operation controls access by employees and vendors entering foodservice operation areas during <u>working</u> hours (e.g. coded doors, receptionist on duty, swipe card, etc.)	Photograph measures used to control access to production and storage areas.
Employees, visitors, and vendors are identified in some manner at all times while on the school premises.	Record observations of identification worn by foodservice employees, other school employees, and visitors.
Procedures exist for dealing with an unauthorized person(s) in restricted areas, including restricted foodservice areas.	Ask available foodservice workers what they have been told to do if unauthorized persons enter production or storage areas. Record reactions of foodservice personnel to unauthorized persons entering production and storage areas.
Monitoring of Production and Storage Areas	
At least one authorized employee is required to be present in the foodservice area at all times when the area is not locked, for example during meal service set-up.	Observe whether at least one foodservice employee is present in the production area at all times while area is unlocked.
Foodservice equipment (such as steam-jacketed kettles, steamers, choppers, hot/cold storage systems, or mixers) is monitored when in use to prevent someone from intentionally contaminating food during preparation.	Observe whether at least one foodservice employee is within sight of foodservice equipment while it is being used to prepare food.
There are procedures to monitor all foodservice areas for signs of suspicious activity or unauthorized entry. This includes self-service areas such as buffets and salad bars, receiving, outside storage, and sold waste disposal.	Observe employee monitoring of self-service bars during meal service. Observe receiving processes for food orders.
Management	
An updated employee roster is kept by management, i.e., who is absent, who the replacements are, and when new employees are being integrated into the workforce.	Ask kitchen manager about employee roster, attendance records, and monitoring of new employees.
All foodservice employees receive training on food defense procedures as part of their orientation training.	Ask available foodservice employees if they have been trained to prevent food tampering, and when this training occurred.
All foodservice employees receive training on food defense procedures as part of regular in-service update training.	Ask available foodservice employees if they have received training during which the term "food defense" was used.
Employees are encouraged to report signs of unknown or suspicious persons in the facility.	Ask available foodservice employees what they are trained to do if they observed a suspicious person in food production, storage, or service areas.