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LETTER FROM THE EDITORS

JOURNAL OF FOODSERVICE
MANAGEMENT & EDUCATION

Welcome to the eighth volume of the Journal of Foodservice Management and Education. Thank you to the authors and reviewers who make this Journal a continuing success.

This issue of the Journal follows a central theme of safe food. Each article approaches the theme from a diverse perspectives.

> *"As organizations continue to invest substantial resources in interventions for implementation of food safety procedures, it is imperative to measure the outcome of such investments. Organizations could evaluate the effectiveness of these interventions by assessing the impact on food safety culture."* Abidin, Arendt, & Strohbehn, 2014

> *"Club managers were initially unfamiliar with the topic of bioterrorism and few were convinced that their clubs were at risk for an intentional attack on their foodservice operations. Most country clubs were easily entered with little or no questioning from staff of the purpose of the investigator's visit. This suggests that better monitoring of club visitors is needed."* Olds and Shanklin, 2014

> *"The results of this study indicated that other stakeholder groups, not just child nutrition program personnel, are viewed as having responsibilities to maintain food defense or responding to a food tampering incident in a district."* Klitzke, Strohben, & Arendt, 2014

We would like to invite all of our readers to consider this Journal for your next manuscript submission. For the past two years we have been able to publish two issues, but this year we were not able to continue the trend. However, we would like to resume publishing two issues per year in 2015. With that in mind, please continue to keep the Journal of Foodservice Management and Education in mind as you consider journals in which to publish your work.

Again we would like to thank all of the individuals who have served as reviewers for this issue of the Journal. Without your dedication to our profession this Journal would simply not be possible.

Warmest Regards,

Kevin R. Roberts, PhD
Co-Editor

Kevin L. Sauer, PhD, RD
Co-Editor

ABSTRACTS

Research Manuscripts

Food Safety Culture in Onsite Foodservices: Development and Validation of a Measurement Scale

The purpose of this research was to develop and validate a measurement scale for food safety culture in onsite foodservices. Nonsupervisory employees in hospital and school foodservices participated in a two-phase, mixed methods research design process. In phase 1, four focus groups were conducted to identify relevant factors of food safety culture. In phase 2, a survey completed by 582 respondents appeared to validate six food safety culture factors: management and coworkers support, communication, self-commitment, environment support, work pressure, and risk judgment. The scale can be used to assess current food safety practices and strategize future food safety improvement goals.

Food Defense Management Practices in Private Country Clubs - A Case Analysis

This field study investigated food biosecurity practices in private country clubs in the Midwestern United States. Interviews with managers and observations of actual operational practices were conducted to identify areas in country clubs that could be at potential risk of a bioterrorist attack. Cost and lack of need were identified as barriers to implementing a food defense management plan. Background checks and good employment practices were perceived as effective in increasing food biosecurity in clubs. Recommendations to improve food biosecurity in country clubs included background checks for all employees, securing access to chemicals, and issuing identification badges to all employees.

Implementation of Food Defense Best Practices in Northern U.S. School Nutrition Programs: A Case Study

One act of intentional contamination of school meals can quickly harm many children. Food defense guidelines for schools exist; yet previous research has found communication, utility security, and physical security practices are infrequently implemented. A multi-site case study approach obtained a 360-degree assessment of food defense practices in five school districts. Meal production and service were observed, a food defense checklist was completed, and key stakeholders were interviewed. Qualitative analysis of interviews revealed lack of awareness, lack of concern, conflicting priorities, and isolation of foodservice from other school operations impaired food defense implementation. School security measures protected children, but not food.

Research Contribution

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FOOD SAFETY CULTURE IN ONSITE FOODSERVICES: DEVELOPMENT AND VALIDATION OF A MEASUREMENT SCALE

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ABSTRACT
The purpose of this research was to develop and validate a measurement scale for food safety culture in onsite foodservices. Nonsupervisory employees in hospital and school foodservices participated in a two-phase, mixed methods research design process. In phase 1, four focus groups were conducted to identify relevant factors of food safety culture. In phase 2, a survey completed by 582 respondents appeared to validate six food safety culture factors: management and coworkers support, communication, self-commitment, environment support, work pressure, and risk judgment. The scale can be used to assess current food safety practices and strategize future food safety improvement goals.

Keywords: Food safety culture, onsite foodservice, measurement scale development, safe food handling practices, organizational culture.

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INTRODUCTION

Food safety continues to be one of the most pertinent issues in the foodservice industry. Annually in the United States (U.S.), there are approximately 48 million cases of foodborne illness, from specified and unspecified agents, resulting in 128,000 hospitalizations and 3,000 deaths (Scallan, Griffin, Angulo, Tauxe, & Hoekstra, 2011a; Scallan et al., 2011b). According to the Centers for Disease Control and Prevention, incidence of foodborne illness was highest in children younger than five years old with an estimated 5% of the infections associated with recognized outbreaks; whereas, infected persons older than 60 years old were reported to have the highest percentages of hospitalized cases (40%) and case-fatality ratios (1.5%) (Centers for Disease Control and Prevention [CDC], 2011). For onsite foodservices serving these populations, food safety is of paramount importance for the health and well-being of their customers. Institutional settings have been identified as the most commonly reported place for norovirus outbreaks in CDC surveillance reports (CDC, 2007). Between 1994 and 2006, long-term care facilities accounted for 35.5% of the norovirus outbreaks confirmed by the CDC, while other settings such as school and childcare centers accounted for 13% of the confirmed incidents (CDC, 2007). It should be recognized the norovirus is just one cause of foodborne illness outbreaks.

The most commonly reported risk factors for foodborne illness outbreaks were improper holding temperatures, poor personal hygiene, and cross-contamination (U.S. Food Drug Administration [FDA], 2009). Multiple studies have been conducted to identify barriers to perform food safety practices associated with these risk factors (Green et al., 2007; Howells et al., 2008; Pragle, Harding, & Mack, 2007; Strohbehn, Sneed, Paez, & Meyer, 2008). Besides lack of knowledge and technical skills, factors related to organizational culture were identified as barriers to perform food safety practices (Green et al., 2007; Howells et al., 2008; Pragle et al., 2007). Lack of organizational support, lack of encouragement from managers and coworkers, inadequate facilities and supplies, as well as lack of accountability were some of the reported barriers related to organizational culture. These studies demonstrate that preventing foodborne illness requires going beyond food safety training. Such findings also highlighted the potential impact of organizational culture on changing food safety practices.

Recognizing organizational culture as a contributing factor to food safety practices, experts have recommended the establishment of a positive food safety culture to encourage and improve practices (Arendt & Sneed, 2008; Griffith, Livesey & Clayton, 2010a; Taylor, 2011; Yiannas, 2009). Organizational culture has been studied in various areas and there are many definitions given. In this study, organizational culture is viewed as shared perceptions among members of an organization regarding policies, procedures and practices (Schein, 1985). Food safety culture is a specific form of organizational culture that represents the way an organization "does food safety" (Yiannas, 2009, p.12). The role of organizational culture in changing behavior is well documented in areas such as workers health and safety education (Flin, 2007; Guldenmund, 2007; Zohar, 2003). Studies have shown that workers' behaviors are partly influenced by the prevailing cultural norms in their work environments, thus effective interventions for behavioral changes need to be designed taking these cultural factors into account. Likewise, organizational culture is predicted to play a significant role in determining the success of food safety interventions (Mitchell, Fraser, & Bearon, 2007; Yiannas, 2009) and food safety management systems (Ball, Wilcock, & Aung, 2010a; Griffith, Livesey & Clayton, 2010b; Taylor, 2008) in the food industry.

In recent years, the concept of food safety culture has attracted increased attention from practitioners and academics. Researchers acknowledge that food safety problems in the food industry are partly caused by organizational culture, thus food safety culture has been highlighted as another focal area for improving food safety practices (Ball et al., 2010a; Griffith et al., 2010a; Powell, Jacob, & Chapman, 2011; Ungku Zainal Abidin, Arendt, & Strohbehn, 2013; Yiannas, 2009).

Despite being an important indicator of performance, organizational culture is recognized as a nebulous academic concept and has been applied in rather ambiguous ways. Numerous definitions and measurement scales of organizational culture have been introduced. There is no agreement on the best approach to measuring the relationship between organizational culture and performance (Clarke, 2000). Although no consensus exists regarding the theoretical

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foundation of this concept, three significant commonalities arise in all applications: the interrelationship between the individual and the environment, emphasis on multi-dimensions, and context specificity. Researchers have adapted measurement scales of organizational culture in various fields of study to understand factors impacting food safety culture as shown in Table 1. The scope of measurement vary depending on study context but three factors appear relatively persistent: 1) management support and commitment, 2) system and process (e.g., procedures, communication, and resources), and 3) employee attitude and behaviors. Assessments of food safety culture help organizations understand why employees do not perform safe food handling practices while working (Ball et al., 2010a; Griffith et al., 2010a; Taylor, 2011; Ungku Zainal Abidin et al. 2013; Yiannas, 2009).

Although many food safety experts suggested the importance of creating a positive food safety culture, limited research has been conducted to understand what constitutes food safety culture in onsite foodservices. In addition, there is a lack of measurement scales to evaluate food safety culture in onsite foodservice. Published works on food safety culture is primarily based on expert opinions. Thus, the current study developed a measurement scale for onsite foodservices by identifying specific items to assess food safety culture (including those determined in previous works). Validity of the developed scale was evaluated to establish the psychometric properties.

METHODS

A mixed methods design was used in this study and included two phases. In phase 1, focus groups were conducted with foodservice employees to explore factors influencing safe food handling practices, thus defining relevant factors of food safety culture in onsite foodservice. In phase 2, a measurement scale of food safety culture was developed based on focus group findings. The measurement scale was tested and validated in two types of onsite foodservices-hospitals and schools. Human Subjects Institutional Review Board approval was obtained prior to data collection.

Phase 1—Focus groups

Participant selection: Participants were selected based on purposive sampling procedure (Patton, 2003) with three selection criteria: 1) current or former employee with nonsupervisory position in hospital or school foodservice, 2) at least 18 years of age at the time of recruitment, and 3) have or had experience in a foodservice job involving food handling. These selection criteria were established to ensure participants could provide information regarding food safety culture in foodservice organizations. Participants were recruited from hospital and school foodservices located in central Iowa. All participants received a $40 token of appreciation for participating.

Data collection: An experienced moderator was hired to facilitate the focus group sessions with help of an assistant moderator; one of the researchers. Four focus groups with homogenous members were held; two sessions with employees from school foodservices and two sessions with college students who were working or had worked in health care foodservice. A topic guide was used to encourage discussion; it consisted of two key questions: 1) What does your workplace do to help you follow safe food handling practices? 2) What do you believe are the main factors in the workplace that prevent you from following safe food handling practices? Focus groups lasted 60-90 minutes with 5-12 participants in each session. Morgan (1998) recommended 6 -12 as an optimum number of participants for enabling effective and meaningful discussion. All focus groups were audio-recorded.

Data analysis: Focus group audio-records were transcribed verbatim and manually analyzed using deductive and inductive thematic analysis (Fereday & Muir-Cochrane, 2006). Two researchers, trained in qualitative data analysis, developed themes independently and then discussed until consensus was achieved. Use of multiple researchers in the data analysis helps to achieve confirmability (Merriam, 2002; Shenton, 2004).

Phase 2 – Survey

Survey design: A paper-based survey containing two sections was developed to test the food safety measurement scale developed for this study. The first section consisted of the food safety culture questions. Participants were asked to rate their level of agreement on 47 statements describing food safety practices in their current workplace using a seven-point Likert scale (1 = Strongly Disagree; 7 = Strongly Agree). Three negatively worded statements were used to minimize agreement bias (DeVellis, 2003). The second section contained 13 questions on demographic and organization information. Pilot testing of the questionnaire was conducted with onsite foodservice employees (n = 31). Minor modifications were made based on suggestions from the pilot test participants.

Study sample: The psychometric properties of the food safety culture scale were tested by surveying foodservice employees from hospitals and schools in Iowa, Minnesota, and Kansas. Only employees who

Table 1: Food safety culture factors identified in the literature

Author(s)/year published	Context	Area adapted/ Tool	Factors
Yiannas (2009)	Retail and foodservice industry	Safety science	Leadership, employee confidence, management support, accountability, and sharing of knowledge and information
Griffith et al. (2010b)	Food industry	Safety science	Management systems and style, leadership, communication, commitment, environment and risk perception
Taylor (2011)	Multi-cultural food industry	Management, international business, psychology	Knowledge (e.g., awareness, technical expertise, training), attitude/ psychological (e.g., agreement, risk awareness, self-efficacy, motivation), external (e.g., inspection, government/industry guideline), and behavioral (e.g., organizational culture, resources, competence)
Ball et al. (2010b)	Meat processing plant	Food Safety Climate tool	Five higher order factors: Management commitment, work unit commitment, food safety training, infrastructure and worker food safety behavior
Neal et al. (2012)	Restaurant	Food Safety Climate tool	Management commitment, worker food safety behavior

held nonsupervisory jobs, were at least 18 years old and had food handling job tasks were selected for the study. A cluster sampling technique was employed for selecting groups of study units (i.e., foodservice organizations) instead of individual study units (i.e., employee) (Babbie, 2001). The sample of hospital and school foodservices selected represented operations of different size (i.e., bed capacity and number of students enrolled in district, respectively). Foodservice directors from 37 hospitals and 24 school foodservices agreed to participate and distribute the questionnaires to a combined 2,030 hourly employees.

Data collection: Questionnaires were mailed to foodservice directors, who then distributed the questionnaires to their foodservice employees. A self-addressed prepaid business reply was used to facilitate the return process and allow employees to send their completed questionnaires directly to the researcher, thus, supervisors could not see employee responses. To motivate participation, a donation of 50 cents was made to a local food pantry for every questionnaire completed.

Data analysis: Survey data were analyzed using the Statistical Program for Social Science SPSS (Version 18.0 for Windows, 2009). Exploratory factors analysis was conducted using principal component analysis to identify the underlying factors of food safety culture. Internal consistency (Cronbach's alpha) of each construct identified was calculated to evaluate the scale reliability (Cronbach, 1951). Confirmatory factor analysis was performed using the Analysis of Moment Structures algorithm, AMOS (Version 3.61), a structural equation modeling package (Arbuckle, 1997) to validate the measurement scale.

RESULTS AND DISCUSSION

Participant profile

Table 2 presents participants profile for the focus group and survey research phases. Participants show rate for the focus groups was 94.0% (31 of 33 recruited came to the focus groups). Seventeen hourly employees from school foodservices and 14 students who were currently or had worked in health care foodservices participated in the focus groups. A majority of the focus group participants were female (93.5%) and slightly more than half (54.9%) were 30 years of age or older. The predominately female make-up of the focus groups is not unexpected given that the recruitment sites had predominately female employees or students.

Experiences in foodservice varied from less than a year (19.4%) to more than 20 years (12.9%), and while 25.8% had worked in their current operations for less than a year, 6.5% had worked more than 20 years. Most of the participants were part-time employees (64.5%) and had received food safety training (93.5%) and certification (71.0%). Participants mainly worked in self-operated (71%) as opposed to contract-managed (29.0%) foodservices.

For the survey phase, about an equal number of the 582 respondents were employees in hospital (28.4% response rate with 287 responding from 1,010 surveys distributed) and school foodservices (28.9% response rate with 295 responding from 1,020 surveys distributed). According to Dillman (2007), a population size of 2,000 requires a sample of 322 to be within ± .05 of the population proportion with a 95% level of confidence; response rate to this study met this standard. Females constituted 89.6% of the respondents with more than 50% aged 50 years old and older. About half (54.4%) of the respondents had at least 8 years of experience in foodservice and 36.6% had stayed in the current operation 8 years and more. Respondents were comprised of 56.6% part-time employees. Almost all respondents (95.2%) had received some food safety training and 68.9% had completed formal food safety certification. About 73% of the respondents were employees in self-operated organizations.

Table 2: Profile of focus group participants and survey respondents

	Focus group (n = 31)		Survey (n = 582)	
Characteristics	**n**	**%**	**n**	**%**
Gender				
Female	29	93.5	517	89.6
Male	2	6.5	60	10.4
Age				
18-29 years old	14	45.2	71	12.2
30-49 years old	8	25.8	190	32.6
50-60 years old	6	19.4	184	31.6
Older than 60 years old	3	9.7	137	23.5
Time worked in foodservice operations				
Less than 1 year	6	19.4	43	7.4
1-3 years	11	35.5	84	14.4
4-7 years	6	19.4	138	23.7
8-12 years	2	6.5	114	19.6
13-20 years	2	6.5	84	14.4
More than 20 years	4	12.9	119	20.4
Time worked in current operation				
Less than 1 year	8	25.8	91	15.6
1-2 years	11	35.5	131	22.5
4-7 years	5	16.1	147	23.5
8-12 years	4	12.9	95	16.3
13-20 years	1	3.2	54	9.3
More than 20 years	2	6.5	64	11.0
Employment status				
Full-time	11	35.5	250	43.2
Part-time	20	64.5	328	56.6
Job title				
Cook/line cook	7	22.6	142	24.6
Food prep	9	29.0	69	12.0
Foodservice assistant	8	25.8	108	18.7
Dishwasher	0	0.0	22	3.8
Server	3	9.7	52	9.0
Other	4	12.9	88	15.3
More than one job title	0	0.0	96	16.6
Received food safety training*	29	93.5	554	95.2
Completion of formal food safety certification*	22	71.0	396	68.9
Type of operation				
Hospital	14	45.2	287	49.3
School	17	54.8	295	50.7
Management system				
Self-operated	22	71.0	270	72.8
Contract management	9	29.0	101	27.2

*Yes responses

Determining factors of food safety culture

Nine themes emerged from the focus groups based on participants' discussions about factors that help or prevent safe food handling practices in the workplace: 1) leadership, 2) communication, 3) self-commitment, 4) management system and style, 5) environment support, 6) teamwork, 7) accountability, 8) work pressure, and 9) risk perception. These themes were identified in focus groups with both

health care and school foodservice employees. In the following section, the nine themes reflecting factors influencing employees' safe food handling practices in onsite foodservice are presented with some pertinent excerpts of participants' narratives included to support the interpretation of the themes.

Leadership: This theme included the role of leaders in inspiring, monitoring, being a role model, and being physically engaged. The extent to which the leader emphasizes and prioritizes food safety was expressed during the focus group as potentially important in inspiring safe food handling practices. Participants also mentioned that leader's commitment by serving as a role model could affect employees' practices. Participants agreed that their leaders showed commitment by monitoring safe food handling practices and physically engaging in monitoring activities. The following quotation illustrates the leader's role in monitoring and inspiring employees' practices:

> "*He [manager] just kinda makes it a habit to like go around and then kinda say hi to everyone, like at some point. And so, that's when he see like the hairnets and like the nail polish and just things like that"[Candace, health care foodservice employee].*

Communication: Participants described several aspects of communication influencing safe food handling practices: openness, consistency, bottom-up approach, respect, feedback, and clarity. Participants noted that there was open communication among coworkers in which they can freely speak up if something that may affect food safety occurred. Managers' feedback and a bottom-up communication approach were mentioned as effective two-way communication that helps improve employees' safe food handling practices. Some participants mentioned that they appreciated when feedback on practices was given nicely and with respect. Others mentioned that employees could better perform their jobs when they know what is expected and organization clearly communicated the expectations. The following quotation is an example of how organization expectations on employees' food safety practices were clearly communicated:

> *"And actually before I got hired, right in my interview, like before I was offered the job, our boss told us what was expected of us as far as our being up, no nail polish, no chewing gum, like...basic stuff to expect" [Courtney, health care foodservice employee].*

However, participants also mentioned that sometimes inconsistent food safety information was received at the workplace as indicated in the following quotation:

> *"So I pretty much learned three different ways to do stuff, and like there were some congruencies but then...for a lot of other stuff, it just wasn't, like it's not as uniform as you would hope, across the board." [Emily, health care foodservice employee].*

Management style and system: Several coordinated activities and provisions of standard practices in management systems were described influencing participants' food safe practices. These included policies and procedures, documentation, guideline, and implementation/ enforcement. Enforcing food safety practices with regular and detailed checking on employees' compliance positively affected safe food handling practices. Participants noted how organizations have detailed food safety procedures and guidelines in the following quotation:

> *"….like by some of the equipment, there's like proper cleaning procedures on there and like checklists that say, "Did you make sure to do this?" Or "Before you leave, did you forget to resanitize this?" So, it's just kind of like little reminders and like step-by-step instructions..." [Courtney, health care foodservice employee].*

Environment support: Adequate and quality resources were mentioned as instrumental elements of environment support that influenced employees' food safety practices. Examples of resources mentioned during the focus groups were facilities, equipment, supplies and food safety training. Some participants confirmed that environment support not only facilitates, but also prompts food safety practices as illustrated in the following quotation.

> *"they provided like extra hair restraints or like nail polish remover, um, just kind of, so there's no excuse to not be following the proper codes" [Taylor, health care foodservice employee].*

However, participants also voiced that equipment or facilities not functioning appropriately did not support production of safe food.

> *"Equipment failure is a big one too. We have freezers that go down all the time, refrigerators that go down and lose everything out of reserves and milk coolers going down in the middle of the night. …losing your milk because they temp it in the morning and it's outta temp [not safe temperature]" [Margaret, school foodservice employee].*

Teamwork: Teamwork among coworkers was reportedly another important aspect that influenced food safety practices. Participants noted that coworkers help remind and support each other to comply with safe food handling procedures. Teamwork spirit would likely cause experienced employees to be helpful to the newcomers. The following quotations reflect how participants perceived teamwork spirit among coworkers:

> *"we all kind of work together, tellin' each other, you know. It's, it works out pretty good" [Susie, health care foodservice employees].*

> *"New people come in, and we...help them and it's like a little family" [female school foodservice employee].*

According to participants, following food safety practices is sometimes challenging when there is a lack of teamwork among coworkers from other departments.

> *"…if Environmental Services isn't keeping up with everything, you know, the towels and, ah, hand sanitizer…it is really hard for us to leave in the middle of our shift to bring back more paper towels or soap dispensers when we're serving forty or fifty residents in an hour-long period" [Lynn, health care foodservice employee].*

Accountability: Participants mentioned that their organizations stressed the importance of food safety by giving disciplinary action to those who do not follow the food safety policies. Termination or suspension was noted as examples of disciplinary actions taken to show how critical food safety is to the organization. The following quotation gives an indication of how organizations have used accountability measures to shape food safety culture as described by participants:

> *"And they have like cameras that they watch, so, if you do anything like that, like I know people have been fired for like eating food while they were like making it or something" [Peyton, health care foodservice employee].*

Work pressure: Participants agreed that some aspects of work pressure did affect their food safety practices. Time constraints were commonly mentioned as the main challenge to comply with the standard procedures. Customers' expectations also created pressures

on employees to comply with procedures, as some participants were aware that customers now are demanding a greater assurance from employees to handle food safely. Participants' descriptions on these work pressures are indicated in the following quotations:

> *"So if you're running low on time or, you know, there's so much to do, sometimes I think that's an easy way to just slough off and not follow exact procedures" [Lynn, health care foodservice employee].*

> *"..in this day and age, a lot of the kids, they're become more, you know, aware...of, [food] safety" [Susie, school foodservice employee].*

Additionally, inadequate number of staff was mentioned as another work pressure affecting employees' practices. Participants mentioned that they had difficulty complying with standards when tasks become overloaded due to inadequacy of staff as demonstrates by the following quote:

> *"If you are shorthanded, if you start hurrying, you know…. And temps don't get taken "[female health care foodservice employee].*

Risk perceptions: Participants admitted that some of their food safety practices had also been influenced by the extent to which organizations were aware of the risks of not complying with food safety regulations and how far precaution measures were taken to avoid the risk. Financial reasons were frequently noted as the drive in making decisions involving risk. One participant explained why this is the case:

> *"due to the funding, the supervisors and most of the people know that, ah, if we don't follow the procedures, we can lose the funding from the State and, ah, we lose the funding then creates a big deficit and jobs will be on the line" [Terry, school foodservice employee].*

Participants noted some risk-taking behaviors in their organizations such as cutting corners with food safety to meet production demands or save money. Several organizational practices were perceived as risky and some participants argued that they did not agree with following these practices as illustrated in the following example of quote:

> *"we were asked to serve milk that was expired like by a day or something, but still not...something I was really not comfortable with" [Emily, health care foodservice employee].*

Scale Development and Validation

Forty-seven items were developed to represent the nine themes identified in the focus groups: 1) leadership, 2) communication, 3) self -commitment, 4) management system and style, 5) environment support, 6) teamwork, 7) accountability, 8) work pressure, and 9) risk perceptions. As recommended by DeVellis (2003), five to seven items were developed to reflect the specific content of each of the nine themes. Table 3 presents the scope and examples of questions measuring food safety culture based on themes and subthemes from focus groups data. In addition, food safety culture aspects in the focus groups unique to this study were identified (see Table 3).

To demonstrate that the factors of food safety culture identified in phase 1 are nine distinct factors, exploratory factor analysis was carried out on the questionnaire data. Principal component analysis with Varimax rotation methods was conducted on the 47 food safety culture items. Kaiser-Meyer-Oklin value was 0.971, exceeded the minimum recommended value of 0.60 (Kaiser, 1974) and the Barlett's test of sphericity was significance ($p < 0.001$), which suggested the data were fit for factor analysis (Pedhazur & Schmelkin, 1991). Six factors with eigenvalues greater than one were extracted, which explained 64.64% of the variance after rotation. To identify significant items, three criteria were used: 1) retain items with factor loadings exceeding 0.60 because loadings in excess of 0.60 (40% variance) are considered good (Tabachnick & Fidell, 1996), 2) retain factors that have at least three items per factor, and 3) eliminate items that load significantly (i.e., 0.50 and above) on more than one factor after rotation as recommended by Hair, Blank, Babin, Anderson, and Tatham (2006). Thirty-one items were retained (Table 4). All items have communalities ranging from 0.571 to 0.845. Cronbach's alpha reliability coefficient was used to assess the reliability of each factor. Alpha scores for the six factors ranged from 0.753 to 0.948 suggesting acceptable internal consistency (Nunnally & Benstein, 1994).

Factor 1 was termed "management and coworkers support" because the 10 items loading on this factor were related to managers and management roles in encouraging safe food handling practices and teamwork among coworkers. Factor 2 was labeled "communication" because this factor contained items related to communication between management and employees as well as communication among coworkers. Factor 3 was labeled "self-commitment" because all items in this factor reflected employees' internal motivation to perform safe food handling. Factor 4 was referred to as "environment support" because this factor contained four items representing measures on adequacy and quality of infrastructures that support safe food handling practices. Labeled as "work pressure", factor 5 contained three items that described pressures in the workplace associated with time, work load and staff adequacy that affect safe food handling practices. Finally, the last factor was named "risk judgment" because the items included were associated with organization risk taking decisions when implementing and complying with food safety rules and regulations.

Confirmatory factor analysis (CFA) was performed to further evaluate the psychometric properties of the scale. A measurement model comprising the six food safety culture factors was tested to assess reliability (latent variables) and construct validity. The results of CFA indicated a good fit level ($\chi^2/df = 3.914$, normed fit index [NFI] = 0.916, incremental fit index [IFI] = 0.940, Tucker Lewis fit coefficient [TLI] = 0.929, comparative fit index [CFI] = 0.940, root-mean-square error of approximation [RMSEA] = 0.057). The values for NFI, IFI, TLI, and CFI greater than 0.90 indicated a satisfactory model fit (Hair et al., 2006). A RMSEA with a value less than 0.08 is recommended (Hoyle & Panter, 1995). Composite reliability and average variance extracted (AVE) were used to test the reliability of the constructs (i.e., latent variables). The composite reliability of the six constructs ranged from 0.793 to 0.960 (Table 5) suggested acceptable reliability (Nunnally, 1978). The AVEs of all six constructs ranged from 0.577 to 0.759, greater than the cut-off value of 0.5 (Bagozzi & Yi, 1988; Hair et al., 2006).

Construct validity was assessed by convergent validity and discriminant validity. All the confirmatory factor loadings were significant at the 0.001 level, which indicated satisfactory convergent validity of the measure (results not shown) (Hair et al., 2006). Discriminant validity was determined by comparing the AVE for each construct with the squared inter-construct correlations. As illustrated in Table 5, all the AVEs were greater than the corresponding inter-construct squared correlation (except for inter-construct squared correlation 0.630) supporting the discriminant validity of the measure (Fornell & Larcker, 1981).

Evaluation of the food safety culture scale developed in the current study showed a good level of reliability and construct validity. In addition, all items were found to load on only one factor (Table 4). A

Table 3: Development of questionnaire items based on themes and subthemes

Themes	Subthemes	Scope of question	Examples of questionnaire items
Leadership	• Inspire • Monitor • Role Model • Physical engagement	The extent to which leaders demonstrate their commitment to food safety	….My manager always watches to see if employees are practicing safe food handling ….My manager is actively involved in making sure safe food handling is practiced
Communication	• Openness • Consistency* • Bottom-up approach • Respect* • Feedback • Clarity	Transfer of food safety messages and knowledge among management, supervisory staff and coworkers	….I can freely speak up if I see something that may affect food safety ….I receive feedback if I do not follow food safety practices
Self-Commitment	• Personal practices • Personal value • Internal motivation	Employees values and beliefs about food safety practices	….Food safety is a high priority with me ….I follow food safety rules because I think they are important
Management style and system	• Policy and procedure • Documentation • Guideline • Implementation/ Enforcement	Coordinated activities or policy and procedure to direct or control food safety	….Managers' actions show that providing safe food to customers is a top priority ….Our food safety policies and procedures give detailed guidance for practices
Environment support	• Availability of facilities • Quality of facilities* • Adequacy of supplies • Quality of supplies* • Adequacy of training	The availability and quality of infrastructure and training that support food safety practices	…. Adequate supplies (e.g., gloves, thermometers, etc.) are readily available to perform safe food handling practices ….. I am provided with quality supplies that make it easy for me to follow safe food handling practices
Teamwork	• Within department • Between department • Between new and experienced staff	Coworkers support with regard to food safety practices in the workplace	…..Employees remind each other about following food safety practices ….New employees and experienced employees work together to ensure food safety practices are in place
Accountability	• Reward and punishment • Internal rules and regulations • External rules and regulations	Checks and balances in place that made certain desired outcomes are being achieved	….Employees are disciplined or reprimanded when they fail to follow food safety practices ….Food safety inspections by health inspectors help to ensure safe food handling practices are followed
Work pressure	• Time • Adequacy of staffing • Work schedule • Customer expectation*	Various aspects of pressure associated with food preparation that affects safe food handling practices	….The number of staff scheduled at each shift is adequate for me to get my work done and handle food safely ….I always have enough time to follow safe food handling procedures, even during rush hours
Risk	• Risk-taking • Risk awareness	Organizational risk awareness and risk taking decisions with regard to food safety	…..No compromises with safe practices are made when handling food …..When there is pressure to finish food production, managers sometimes tell us to work faster by taking shortcuts with food safety

* Subthemes unique to this study

possible explanation for this result could be the use of a homogenous sample in the survey (i.e., only employees who held nonsupervisory position). Studies using multiple groups of respondents within a sample (e.g., employees of different job positions) reported poor measurement validity because factor structure was found unique to each group (Coyle, Sleeman, & Adams, 1995; Ginsburg et al., 2009). Another possible reason accounting for this result was the utilization of mixed methods approach in the development of the scale. Creswell and Clark (2007) asserted mixed methods design is a good approach in identification of items and scales for quantitative instrument development. Arendt, Strohbehn, Ellis, Paez, and Meyer (2011) reported a statistically sound finding with combined use of open-ended questions and survey in developing an instrument to measure motivators for following food safety practices. The current study further supports the advantages of using a mixed methods approach with a combination of focus group and survey data collection in scale development.

Researchers have proposed a range of factors impacting food safety culture. These factors were incorporated from a broader field of studies including safety and health science, management, international business, psychology, and food processing (Ball, Wilcock, & Colwell, 2010b; Griffith et al., 2010b; Neal, Binkley, & Henroid, 2012; Taylor, 2011; Ungku Zainal Abidin et al. 2013; Yiannas, 2009). As evident in the current study, factors related to management and coworker support, communication, self-commitment, environment support, work pressure, and risk judgment appeared to be relevant in the context of onsite foodservice. Most of these factors were in line with previously proposed or identified factors affecting food safety culture in a broader context of the food industry. Some disparities between previous research and the current findings were identified. Neal et al. (2012) found two factors, management commitment and worker food safety behavior, when evaluated food safety culture in restaurants using a Food Safety Climate tool (Ball et

Table 4: Exploratory factor analysis results from the survey (n = 582)

Factor	Items	Varimax rotation loading						Communalities
		F1	F2	F3	F4	F5	F6	
F1: Management and coworker support								
	My manager always watches to see if employees are practicing safe food handling	0.689	0.325	0.108	0.172	0.047	0.031	0.704
	My manager is actively involved in making sure safe food handling is practiced	0.664	0.430	0.127	0.178	0.003	0.092	0.812
	My coworkers are always supportive of each other regarding food safety	0.789	0.225	0.133	0.219	0.211	0.063	0.787
	When lots of work needs to be done quickly, employees work together as a team to get the tasks completed safely	0.738	0.203	0.157	0.179	0.303	0.062	0.755
	Employees remind each other about following food safety practices	0.743	0.210	0.216	0.124	0.266	0.002	0.735
	New employees and experienced employees work together to ensure food safety practices are in place	0.664	0.324	0.217	0.252	0.254	0.162	0.770
	There is good cooperation among departments to ensure that customers receive safely prepared food	0.601	0.263	0.220	0.281	0.288	0.177	0.690
	Management enforces food safety rules consistently with all employees	0.701	0.378	0.089	0.218	0.038	0.112	0.814
	Management inspires me to follow safe food handling practices	0.643	0.415	0.134	0.290	0.008	0.138	0.790
	Employees are disciplined or reprimanded when they fail to follow food safety practices	0.603	0.258	0.166	0.017	0.212	0.044	0.664
F2: Communication								
	I can freely speak up if I see something that may affect food safety	0.226	0.688	0.277	0.036	0.279	0.104	0.693
	I am encouraged to provide suggestions for improving food safety practices	0.299	0.715	0.199	0.068	0.252	0.048	0.715
	All managers give consistent information about food safety	0.476	0.640	0.173	0.170	0.111	0.087	0.756
	Management provides adequate and timely information about current food safety rules and regulations	0.355	0.670	0.216	0.301	0.122	0.116	0.800
	My manager generally gives appropriate instructions on safe food handling	0.410	0.671	0.263	0.224	0.001	0.147	0.819
	All of the necessary information for handling food safely is readily available to me area	0.229	0.609	0.130	0.359	0.203	0.076	0.666
F3: Self-commitment								
	Food safety is a high priority to me	0.190	0.156	0.808	0.274	0.040	0.088	0.807
	I follow food safety rules because I think they are important	0.151	0.231	0.829	0.231	0.092	0.120	0.840
	I follow food safety rules because it is my responsibility to do so	0.129	0.170	0.840	0.246	0.105	0.075	0.845
	I am committed to following all food safety rules	0.176	0.206	0.828	0.194	0.093	0.111	0.833
	I keep my work area clean because I do not like clutter	0.066	0.118	0.612	0.112	0.103	0.070	0.575
F4: Environment support								
	Adequate supplies are readily available to perform safe food handling practices	0.228	0.248	0.336	0.694	0.108	0.110	0.734
	Equipment items needed to prepare food safely (e.g., hand washing sinks) are readily available and accessible	0.140	0.155	0.300	0.723	0.185	0.063	0.730
	Facilities are of adequate quality to follow safe food handling practices	0.254	0.178	0.346	0.705	0.206	0.106	0.792
	I am provided with quality supplies that make it easy for me to follow safe food handling practices	0.284	0.231	0.295	0.700	0.243	0.043	0.780

Table 4: Exploratory factor analysis results from the survey (n = 582)

Factor	Items	Varimax rotation loading						Communalities
		F1	F2	F3	F4	F5	F6	
F5: Work pressure								
	I always have enough time to follow safe food handling procedures, even during rush hours	0.258	0.208	0.222	0.258	0.633	0.136	0.675
	My work load does not interfere with my ability to follow safe food handling practices	0.279	0.202	0.137	0.359	0.662	0.167	0.767
	The number of staff scheduled at each shift is adequate for me to get my work done and handle food safely	0.367	0.224	0.055	0.238	0.668	0.132	0.737
F6: Risk judgment								
	I am sometimes asked to cut corners with food safety so we can save costs when preparing food	0.098	0.097	0.035	0.156	0.027	0.862	0.571
	When there is pressure to finish food production, managers sometimes tell us to work faster by taking shortcuts with food safety	0.110	0.077	0.080	0.154	0.036	0.861	0.791
	I believe that written food safety policies and procedures are nothing more than a cover-up in case there is a lawsuit	0.005	0.167	0.076	0.107	0.195	0.620	0.796
% of variance explained								Total variance explained
		17.08	14.23	10.79	10.12	6.94	5.48	64.64
Eigenvalue		23.53	3.04	1.97	1.68	1.17	1.07	
Cronbach's alpha		0.948	0.922	0.908	0.902	0.877	0.753	
Number of item		10	6	5	4	3	3	

al., 2010b). A larger set of factors identified in the current study exhibits a context effect that distinguished food safety culture in commercial and noncommercial sectors of the foodservice industry.

CONCLUSIONS AND APPLICATIONS

This study explored food safety culture in onsite foodservices and addressed the questions: what is food safety culture in this context and what are the factors? Six food safety culture factors were identified using a mixed methods approach. Based on the satisfactory statistical evidence obtained in the six-factor structure, the measurement scale shows potential application for further researching this topic in other types of retail foodservice settings. Food safety culture is known to be context specific, thus the current study introduced a set of assessment questions developed and validated specifically for onsite foodservices whereby employees in this specific sector defined relevant aspects of culture. The scale was established based on what factors were perceived to help or prevent employees from following safe handling practices in the workplace. Recognizing that food safety culture is a multidimensional and broad concept, it could become a challenge to capture relevant aspects of culture within an operation with a manageable assessment tool. The measure developed in this study consists of a reasonable number of questions (31 questions) and captures six areas of food safety culture. Because the measure was developed and tested in two segments of the onsite sector, it has generic features that may be applicable for other foodservices in this sector, such as college and university dining or child care centers. For example, management and coworker support are generic to all foodservice operations.

Food safety culture has been recognized as an emerging area of food safety research (Arendt & Sneed, 2008; Griffith et al., 2010a; Powell et al., 2011; Ungku Zainal Abidin et al. 2013), thus educators should introduce this concept to hospitality and dietetics students; thereby highlighting the importance of various soft skill competencies in

Table 5: Inter-construct correlation, composite reliability, and average variance extracted for identified factors

Factor*	Management & coworker support	Communication	Self-commitment	Environment support	Work pressure	Risk judgment
Management and coworker support	-	0.630	0.213	0.377	0.430	0.085
Communication	0.794	-	0.251	0.376	0.371	0.118
Self commitment	0.461	0.501	-	0.399	0.191	0.056
Environment support	0.614	0.613	0.632	-	0.382	0.086
Work pressure	0.656	0.609	0.437	0.618	-	0.110
Risk judgment	0.291	0.344	0.236	0.293	0.331	-
Composite reliability	0.960	0.949	0.928	0.908	0.852	0.793
Average variance extracted	0.720	0.759	0.725	0.713	0.658	0.577

* For all factors, values below the diagonal are correlation estimates and values above are squared correlations

managing food safety and preventing foodborne illness. This study showed that food safety culture is shaped, to some degree, by soft skills (not the job specific knowledge and skills, but rather the interpersonal attributes and ability to work with others) such as communication, leadership, and human resources management (e.g., encouraging teamwork among employees or managing employees work stress). Therefore, future foodservice managers must be equipped with these soft skills. Several researchers have stressed the importance of soft-skill competencies in food safety education (Roberts, Arendt, Strohbehn, Ellis, & Paez, 2012; Scheule, 2000). To help educators prepare future foodservice managers with such competencies, the measurement scale developed in this study can potentially be used in courses such as quantity food production to improve students' competencies for managing food safety in a practice production setting.

As organizations continue to invest substantial resources in interventions for implementation of food safety procedures, it is imperative to measure the outcome of such investments. Organizations could evaluate the effectiveness of these interventions by assessing the impact on food safety culture. The food safety culture measurement scale described in this study could be used as a baseline guide in identifying areas for intervention, and then evaluating success of the effort. Using this information, organizations could develop and evaluate effective strategies to ensure food safety culture prevails in the organization.

It is important to take into account some limitations of this study. The food safety culture measurement scale was tested in three states, thus there is limited generalization of the current findings. More research, particularly in states with different food safety regulations and different labor pool characteristics is needed. Additionally, future research is needed to confirm and validate the application of this food safety culture measurement scale in other types of onsite foodservices (e.g., college/university dining, childcare center, and assisted living).

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Research Contribution

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FOOD DEFENSE MANAGEMENT PRACTICES IN PRIVATE COUNTRY CLUBS – A CASE ANALYSIS

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ABSTRACT
This field study investigated food biosecurity practices in private country clubs in the Midwestern United States. Interviews with managers and observations of actual operational practices were conducted to identify areas in country clubs that could be at potential risk of a bioterrorist attack. Cost and lack of need were identified as barriers to implementing a food defense management plan. Background checks and good employment practices were perceived as effective in increasing food biosecurity in clubs. Recommendations to improve food biosecurity in country clubs included background checks for all employees, securing access to chemicals, and issuing identification badges to all employees.

Keywords: food defense, club management, bioterrorism

INTRODUCTION

Food Biosecurity

Safety and security is a concern of country club managers. This includes the security of the food prepared for club members. The terrorist attacks on New York City and the Pentagon on September 11, 2001, closely followed by anthrax attacks on governmental officials and members of the media, forever changed public perceptions of safety and security in the United States (U.S.). Following these incidents, increased priority was placed upon the safety and security of the food supply (Rasco & Bledsoe, 2005). Bioterrorism is defined as the "intentional use of biological or chemical agents for the purpose of causing harm" (United States Department of Agriculture Food and Nutrition Service, 2004). The USDA defines food biosecurity as the "protection of food from bioterrorism" (United States Department of Agriculture Food and Nutrition Service, 2004). The National Restaurant Association (NRA) defines food security (also known as food defense) as "preventing or eliminating the deliberate contamination of food" (National Restaurant Association Educational Foundation [NRAEF], 2003).

The food supply chain, from production to consumption of food, is commonly called "farm to fork" or "farm to table" (Food and Drug Administration, 2014). Threats to food biosecurity may occur in any portion of the food supply chain (NRAEF, 2003). For the purpose of this study, individuals or groups who intentionally contaminate or harm food products will be referred to as bioterrorists. A bioterrorist is any individual who intentionally contaminates food including business competitors, people posing as customers, employees, vendors, and anyone with a malicious agenda or cause (NRAEF, 2003). Bioterrorists may be motivated by attention/publicity, financial benefit, thrill-seeking, revenge/retribution, humor/prank, notoriety, creating chaos, obtaining a competitive advantage, and political/ ideological differences (AIB International, 2006).

Although no publicly documented incidents of food terrorism have occurred in country clubs, former incidents of food bioterrorism demonstrate the necessity of food defense practices. The Rajneeshee religious cult contaminated an Oregon restaurant's salad bar with Salmonella Typhimurium in 1984, affecting an estimated 751 people. The cult's motivation was to try to influence the outcome of a local election (AIB International, 2006). Ground beef purchased in a Michigan supermarket in 2003 was responsible for making 148 individuals ill. It was later discovered that 200 pounds of ground beef had been purposefully contaminated with insecticide by a disgruntled employee of the supermarket (Centers for Disease Control and Prevention, 2003). Methomyl, a highly-toxic pesticide, was used to intentionally contaminate salsa served at a Mexican restaurant in Lenexa, Kansas in 2009. Two employees of the restaurant were charged, both who were relatives of the restaurant owner. Revenge was identified as the motivational factor to poison the restaurant's salsa that resulted in 48 customers becoming seriously ill (United States Department of Justice, 2010).

Country club managers should be aware of the dangers posed by bioterrorism because they oversee the final step of the food supply chain, where food is prepared and served to members. Creating a food defense management plan that outlines preventive practices to be implemented within a foodservice operation should be the most effective method to decrease the threat of bioterrorism (Bledsoe & Rasco, 2002; United States Department of Agriculture Food and Nutrition Service, 2004).

Terrorism

The terrorist attacks against the United States on September 11, 2001 showed a worldwide audience how terrorism could create chaos and strike fear within society. The combined attacks of September 11th caused 3,056 deaths (Bogen & Jones, 2006). In the weeks after September 11th, two U.S. Senators and members of the media received letters that contained anthrax spores, resulting in 17 people becoming ill and five deaths. This was regarded as the worst case of biological terrorism in U.S. history (Federal Bureau of Investigation, 2014a). Although the anthrax-laced letters were mailed to only a few individuals, many U.S. citizens were understandably concerned about opening their mail, a potentially lethal activity (Hall et al., 2003).

Governmental agencies and international organizations have increased their efforts to counter bioterrorism since 2001. No longer can governments, businesses, and institutions (including country clubs) dismiss the possibility of intentional biological attacks upon their organizations. Taking precautions, effective monitoring, and response capability are vital to managing bioterrorism and food safety emergencies (World Health Organization, 2002).

Previous Bioterrorism Research Conducted in Foodservice

Country club foodservice operations are one of the endpoints of the food chain (the "fork") where final food preparation occurs before service to customers. Prior research was conducted in school and hospital foodservice operations in the United States regarding food bioterrorism (Yoon & Shanklin, 2007a; Yoon & Shanklin, 2007b; Yoon & Shanklin, 2007c). Yoon and Shanklin (2007) researched foodservice

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operators' importance perceptions, implementation frequency of preventive practices, and self-efficacy measures in the development of a food defense management plan. Operators who were more concerned and cautious of threats of food bioterrorism performed preventive practices more often than foodservice operators who were less concerned and less cautious of food bioterrorism (Yoon & Shanklin, 2007c). Foodservice operators identified chemical use and storage practices as the largest concern in protecting their operations from bioterrorism; these were the most frequently implemented practices in their operation (Yoon & Shanklin, 2007a). Yoon and Shanklin's research concluded that greater awareness of foodservice operators and the implementation of preventive practices in foodservice operations can enhance levels of food defense against bioterrorism (Yoon & Shanklin, 2007b). It is not unreasonable to suggest that Yoon and Shanklin's conclusions could be applied to foodservice operations outside of hospitals and schools. For this study, private country club foodservice operations were identified to continue Yoon and Shanklin's research in food bioterrorism.

Statement of Problem

Private clubs are governed by a board of directors, which consists of club members elected by their peers. Legal duties that the board of directors assumes include the duty of care – taking precautions while governing the club that an "ordinarily prudent" individual would take (Perdue & Koenigsfeld, 2013). In private clubs, the board of directors establishes club policies, and the club's general manager manages the club. This shared relationship of the governance of the club by the board of directors and the management of the club by the club manager is unique to private clubs.

Clubs are exclusive and typically only invite affluent and influential individuals (along with their families) to join their membership (Walker, 2009). Examples of people frequenting private clubs (members, their guests, or non-members) include: prominent citizens, business executives, celebrities, and government officials, all of whom could potentially be selected as targets by bioterrorists. In the past, affluent individuals have been targeted by kidnappers and terrorist groups in past high-profile cases such as John Paul Getty III (grandson of billionaire J. Paul Getty, founder of the Getty Oil Company) and Patty Hearst (granddaughter of the wealthy newspaper publisher, William Randolph Hearst) (Federal Bureau of Investigation, 2014b; Weber, 2011). Kwoh (2012) reported that 30% of U.S. companies pay for security services for their CEOs, including the Las Vegas Sands Corporation ($2.6 million spent annually) and the defense contractor Northrop Grumman Corporation ($2.2 million spent annually). Northrop spokesperson Randy Belote stated, "We don't consider providing security protection for our senior executives as an option, but as critically important" (Kwoh, 2012). Private clubs, which typically exclude non-affluent individuals from their membership rolls, may unintentionally project an image of wealth and privilege to non-members. Because private clubs are exclusive and cater to affluent, powerful, and influential individuals, they could be considered as potential targets to would-be bioterrorists.

Club members consider their club as an extension of their business as well as a home-away-from-home and will use its facilities for both business and leisure (Angelo & Vladimir, 2004; Perdue & Koenigsfeld, 2013). Nearly all U.S. private clubs have food and beverage facilities and serve food procured and prepared from the U.S. food supply (Walker, 2009). The safety and security of food served in private clubs ultimately resides with the club's general manager, who is directly responsible for supervising all club professionals and department heads (Perdue & Koenigsfeld, 2013). The service of food and beverages is generally at the center of all club events. To facilitate these events, private clubs employ foodservice workers and banquet servers. These positions may have up to a 285% annual turnover rate, due to significant numbers of seasonal employees hired to meet peak demands (Aziz et al., 2007). Temporary foodservice employees may be utilized to provide additional labor during busy times in club operations (e.g. summer and holiday seasons), meaning that workers come and go year-round. This high turnover rate along with the use of temporary employees can complicate attempts at conducting background checks or thorough verification of job references. Background checks can be easily run on every line-level employee, including temporary employees who may be hired for busy times of the year; however this may be cost prohibitive to the club.

Food prepared in large quantities is easy to contaminate, thus banquets held at private clubs may present a bioterrorist (possibly an employee of the operation) the opportunity to harm 200 people or more at a time. One disgruntled employee could intentionally contaminate food or beverages served to members and cause extensive harm to club members, their guests, and club employees. Food production equipment that combines large batches of food ingredients together, such as a floor mixer, offer a would-be bioterrorist an ideal opportunity for contamination. Additionally, equipment located in low-traffic or out of the way areas, such as an icemaker in a side room, could provide opportunities for intentional contamination with little chance of being detected. Following the physical damage from a bioterrorism attack, the psychological aftereffects and shock value may linger on. Members might resign from the private club, even if they were not among those directly impacted by an incident of intentional food contamination.

Food biosecurity threats are predicted to be likely in the future and are relatively simple to execute (Bledsoe & Rasco, 2002). Regardless of the motivations or types of bioterrorists, the ultimate outcome is purposefully harming humans using food intentionally contaminated with biological, chemical, or physical agents (World Health Organization, 2002). Many biological agents and readily available chemicals can be used to intentionally contaminate food (AIB International, 2006). Governmental agencies recommend implementing a food defense management plan to manage the risk of bioterrorism (Bledsoe & Rasco, 2002; United States Department of Agriculture Food and Nutrition Service, 2004). Prior research has concluded that increasing awareness of foodservice operators and implementing preventive practices to address bioterrorism can increase levels of food defense in foodservice operations (Yoon & Shanklin, 2007a, 2007b, 2007c). Limited research has been conducted regarding bioterrorism in retail foodservice and no bioterrorism research has been conducted in private clubs.

Foodservice professionals should be knowledgeable of the risks of food bioterrorism as they are responsible for supervising the endpoint of the food supply chain - the preparation and service of wholesome food to the public. Some foodservice operations have implemented crisis management plans to address events such as workplace emergencies and natural disasters. However, crisis management plans do not adequately deal with intentional contamination of food or an operation's water supply. Populations at high risk for foodborne illness, such as immune-compromised individuals, may have additional health issues that may complicate a full recovery from an event such as food bioterrorism (NRAEF 2012; Yoon & Shanklin, 2007c). Foodservice operators should revise their crisis management plans in order to secure their operation against food bioterrorism (Bledsoe & Rasco, 2002; Bruemmer, 2003; United States Department of Agriculture Food and Nutrition Service, 2004; Yoon & Shanklin, 2007a)

Past research has focused upon foodservice operators' importance perceptions of bioterrorism and preventative practices implemented in hospital and school foodservice operations to protect food from intentional contamination (Yoon & Shanklin, 2007a, 2007b, 2007c). Foodservice in private country clubs is technically classified as a part of the commercial foodservice segment and country club members are considered to be a "hybrid of customer and owner" (Gregoire, 2013). However, one can draw parallels to the definition of the onsite foodservice segment in that foodservice is not usually the primary activity or goal of country clubs and a profit is not necessarily desired. To the best of our knowledge, there has been no research in country club foodservice operations that has studied club professionals' importance perceptions and preventative practices regarding food bioterrorism.

Purpose of Study

This research involved conducting interviews with managers of country clubs and observations of actual practices in club operations. The purpose of the study was to identify areas within country clubs that could be at potential risk of bioterrorism due to their operational practices. Based on results of the interviews and observations, recommendations for country club managers are presented.

METHODS

Population and Sample

The population used for this study was country clubs within a 500-mile radius of Manhattan, Kansas whose managers were members of Club Managers Association of America (CMAA). Country clubs were selected for the study because they are the most common type of private club in the United States (Perdue & Koenigsfeld, 2013). The CMAA member directory was used with permission to identify country club professionals to contact for the field study. Twenty-five private country clubs were included in the field study. Country clubs in the Midwest including clubs in Kansas (14), Iowa (5), Nebraska (4), and Missouri (2) comprised the convenience sample and were selected given their close proximity to Kansas State University. Country clubs were visited during regular business hours. Visits to country clubs were scheduled during key production times at lunch or dinner from February through June 2010. Country club managers were contacted via telephone; after explaining the purpose and goals of the study, they were asked to participate in a personal interview and to allow the researcher to observe their respective country club's premises (i.e. the field study). Of 33 club managers contacted, two declined to participate in the field study. One manager who declined indicated that the field study would touch upon sensitive issues in their club and another manager simply refused, citing no reasons. A total of 31 clubs were visited during the course of the field study. Clubs not used in the final data collection included one club selected for the pilot study, two clubs in which the club managers were not available at the time of the scheduled visit even though they had indicated they would be available at the designated time, and three clubs in which access to observations of the clubs' foodservice operations was restricted during the visit. A total of 25 clubs composed the final sample for the field study. The average club size in terms of memberships was 491 (each membership could include a whole family). An annual foodservice operating budget of under $2,000,000 was reported for 62% of clubs, with 38% reporting an annual budget of $2,000,000 - $5,000,000.

Development of Field Study Instruments

Open-ended interview questions were developed from the literature review and ideas generated in an elicitation study that identified items to use in a separate survey research project. Interview questions were used to further explore club professionals' perceptions regarding food defense in their operation. The interview questions included knowledge of food biosecurity resources, resources needed for food defense, training needs, and policies and procedures in club operations. The interview questions are summarized in Table 1.

Permission was obtained to modify previous observation instruments that were used to conduct food defense and bioterrorism research in school foodservice (Yoon & Shanklin, 2007a, 2007b, 2007c). The observation instrument was adapted for use in country clubs using items identified in the literature review and in the aforementioned elicitation study. The adapted instrument included sections to record observations for the following criteria in country clubs: areas outside each country club, clubhouse receiving areas, clubhouse storage areas, clubhouse foodservice / food preparation areas, chemical storage areas, foodservice equipment, foodservice personnel, utility security, and general clubhouse security items. The observation instrument (with results from the 25 clubs visited) is presented in Table 2.

Pilot Study and Refinement

Field study instruments (the interview guide and the observation form) were pilot tested in one country club in Kansas. Feedback from the club manager during the pilot test helped to establish the interview format and how to ask the questions clearly and concisely. Changes made to the observation instrument included deleting the "n/a" (not applicable) checkbox from the "observed/reported" columns to avoid confusion with "yes/no" checkboxes. A blank space used for comments was substituted in place of the "n/a" checkbox. Cash handling was also deleted as private clubs typically operate with minimal cash exchange between staff and club members.

Data Collection

Club managers were interviewed in all 25 country clubs. Prior to visiting each club, the investigator sent club managers an e-mail containing a set of Internet links (URLs) to background literature regarding food biosecurity. This provided club managers with some background information about food biosecurity and was intended to help facilitate discussion. Interviews were conducted by one person, and were recorded with notes.

In four of the 25 interviews, additional club professionals were invited to participate (per the club manager's discretion in all interviews). This included executive chefs, food and beverage directors, and assistant club managers. Probing, open-ended exploratory questions were used to obtain data related to club managers/professionals' perceptions of bioterrorism. Interviews ranged in length from 20 minutes to one hour and all interviews followed the same set of probing open-ended questions. Interview data were coded to remove links to those being interviewed to ensure anonymity of responses and to maintain confidentiality of participants and their operations. Following the completion of the study, a debriefing form containing a summary of the major findings of the research study and confirmation of confidentiality of responses was offered to all study participants. Country club professionals interviewed were also offered a list of resources to address concerns shared during interviews.

Observations were conducted in all 25 country clubs. The observations of food biosecurity practices focused on the clubhouse or wherever the majority of food production occurred in all clubs. Observations focused on food defense practices, not individuals being observed; no individuals were identified when recording observation data. Data were aggregated so that specific locations observed remained anonymous. Any observations that revealed risks to an

operation (such as a breach in food safety, an operational problem, or a food biosecurity risk) were communicated to the club professional during the on-site observation.

Table 1: Private Club Biosecurity - Club Manager Interview Form

Section A	Knowledge of National Restaurant Association (NRA) and Food and Drug Administration's (FDA) Resources
The following set of interview questions pertain to your knowledge of NRA and FDA resources pertaining to Food Biosecurity Defense.	
1.	Are you aware of the NRA publication "Food Security – An Introduction"?
2.	If so, then how did you first become aware of this resource?
3.	Are you familiar with the FDA's responsibilities in enforcing the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (the Bioterrorism Act)?
4.	If so, then how did you first become aware of the NRA publication "Food Security – An Introduction"?
5.	Are you aware of any other resources on food biosecurity applicable to country clubs or private clubs? If yes, please specify:
6.	Do you feel that your country club is at risk for an intentional attack on your food production systems? (yes/no)
7.	What areas of your operation do you think are the most vulnerable to an intentional attack from outsiders (non-employees)?
8.	What areas of your operation do you think are the most vulnerable to an intentional attack from insiders (employees)?
Section B	**Resources Needed for Food Biosecurity Defense**
The following set of interview questions were designed to measure needed resources.	
1.	What resources are needed to implement a Food Biosecurity Defense Plan in your club?
2.	Facilities needs (i.e. storage, utility updates, equipment upgrades, grounds or building improvements)?
3.	Employee needs (i.e. training, screening)?
4.	Security needs (i.e. security devices, alarms, etc.)?
5.	Please explain some perceived barriers to implementing a Food Biosecurity Defense Plan in your operation:
Section C	**Training Needs Related to Food Biosecurity Defense**
The following set of interview questions are designed to measure your Training Needs for Food Biosecurity Defense. Please indicate the amount of training that is currently given in the following areas:	
1.	What type of training programs have you implemented in your club related to Food Biosecurity? (Start with broad based, probing questions. Broad categories would be: facility security, utility security, employee management, communication, food handling, chemical use and storage.)
2.	What types of training needs would be essential in your club related to Food Biosecurity? (Begin to narrow focus – asking more specific questions).
Section D	**Policies and Procedures**
The following set of interview questions are designed to measure policies and procedures.	
1.	To what extent do you already have policies and procedures developed that would overlap with/ indirectly address food biosecurity issues in your club (Crisis Management Plan, Disaster Management Plan)?

Data Analysis

Interview data were compiled and sorted by categories per the interview question. Data were also sorted by themes; factors included importance perceptions, perceived self-efficacy, barriers, and attitudes. Observation items were recorded as "yes," "no," or "not applicable." Observation data were analyzed with the Statistical Package for the Social Sciences (SPSS) version 19.0 (SPSS Inc., 2010). Frequencies and percentages were calculated for observation items.

RESULTS

Interviews

All club managers were asked if they thought that their country club was at risk for an intentional attack on their food production systems. Four club managers answered "yes" while the remaining 21 managers answered "no." Six club managers indicated that it was possible but not probable that an attack could occur and three club managers stated that the risk was lower in a private club setting than in a public setting. Nine club managers indicated that if someone really wanted to contaminate food that it would more likely be a disgruntled employee that did so (rather than a non-employee). Conversely, two club managers stated that it would be more likely that an outsider would contaminate food rather than a disgruntled employee.

Club managers were asked to identify areas of the club that were the most vulnerable to intentional attack from outsiders (non-employees). Fourteen managers indicated that vendors and/or delivery people would be able to exploit vulnerabilities in a club's food biosecurity due to the direct access they had to foodservice preparation areas in their club. These areas included the delivery dock and anywhere food was stored (storerooms, coolers, etc.). Since these areas are generally located in proximity to food production areas, the potential that a club's food production system would be vulnerable to delivery personnel is high. Six club managers stated that vendors could also potentially tamper with food before delivery. However, three club managers indicated that they trusted their vendors and that intentional contamination of food would not occur by the actions of a vendor or a delivery person. Six club managers stated that buffets, beverage service, condiment dispensers, and food served at wedding receptions, poolside areas, and corporate events could be vulnerable to contamination from other individuals granted public access to club premises. This included members, their guests (including former members and former club employees), and contractors.

Club managers also were asked to identify areas of the club that were the most vulnerable to intentional attack from insiders (employees). Sensitive areas of vulnerability identified where food was stored, produced, or served. Club managers were asked to identify resources such as facility, employee, and security needs to implement a food defense plan in their operations. For facility needs, fencing, more secure club design, and pass gates were the most commonly cited examples of improvements to a club's overall security. However, one manager indicated that while effective, installing pass gates would be problematic for club traffic. Other responses included locks on coolers and storage units, and a dedicated secure receiving area for all deliveries.

For employee needs, 16 club managers identified good employment practices (including background checks of all new potential employees) were needed to increase food defense. Regular staff meetings and training to increase awareness of overall club security (including food) was also mentioned. Seven managers stated the method used for training employees about food biosecurity should avoid presenting information that could result in negative behavior. Creating an environment of trust and identifying employees that are

Table 2 : Observed / Reported Food Security Items During Onsite Visit to Country Club Properties (n=25)

FOOD SECURITY ITEMS	OBSERVED / REPORTED Yes	No	N/A
Exterior Premises & Outside Exits/Entrances of Country Club			
Parking lot for visitors & guests are at safe distance from CC.	17	8	
Outside lighting is adequate to detect unusual activities.	24	1	
Video surveillance monitoring is used.	11	14	
Gates/security checkpoints used to restrict access to club premises	6	19	
Fencing or other deterrents are used around sensitive areas (i.e. non-public perimeter and/or storage lockers, air intakes, etc.)	18	7	
Security patrols are present.	7	18	
Access limited to outside controls for airflow.	18	7	
Access limited to outside controls for water.	20	5	
Access limited to outside controls for electricity.	18	7	
Access limited to outside controls for refrigeration.	16	7	2
External facility signs are up-to-date and useful in maintaining control of premises.	6	19	
Dedicated public entrance(s) to clubhouse exists.	24	1	
Dedicated employee entrance(s) to clubhouse exists.	22	3	
All other non-dedicated clubhouse exits/entrances secured.	4	21	
Dedicated employee entrance to facility secured.	5	20	
Employee entrance has policy posted for entrance/exit guidelines.	1	24	
Outer doors are sturdy / reinforced (i.e. metal frame or equivalent).	25	0	
An authorized person is assigned to receive shipments during regular business hours.	23	2	
An authorized person is assigned to receive shipments after regular business hours.	5	20	
Daily schedule of deliveries is posted/available.	4	21	
List of approved suppliers is posted/available.	14	11	
Exterior Premises & Outside Exits/Entrances of Country Club			
Receiving logs are used and up-to-date.	4	21	
Receiving policies/procedures for food deliveries are posted/available.	13	12	
Receiving policies/procedures for chemical deliveries are posted/available.	13	12	
Receiving policies/procedures for MSDS sheets are posted/available.	20	5	
Guidelines for tamper-resistant verification are posted/available.	8	17	
Delivery trucks are kept locked when not being unloaded or loaded.	2	23	
Dedicated vehicles are secured at all times for transporting food produced in a centralized CC to satellite CC locations (pool/golf course).	12	10	
List of phone number of approved primary suppliers and alternative suppliers is posted/available.	22	3	
Dock doors are closed and locked when not in use.	9	16	
Clubhouse Storage Areas			
Access to all food product and food ingredients is secured.	15	10	
Access to chemical storage areas is secured.	14	11	
Only designated employees have access to storage rooms.	16	9	
Designated area for storing distressed, damaged, and returned products to ensure that they are not served or used in the operation.	19	6	
Accurate inventory of all supplies is readily available.	25	0	
Security alarm installed on storage room doors?	5	20	
Storage room doors reinforced and secure/tamper-proof?	20	5	
Clubhouse Foodservice / Food Preparation Areas			
Restricted foodservice areas are assigned and clearly marked with appropriate signs, including food and chemical storage areas.	3	22	
Leftover food items stored in sealed containers that are labeled/dated.	23	2	
Only designated employees have access to restricted foodservice areas.	20	5	
Key log is readily available and up-to-date to verify access to restricted foodservice areas.	12	12	1
Access to airflow is restricted and accessible only by designated employees.	19	6	
Access to HVAC is restricted and accessible only by designated employees.	21	4	
Access to water system is restricted and accessible only by designated employees.	20	5	
Access to electricity is restricted and accessible only by designated employees.	18	7	
Access to gas is restricted and accessible only by designated employees.	21	4	
Emergency exits (alarmed) are present per local, state, fire/building codes.	17	7	1
Self-locking doors (opened from the inside only) are present per local, state, fire/building codes.	17	7	1
Doors are secured (lock, seal, sensor device) at all times.	5	20	
Windows are secured (lock, seal, sensor device) at all times.	15	9	1
Roof openings are secured (lock, seal, sensor device) at all times.	16	6	3

Table 2 : Observed / Reported Food Security Items During Onsite Visit to Country Club Properties (n=25) (CONTINUED)

FOOD SECURITY ITEMS	OBSERVED / REPORTED Yes	No	N/A
Clubhouse Foodservice / Food Preparation Areas (CONTINUED)			
Vent openings are secured (lock, seal, sensor device) at all times.	16	6	3
Outside refrigeration are secured (lock, seal, sensor device) at all times.	6	7	12
Outside storage units are secured (lock, seal, sensor device) at all times.	4	7	14
At least one authorized employee is present in the foodservice area at all times when the area is not secure.	21	4	
Alternative storage place (outside of foodservice areas) exists for employees to secure personal foods and medications.	18	6	1
Documentation exists describing where ingredients and foods are stored and prepared in the CC.	5	20	
Self-service foodservice areas are monitored.	17	5	3
All leftover items are stored in sealed, labeled, and dated containers.	25	0	
Food or ingredients not properly sealed and labeled is discarded.	24	1	
Purchase records are available.	25	0	
Food production records are available.	7	18	
HACCP records are available (if applicable).	4	21	
Temperature logs are available.	11	14	
Map or diagram defining boundaries of all foodservice areas & locations of specific foodservice activities is available.	3	22	
Clubhouse Hazardous Chemicals			
Chemical storage area is outside of food preparation areas.	24	1	
Chemical storage area is secured.	12	13	
Chemical storage area is accessible only by designated employees.	15	10	
Manufacturer's instructions for use of hazardous chemicals are available, including instructions for amounts of chemicals to use, personal protective equipment guidelines, and guidelines for optimal environmental conditions for use of chemicals.	25	0	
Daily inventory of hazardous chemicals is available (should contain a chemical inventory and usage log).	1	24	
Material Safety Data Sheets (MSDS) for hazardous chemicals are readily available.	24	1	
Containers used to transport chemicals from the storage area to the work area are properly labeled.	22	2	1
Clubhouse Foodservice Equipment			
Access to foodservice equipment is secured. Only designated employees are allowed to operate and maintain/clean equipment.	22	3	
Signs and/or instructions are posted to increase safety especially with potentially dangerous equipment (meat slicer, mixers, steamers).	7	18	
Clubhouse Foodservice Personnel			
Updated daily or shift roster of foodservice personnel is available to foodservice supervisors.	24	1	
Employees are easily identifiable (ID badge).	7	18	
Temporary workers, contractors, cleaning crews, construction workers, truck drivers, etc. are clearly identified.	10	14	1
Only authorized individuals in restricted sections of foodservice area.	22	3	
Clubhouse Water and Ice Supply			
Water supply is secured against outside access.	21	4	
Ice-making equipment are secured against outside access.	17	8	
Backflow devices are in place on all water-supply equipment.	25	0	
Clubhouse General Security			
Computer systems have effective, up-to-date firewalls and virus detection systems.	24	1	
Computer systems files are backed up regularly.	20	5	
Sign-in desk or other designated area for visitors and non-club employees to explain purpose of their visit.	7	18	
I.D. badges issued to visitors.	25	0	
Escort/Security personnel at public entrances.	5	20	
Written program in place specifying how access to keys, keycards, and number codes/PINs are granted and denied to employees.	7	18	
Adequate interior lighting.	25	0	
Adequate emergency lighting to facilitate detection of suspicious or unusual activity.	24	1	
Minimal number of places in non-public areas exist that an intruder could remain unseen after work hours (e.g. trash dumpster areas).	3	22	
Minimal number of places in non-public areas exist that could be used to temporarily hide intentional contaminants.	2	23	
Inspection of incoming and outgoing packages and briefcases.	2	23	
Duress alarms installed in refrigerators and freezers.	11	14	
Access to roof & roof equipment under control?	20	5	
Access to food product (i.e. to the interior) from roof under control?	20	5	
Employee lockers monitored/inspected?	3	18	4

problematic, unhappy, or exhibiting unusual behaviors also are important. Fair and dignified progressive disciplinary procedures were mentioned as a way to curtail disgruntled employees. Hiring a dedicated purchasing agent who oversees the procurement and inspection of all goods also was identified as an effective employment strategy to increase food defense. Six managers recommended having and enforcing an operational policy that required at least two people to be in food production areas at all times (to keep an eye on one another).

For security needs, club managers were supportive of having closed circuit television (CCTV) surveillance systems installed for monitoring activity in their club. Eleven clubs already had video cameras installed, but their value as a deterrent was questioned. Five club managers indicated that someone committed to intentionally contaminating a club's food supply would do so regardless of video cameras being in place. In addition, an employee would be needed to observe the security tapes; this practice was viewed by managers as not being cost-effective. Fifteen club managers stated that for video surveillance to truly be effective, it would need to be club-wide. Finally, the feasibility of installing video cameras in coolers, privacy issues in locker rooms, and the usefulness of monitoring seldom-trafficked areas (in addition to club members' acceptance of CCTV) were also questioned.

When asked about perceived barriers to implementing a food defense plan, 16 club managers stated that the cost was the biggest issue. Six club managers were not convinced of a sufficient enough threat to their country club to warrant the expense of implementing food defense strategies. The time required to implement a food biosecurity management plan or to continually train employees also was identified as a barrier by six club managers. Apathy, lack of need, and staff resistance were mentioned as potential barriers. Low motivation to implement new changes (unless a food biosecurity issue arose) was identified as a barrier. Suggestions to improve motivation were to issue CMAA education credits to club managers who implemented food biosecurity management plans or to require (by law) that clubs have such plans in place. Board of directors' approval and the quality of member/employee life (e.g. excessive surveillance) also were identified as barriers to implementing a food biosecurity management plan.

Training programs already in place pertaining to club security included procurement procedures, pilferage and inventory control, food safety/sanitation training, chemical handling, grounds security training, and CPR/defibrillator training. Training needs identified as essential to club operations to increase food biosecurity included the following topics: financial implementation of food defense plans, specific training on the topic for management staff, service employees, vendors, training employees to use an anonymous hotline (whistleblower) and OSHA compliance. Further recommendations include awareness training, having written training materials in place, and training to prevent anything else that has the potential to harm a club member.

Club managers were asked to what extent they already had policies and procedures developed that would overlap with or indirectly address food biosecurity issues. Fifteen club managers indicated they had no disaster management plan in place. Twelve club managers stated that they had some policies and procedures in place, such as CPR training, chemical handling procedures, and informal disaster management procedures (e.g. calling 911). Only four club managers had formal disaster management plans in place which detailed specific actions to take in the event of an emergency in their club.

Themes Identified in Interviews

Club managers' input was valuable in identifying themes regarding food defense from their perspective. During the interviews, managers freely offered their opinions of food biosecurity issues in country clubs. At the close of each interview, club managers were explicitly asked if they had any additional information to provide, including any constructive criticism or their "gut feelings" about the subject matter. What follows is a compilation of club managers' responses (in their own words) grouped into common themes.

Importance perceptions

Importance perceptions regarding food biosecurity included responses such as "this is a very important topic" and "it should be a higher priority than it currently is." Other responses were "you should not be naïve about food biosecurity – it should be on a club manager's radar" and "if implementing food biosecurity management procedures prevents even one incident from happening, then it's worth the investment." Some club managers did not perceive food biosecurity to be as important as others did. Comments included "this is not as important as other areas to focus your resources" and "you shouldn't make a mountain out of a molehill if you don't have to."

Perceived self-efficacy

Club professionals' perceived self-efficacy is their belief in their own capabilities to plan and implement necessary actions to effectively deal with events in their country club. Club managers' responses showed varying degrees of self-efficacy while describing food terrorism issues. Responses of lower self-efficacy levels included "unless you catch them red-handed, they will be hard to catch" and "if someone wanted to do it, they could." Conversely, responses indicating higher levels of self-efficacy were "if this ever became a true issue in my club, I would eliminate food and beverage service altogether," and "I could do this. If I told the board (that we should create a food defense management plan) they would say it was a good idea."

Barriers

Club managers described potential barriers that could either impede implementing food biosecurity in country clubs or affect club operations in general. These included "this (food defense) gets in the way of employees doing their job" and "the lack of need (of food defense management) would be the biggest barrier." Some club managers indicated that there were factors in their clubs that could possibly reduce barriers to food biosecurity issues. Comments included "every item purchased by our club comes through one door and is inspected by one person – our purchasing agent" and "besides the local hospital, we have the highest concentration of doctors under one roof in town."

Attitudes

Club managers' attitudes varied regarding food biosecurity. Attitudes supportive of food biosecurity included "the benefits of training outweigh the risks – it is incumbent of managers to take steps to maintain security and act upon the risks and take precautions" and "there should be mandatory (food defense) certification and it should be posted on the front door." Attitudes less supportive of food biosecurity were "if you were to try to address this issue, you would risk someone copycatting or mimicking it – it would appear as if you were 'professing' food terrorism" and "in my 25 years as a club manager, I've only heard of two incidents of intentional food contamination, and neither of them occurred in a club."

Observations

Following interviews, observations were conducted at each private country club visited. For items that were directly observable (e.g. if entrance guidelines were posted by the employee entrance), the

researcher recorded the results. For items that were not directly observable (e.g. if a key log was readily available), the researcher queried club professionals for the answer. The observation results are presented in Table 2.

Exterior premises

Upon arrival at each country club, the researcher examined the exterior of the country club. Nineteen country clubs observed did not have a dedicated front gate to limit vehicle access into the country club. Security patrols were present in only seven clubs visited. The majority (19) of clubs did not have signs that helped maintain control of the premises. Access was limited to outside controls for utilities, including airflow (18), water (20), and electricity (18). All but one club had a dedicated public entrance to the clubhouse and 22 clubs had a dedicated employee entrance. However, only one employee entrance had formal entrance/exit guidelines posted and only four were considered secure. Most clubs had an authorized person assigned to receive shipments during regular business hours (23), however, dock doors in 16 clubs were usually not closed and locked when not in use.

Storage areas

All 25 clubs indicated that they could take accurate inventory anytime. Storage doors were tamper proof in 20 clubs. However, 10 clubs stated that access to food product was not secured and 12 clubs indicated that access to chemicals was also not secure.

Foodservice / Food preparation areas

Only three clubs restricted access to foodservice areas via signage and only five had doors secured at all times. All but four clubs had at least one authorized employee in the foodservice area at all times and 20 restricted access points to foodservice areas to only designated employees. Five clubs indicated that they possessed documentation describing where ingredients and foods were stored and prepared in their country club.

Hazardous chemicals

Chemicals were stored outside of food preparation areas in all but one of the clubs observed but less than half (12) of the chemical storage areas were secured. Only one club took a daily inventory of chemicals and all but two clubs labeled their chemicals (e.g. spray bottles filled from bulk containers).

Foodservice equipment

Access to foodservice equipment was secured in 22 clubs, with only designated employees allowed to operate and/or clean equipment. There was a lack of signs or instructions posted to increase safety with potentially dangerous equipment in the majority of clubs (18). Supervisors indicated that the operation of equipment was a part of an employee's training.

Foodservice personnel

An updated shift roster was available in all but one club; however, employees were not clearly identifiable in 18 clubs (no identification badge or nameplate). In addition, only 10 clubs stated that they clearly identified temporary workers.

Water and ice supply

As required by law, backflow devices were observed in all clubs' water -supply equipment. Access to the water supply was considered to be safe in 21 clubs. Ice machines were secure in only 17 clubs.

Clubhouse general security

The majority of clubs kept their firewalls and virus detection systems up to date (24), and backed up system files regularly (20). No club issued identification badges to visitors and only seven had sign in desks (7) for visitors.

DISCUSSION

Suggestions for Improving Food Defense in Country Clubs

According to Howe (2004), clubs have long been analogized as "safe havens and homes-away-from-home for their members; a place of comfort and security." Only four club managers thought that their country club was at risk for an intentional attack on their food production systems. Sixteen club managers indicated that cost was the primary barrier to implementing a food defense management plan. Furthermore, 15 clubs had no disaster management plan in place. Given the low perceived risk of food biosecurity, the high perceived cost, and the lack of formal disaster management plans in place at the majority of country clubs visited, it is recommended to implement economical improvements to overall club security that overlap with food biosecurity issues.

Security measures most often utilized in country clubs include gates and fences (Macklin, 2004). Following September 11th, 2001, U.S. country clubs implemented stronger security protocols, by installing more guard gates and increasing the use of security personnel (Howe, 2004). This could also include securing exterior doors that are used infrequently and installing locks on all storage areas. A key control program could be implemented that specifies how keys are issued, revoked, and under what circumstances keys and lock should be changed. Accountability for either metal key or electronic access control systems "is paramount" (Clifton, 2012). Establishing a "backdoor" policy specifying how deliveries are handled and access is granted into sensitive club areas could also improve overall club security.

Criminal background checks are relatively low-cost insurance to screen applicants before hiring. Sixteen club managers indicated background checks of all new employees were important to increasing food defense. Several club managers stated that a disgruntled employee would be more likely to intentionally contaminate food than a non-employee. It is specifically recommended for country clubs to consistently conduct background checks on all potential employees (Clifton, 2012).

Closed circuit television (CCTV) is the most common surveillance equipment used in country clubs (Macklin, 2004). Fifteen club managers recommended club-wide video surveillance as an effective security measure. Although cost could be an issue, video cameras could be installed as a general security procedure and as a deterrent against pilferage. "Dummy" (nonfunctional) video cameras can serve as an inexpensive alternative to functioning video cameras and as a psychological deterrent to bioterrorists even though images are not actually recorded. However, dummy cameras may provide a false sense of security and legal counsel should be consulted before choosing to install them (Clifton, 2012). Resistance from club members can also be an issue when installing video surveillance (functioning or not), especially in sensitive areas such as locker rooms. However, given the fact that 21 clubs could be entered through doors other than the dedicated public entrances, video surveillance is highly recommended for country clubs.

Chemicals are of primary concern in food defense management, thus it is recommended that chemical storage areas be secured throughout clubs. Access to chemicals was not secured in 12 clubs visited. Chemicals are also costly, so securing access to them could reduce pilferage, while increasing food biosecurity. Pool chemicals (commonly used in country clubs) should be stored securely and away from guests and would-be bioterrorists (Clifton, 2012).

It is recommended that club managers appoint dedicated purchasing agents and to route deliveries to one primary delivery area in their clubs. An authorized person was available to receive shipments in 23 clubs observed. This meant that for every delivery made to various locations in the club, an authorized individual accepted delivery. Only one club visited had a dedicated purchasing agent that was solely responsible for inspecting all club deliveries. Access granted to areas past the delivery area (such as coolers and storage areas) should be regulated and granted only to trusted delivery personnel. In addition, club access should also be monitored for anyone else who is not a member or an employee of the club (e.g. contractors). The perceived cost of hiring a purchasing agent could be justified by lower pilferage, spoilage, and savings from improved purchasing practices, while improving food defense practices.

Clear identification of all club employees is recommended. This includes temporary workers and back-of-the-house workers who do not normally come into contact with members. Eighteen clubs did not clearly identify their employees using nameplates or identification badges. A timely issuance of identification badges or nameplates would ensure that workers are always identified, even on their first day of employment. Terminated employees should be required to return their identification badges before receiving their last check. In addition, 18 clubs did not have sign-in desks and were easily entered unnoticed through the front entrance. It is recommended to have a dedicated greeter or sign-in desk at the front entrance of clubs to welcome every visitor.

Fifteen clubs had no disaster management plan in place. Disaster management plans help prepare clubs for disasters before they occur, detail the responses to take in the event of a disaster, and help support rebuilding after a disaster occurs. It is strongly recommended that clubs develop formal written procedures to deal with issues such as fire, flood, lightning, evacuation, and food defense procedures. For example, a calling tree is a telephone procedure or automated software which can be used to notify staff promptly of an emergency. This can help expedite emergency response to various club disasters, including bioterrorism.

Limitations of the Study

The field study conducted observations and interviews in 25 clubs over a four month time period. During the course of the data collection, potential limitations in data collection and analysis were identified. These included:

1. The researcher's observations focused primarily on the main clubhouse, or wherever the majority of food production occurred. Even though the country club segment was selected to help standardize observations and interviews, country club facilities varied slightly from club to club.
2. Of the 25 club managers interviewed, 24 were male and one was female. This may or may not have contributed to sex bias in the interviews.
3. Data collection can present challenges if the club professionals are too busy to complete surveys or schedule interviews. Following Memorial Day, persuading club managers to participate in data collection was challenging due to increased summer activities (pool, tennis, golf, etc.).
4. Although this study added to the existing body of literature on bioterrorism in foodservice operations, results cannot be generalized and applied to settings other than country clubs.
5. Due to the serious nature of the research topic, club professionals may have been resistant or reluctant to share weaknesses of their club's readiness to protect their members from harm.
6. Due to time and cost considerations, only 25 country clubs were visited. Only clubs in the Midwestern region of the United States were visited, limiting the ability to generalize results to the United States or beyond.
7. This study only focused upon country clubs whose managers were members of Club Managers Association of America (CMAA). It is unclear if there would be any significant differences with clubs whose managers were not CMAA members.
8. Observations and interviews took place primarily in the off-season. The time the data were collected could have influenced the outcome or access to several club managers and their clubs.

CONCLUSIONS AND APPLICATIONS

Within the hospitality foodservice literature, there is a dearth of research on food defense practices. This study attempted to identify country club operation areas that could be at potential risk of a bioterrorist attack due to current operational practices. Recommendations for managers of country clubs were identified and were based on results of the interviews and observations.

Club managers were initially unfamiliar with the topic of bioterrorism and few were convinced that their clubs were at risk for an intentional attack on their foodservice operations. Most country clubs were easily entered with little or no questioning from staff of the purpose of the investigator's visit. This suggests that better monitoring of club visitors is needed. Barriers identified by club managers in implementing improvements to food biosecurity were mainly cost/benefit related. As most club managers did not perceive their clubs to be at risk, they felt that the cost to implement food defense practices outweighed the benefits.

Future research recommendations are to gather more baseline data from club managers across the United States. This could include studying if there were any differences between club managers who were members of CMAA and those who were not. It would be interesting to assess if the same preventive food biosecurity practices would be more accepted if they were framed in the context of overall club security and controlling pilferage. As this topic has now been studied in hospitals, schools, and country clubs, further research in additional onsite or commercial foodservice operations could be useful.

Risk perceptions also could be explored in future research. Although the perceptions in this study were that the risk of food bioterrorism in country clubs is low, having a formal food defense management plan in place is better than assuming that no one will commit a bioterrorist attack on a country club's foodservice operation.

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Research Contribution

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IMPLEMENTATION OF FOOD DEFENSE BEST PRACTICES IN NORTHERN U.S. SCHOOL NUTRITION PROGRAMS: A CASE STUDY

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ABSTRACT

One act of intentional contamination of school meals can quickly harm many children. Food defense guidelines for schools exist; yet previous research has found communication, utility security, and physical security practices are infrequently implemented. A multi-site case study approach obtained a 360-degree assessment of food defense practices in five school districts. Meal production and service were observed, a food defense checklist was completed, and key stakeholders were interviewed. Qualitative analysis of interviews revealed lack of awareness, lack of concern, conflicting priorities, and isolation of foodservice from other school operations impaired food defense implementation. School security measures protected children, but not food.

Keywords: food defense, food terrorism, food tampering, school administration, emergency response planning

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INTRODUCTION

Acts of terrorism have become common occurrences throughout the world. Although most terrorist attacks currently involve explosive devices, researchers have predicted that terrorism may spread to new targets, including the food supply (Khan, Swerdlow, & Juranek, 2001; Mohtadi & Murshid, 2009; Radosvljevic & Belojevic, 2009). Terrorist targets were described by Radosavljevic & Belojevic (2009) as hard or soft depending on the level of sophistication needed to breach the target. Well-known venues that house important people and are well protected are considered hard targets, whereas soft targets are public places occupied by ordinary citizens. Schools are considered soft targets. An attack on school meals would cause great social disruption because a large number of families in a community would be affected by the event (Greene et al., 2004). Mohtadi and Murshid (2009) noted a trend away from attacks on airlines, military, and government targets, with a move to less protected targets. Experts consider the U.S. food industry to be a soft target, vulnerable to acts of intentional contamination with chemical, biological, radiologic, or nuclear weapons (Jackson, 2009; Khan, Swerdlow, & Juranek, 2001). The World Health Organization has urged its member states to recognize the potential for food to be deliberately contaminated, and therefore strengthen food production, processing, and preparation systems (World Health Organization [WHO], 2008).

Primary motivations behind terrorist attacks are disruptions of social life causing physical, psychological, or economic damage (Bruemmer, 2003; Elad, 2005; Sobel, Khan, & Swerdlow, 2002, WHO, 2008). The existence of a global food system means an attack contaminating a large batch of food product has the potential to affect a large number of people over a widely dispersed area. An attack on one batch of food produced in a single facility, such as a school, might even create wider social disruption than achieved by destroying the food processing facility itself.

Potential for intentional contamination of food with chemical or biological agents has led to establishment of food defense measures by industries associated with the food supply. For example, there is a 38-member industry work group sponsored by the National Center for Food Protection and Defense that includes representatives from national retail and grocery stores, restaurants, food processors, and food management companies (National Center for Food Protection and Defense, n.d.). Food defense is defined as the protection of food from intentional contamination. In recognition of this emerging threat, the U.S. government increased spending for food defense from $1 million in 2001 to $217 million in 2011 (Franco & Sell, 2010).

Food contamination threats may be presented from internal sources such as disgruntled employees or individuals within the organization seeking revenge or other notoriety (e.g. student pranks). Criminals, extortionists, and extremist special interest groups without a direct connection to the organization may also pose threats of intentional food contamination (Busta, 2010). An analysis of 365 confirmed incidents of malicious food contamination across the globe showed the majority occurred in the home or at work, and were perpetrated by relatives, co-workers, and/or acquaintances of the victims (Dalziel, 2009). However, of these incidents, 23.3% (n = 85) occurred in retail foodservice venues and contributed the highest average number of casualties (n = 39) per incident. A survey of 926 restaurant managers in South Carolina found that managers reported 29 alleged food tampering incidents in their restaurants (Xirasagar, Kanwat, Smith et al., 2010). Managers identified dissatisfied or terminated employees as probable perpetrators in 16 of the incidents. Sneed and Strohbehn (2008) identified concerns about food defense in retail foodservice operations as a trend with implications for food and nutrition professionals.

Food defense practices are designed to make targets less vulnerable. The United States Department of Agriculture Food and Nutrition Service (USDA-FNS) published A Biosecurity Checklist for School Food Service in 2004, which included 104 practices in 16 categories (USDA-FNS, 2004). These practices were reorganized into six major categories and updated to a total of 93 in 2012 (USDA-FNS, 2012). Research about the extent of implementation of food defense practices in schools is sparse. Yoon and Shanklin (2007) utilized the Biosecurity Checklist for School Food Service as a foundation for developing an abbreviated checklist of 35 practices divided into six categories: chemical use and storage, food handling, employee management, utility security, facility security, and communication. They surveyed foodservice directors in Kansas schools and found mean ratings for reported frequency of implementation in categories

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of chemical use and storage and food handling were less than 4.0 on a 5-point scale, indicating implementation most of the time. Practices related to employee management, utility security, and facility security had mean ratings between 3.0 and 4.0, indicating implementation some of the time. The communication category had a mean rating of 2.7, meaning the practices were reported as seldom implemented.

In a subsequent study, Yoon (2007) selected 12 of the 35 food defense practices and asked a national sample of foodservice directors from school districts with enrollments greater than 7500 students to rate the degree to which they were implemented. Five practices were identified as being implemented most of the time (greater than 6 on a 7-point scale where 1 = never and 7 = always): 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. Clear identification of personnel, control of access to storage and production areas, and accounting for former employees' badges and uniforms had mean ratings between 5 and 6 on the 7-point scale. Practices with lowest mean ratings were restriction of access to air and utility systems, controlling access to the foodservice facility, and maintaining an updated contact list of local authorities (mean ratings ranged from 3 to 5). The mean rating of employee training about the food defense management plan was equivalent to not very frequently (between 3 and 5 on the 7-point scale).

There has been no known published research about food defense practices in schools since 2007 (Yoon; Yoon & Shanklin). The purpose of this study was to determine the extent to which best practices in food defense are currently implemented in U.S. schools. The objectives of this study were:

- To observe current implementation practices in five school districts of food defense best practices
- To investigate reasons why communication and physical security aspects of food defense have been identified as infrequently implemented in school foodservice operations

METHODS

This study used a holistic, case study approach with data from interviews, observations, and document reviews obtained during site visits to five school districts in 2012. School districts were recruited from four of seven states included in the USDA-Risk Management Agency's Northern Region. Yoon (2007) used this configuration of states when comparing regional differences in implementation of food defense practices. The number of responses from the northern region in her study was limited; thus the current study was planned to provide insight into practices in this geographic region. The Institutional Review Board of the Office of Responsible Research approved the study.

Sample

A convenience sample of five school districts was recruited to include maximum variation of student enrollment, type of food production system, location (urban, suburban, or rural), and credentials of the foodservice director. Selection included one school district in South Dakota, Iowa, and Wisconsin, and two school districts in Minnesota. These states were chosen because they could be reached by the primary investigator within a one-day drive and two of the states are located along the United States border with Canada.

A one-day site visit to each district was made to conduct a comprehensive assessment of food defense readiness. Three visits were made in May 2012 and two visits were completed in October 2012. The schedule for each visit included observations of breakfast and lunch production and service. In two of the districts, observation was allowed at two production sites for a total of seven sites observed. Five individuals holding four different positions within the district were interviewed at each site. Interviews were scheduled with the foodservice director and two foodservice production workers, a school administrator, and an individual representing an agency that would be called in the event of a crisis. In all cases, the administrator was a building principal.

The initial contact was made with foodservice directors in four of the districts; the remaining site was recruited through the district superintendent, who arranged all other interviews for that site. Emergency response officials were recruited by the foodservice director or the administrator; position titles varied by district and included a city fire chief, a county coroner, two security management officials and a School Resource (police) Officer.

Data Collection

Data collection was guided by three principles outlined by Yin (2009): use multiple sources of evidence, create a case study database, and maintain a chain of evidence.

Multiple sources of evidence: Data collected included observations of food production and service, interviews with key stakeholders, and food defense documents made available by the site.

Observations: Observations of two meal production and service periods were planned for each district. Food defense practices were assessed using a validated 32-item, 5-category checklist, Food Defense Checklist for Retail Foodservices, (Strohbehn, Sneed, Paez, & Beattie (2007).

Interviews: An interview guide was developed for each stakeholder group based on four topics in A Biosecurity Checklist for School Food Service (USDA-FNS, 2004): communication, handling a crisis, foodservice/food preparation areas, and water and ice supply. The interview guide was reviewed by a team of researchers with expertise in social sciences and foodservice management with modifications made based on their feedback. Open-ended questions about perceptions related to vulnerability of the foodservice operation, personal experiences with food tampering, barriers to food defense, importance of food defense, and communication about food defense were included in the guides for all stakeholders. Each interview was audio-recorded with permission.

Document review: The foodservice director was asked to make available for review the food defense plan, if one was in place.

Create study database: Yin's (2009) second identified principle for data collection was to create a case study data base. Reliability of case studies is enhanced with the use of a written protocol and development of a case study data base (Yin, 2009). The data collected from each school site were imported into QSR International's Nvivo 9 qualitative data analysis software. Digital copies of documents, scans of completed observation checklists, interview transcripts, and receipts documenting transcription service and travel were included in the data base.

Chain of evidence: All documents were coded for location and, in the case of interviews, individuals by group of stakeholder and interview item. Date, time, and interviewee code were included in recordings of each interview.

Data Analysis

Interview data: Digital recordings of the interviews were transcribed by an individual with human subjects in research training and previous experience transcribing research interviews. Transcripts from the first three site visits were reviewed independently by first and second authors, with each suggesting themes. Proposed themes were discussed via telephone conversation; a consensus of six themes and 10 sub-themes was reached. Transcripts of interviews with stakeholders at the final two sites were reviewed in late fall 2012. No new themes emerged from interviews at these sites, justifying cessation of data collection. Discussion about wording and organization of themes and subthemes continued until a list of four themes and 11 subthemes was finalized.

Procedures outlined were used to code transcript data. QSR International's Nvivo 9 qualitative data analysis software facilitated the process recommended by Maykut and Morehouse (1994) that meaningful content be extracted from transcripts and arranged into larger units of meaning. Interview transcripts were uploaded into the program and units of meaning highlighted. Highlighted text was coded according to themes and subthemes.

Observation data and document review: Observational data of foodservice operations during production and service of two meals were tallied and summarized. The kitchen manager or foodservice director was asked about practices that could not be directly observed. Pertinent information from interviews was also used to complete checklists. Food defense plans, if available, were reviewed for format and content.

RESULTS AND DISCUSSION

A profile of the participating districts and findings from interviews, observations and reviews of district food defense plans are presented below. Demographics for each site are shown in Table 1. Only one of the five districts had a food defense plan and a team of employees designated as responsible for it.

Profile of Districts

This convenience sample of districts represented small to mega districts with student enrollment ranging from approximately 2,000 students to over 43,000. Districts were located in rural, suburban, urban and metropolitan areas. Production systems also varied, with three using on-site preparation and service and two using either a central production facility or a commissary operation. A central food warehouse system was used by four of the five districts; only the medium sized district located in an urban area stored food at the on-site production location.

Summary of Interviews

Twenty-five interviews were conducted with district stakeholders. Five people were interviewed at each study site: a school principal, the district foodservice director, two production workers, and an individual with district and/or community security responsibilities. This last group is referred to as "emergency responders" in this paper. Four themes emerged from these interviews: 1) lack of awareness; 2) lack of concern; 3) food not considered as a potential danger; and 4) conflicting priorities and expectations influence food defense.

Lack of Awareness: Food defense was an unfamiliar concept among the stakeholder groups. Representative quotations for this theme are shown in Table 2. Principals confused food defense with the need for food and water supplies when sheltering students during an emergency, or with the need to maintain a safe environment in the school cafeteria. Emergency responders with work-related experience involving food tampering outside the school environment had not transferred the threat of intentional food contamination to the school setting. Production workers often related the concept of food defense to the need to check produce and food packaging for tampering, with several production workers identifying food safety training as their introduction to the concept of food defense.

The four stakeholder groups each identified different areas of vulnerability to acts of intentional food contamination in their districts. The responses of the principals reflected their concern with protection against intruders. Three of five principals were most concerned with the security of exterior doors; one stated that the cafeteria was the most vulnerable area and one thought the food was most vulnerable in the central kitchen. Foodservice directors saw food as most vulnerable outside of the food production areas. One foodservice director mentioned the serving line; two mentioned deliveries/loading dock and two of the foodservice directors believed the food was most vulnerable in the supply chain before it was delivered to the district.

Production workers identified vulnerabilities in their workplaces: delivery, the serving line, a large steam-jacketed kettle in the

Table 1: Demographics of Case Study

Parameter	Site A small district rural area	Site B medium district suburban area	Site C medium district urban area	Site D medium district metropolitan area	Site E mega district metropolitan area
Student enrollment[a]	2,000	5,000	7,000	9,000	43,000
Primary production system	on-site	on-site	on-site	commissary	central
Storage system	central warehouse	central warehouse	onsite	central warehouse	central warehouse
Population[a]	10,000	22,000	50,000	57,000	285,000
Credentials of foodservice director	Some college	Bachelor's Degree	Graduate Degree, RD	Graduate Degree, RD, SNS	Bachelor's Degree, RD
Average number of breakfasts served daily[a]	950	300	2,100	1,000	18,000
Average number of lunches served daily[a]	1,700	3,000	3,800	5,000	31,000
Approximate ADP (lunch)	77%	64.5%	56%	54%	72%
Population below poverty level[b]	48%	6%	23%	5%	22%

Note: Data were collected at seven buildings in five districts

RD = Registered Dietitian, SNS = School Nutrition Specialist; ADP = average daily participation

[a]Rounded to protect identity

[b]Obtained from 2010 Census

Table 2: Sub-themes and Illustrative Quotations for the Theme of "A Lack of Awareness"

Sub-theme	Sample illustrative quotations
Food defense is an unfamiliar term, but the concept is familiar	• [Under shelter-in-place] we would be self-sufficient here with the food and the water that we have in the building. No one would come in and nobody would go out. So it would be important to make sure that our food supply was safe. (principal) • … Such as dating and making sure seals are shut. Things like that, yes. We're all responsible for that and to report anything unusual. (production worker) • I would say that I've thought about it before but not in relationship to the school and I guess to our community as a whole. (emergency responder)
Experience with food tampering was uncommon	• … not specifically about terrorism type contamination, it's more about natural contamination. (production worker)
Different stakeholders are aware of different areas of vulnerability	• Because basically… I could go in the freezer and sprinkle something on whatever and … you're not able to see with the eye but it would still be very toxic to you. So am I wrong in thinking that… we're easy? (production worker)

production area, and unlocked storage areas. Another cook was concerned that identification badges weren't being worn by school staff. Three workers were unable to identify a vulnerable area and expressed confidence that kitchens were safe.

Lack of concern: Participants expressed beliefs that attacks on the food supply would occur in large cities, at nationally recognized locations, in other geographic locations such as the "East," or at other points in the supply chain, but not in their schools (Table 3). Although a number of production workers and administrators voiced a strong belief that food tampering would not happen in their school districts, this belief was in contrast with actual experiences reported by foodservice directors.

All participants were asked if they had experienced an incident of food tampering at work or in their personal lives. Four foodservice directors and two emergency responders reported experiences of food tampering, with two reporting two occurrences. Two emergency responders reported involvement with cases of intentional food contamination in non-school settings. Four of the incidents occurring in schools were perpetrated by students: BB gun pellets were added to a batch of mashed potatoes, a used condom was placed in a container of ranch salad dressing, urine was found on and around a salad bar, and a worm was placed on a pan of corn in the serving line.

The only food tampering cases involving employees occurred in the mega district with the central kitchen facility. A foodservice production employee was suspected when plastic bandages were found in batches of cooked noodles on more than one occasion. The final school incident involved an "irritated" employee who knowingly performed an incomplete cleaning of a machine that had been used to process raw ground beef.

Food is not considered a potential danger: A third theme that emerged from the data is that food issues were viewed as being separate from school operations and that those issues were the responsibility of the foodservice director (Table 4). As a result, only one of five districts had a food related issue included in their crisis management plan. Principals and foodservice directors interviewed had no specific procedures for dealing with food tampering; only one district had procedures for handling food in which contamination was suspected. The two emergency responders reporting work-related experiences with food tampering expressed belief that it is a reasonable concern for schools, but the other three did not, suggesting awareness of a potential danger raised only through experiences. Emergency responders did not rule out a rural location or small district as too unimportant to be the target of terrorist attacks, expressing the view that an attack in the heartland of America would achieve terrorist goals of causing nationwide fear and disruption.

Conflicting priorities and expectations influence security: School administrators did not perceive that their goals of preventing entry of intruders, monitoring student safety in the cafeteria, or preventing theft and vandalism were helpful with food defense. The focus of school security measures was on protecting children from harm; when children were not present, security measures were loosened

Table 3: Sub-themes and Illustrative Quotations for the Theme of "A Lack of Concern"

Sub-theme	Sample illustrative quotations
Food is most vulnerable to contamination before it arrives at the site.	• Attacking the food not the people? Once it's in our kitchen it would be pretty tough because you have to be authorized to be in the kitchen so it would have to be someone who is already working there. So I think [the risk] is slight. (production worker) • It would have to be before it came to this building. Everything we have is locked. (kitchen manager) • We have no control from where it comes from until the time it gets to us. But for here, everybody is conscious of what goes on with the food here but before it gets to us we have no idea. (school administrator)
Food is safe because co-workers are trustworthy	• I never thought of tampering before, you know. It's just kind of a family here. You just trust everyone. (production worker) • I think it's pretty much safe. Not 100% but pretty much. (production worker) • I can't think of a time we've had an intruder that wasn't either a student or a parent. (principal)
No one would want to attack *our* school	• The only time I really thought about terrorists was when I was in Mall of America, but I never really thought about food tampering or anything. (production worker) • … I always think it happens on the east coast because they're right there. They're more at risk than we would be. (production worker) • … [the risk of terrorist acts] is almost none in our area. I think in the nation it's different. But I think in our area almost none. (emergency responder)

Table 4: Sub-themes and Illustrative Quotations for the Theme of "Food not Considered a Potential Danger"

Sub-theme	Sample illustrative quotations
The foodservice operation is perceived as separate from school operations	• They have their own budget and operate out of it so [foodservice director] doesn't have to go through any hoops to get stuff … There is a separation. (emergency responder) • Yes, 'cause generally food service is dealt with separately, they have their own budget. (emergency responder)
The foodservice operation is responsible for food defense and the administration is responsible for security.	• It would be the district nutrition person and then directly in our building would be the kitchen manager. Everyone [is responsible for building security]. (principal, when asked who holds responsibility for food defense and for building security) • I think that's what we do. I think that's our job (production worker, in response to question about who is responsible for making sure no one contaminates the food)
Crisis management planning does not address food hazards.	• I met with [name], the fire chief, and the police chief, and HAZMAT was also there. So we talked through every scenario involving the school and the city, we talked about issues with trains coming through. Issues, since we're next to an Interstate, semis turning over, [gas station] that has petroleum that could cause a problem. So we talked about every scenario we could think of, gas leaks and what we would do in the building, how we would evacuate, if we would evacuate. (principal) • … so the notion of possibly doing one on food safety and food contamination, purposeful contamination would be intriguing. I never thought of that. (principal)

(Table 5). There was lack of understanding that building security practices, enforced 24 hours a day, maintain the safety of food as well as the safety of children and facilities. Emergency response planning is recommended by the U.S. Department of Education (2011) and the U.S. Department of Homeland Security (2010) for all school districts; however food tampering was not identified as an event in existing plans of the five districts in this study.

Because public schools are partially funded by community property tax dollars, school administrators felt obligated to consider the values and desires of the community. Two districts reported community groups expected to be able to use school kitchens for events not related to the child nutrition program: District policies required a foodservice employee be present, however this policy was not enforced during the summer in one of the schools where observation occurred.

Summary of Observations

Seven foodservice operations were observed during the five district case study visits. One central kitchen, a private school served by the central kitchen, and five on-site production facilities were observed. Food preparation was observed at five of seven facilities visited, and only lunch service was observed at the remaining two sites. Breakfast service was observed in four service sites and lunch service was observed in four sites. At each site, it was noted whether practices were implemented, not implemented, not observed or not applicable. At four sites the need to schedule interviews at times convenient for administrators and emergency responders reduced the time available for observation.

Implementation of the listed 11 practices were observed in at least one site. Receiving entrances were locked at one site, as were chemical storage cabinets. All seven sites issued employees photo identification badges. Two schools had secured and controlled access to food product storage areas and six sites monitored self-service stations at all times. A summary of observations is shown in Table 6.

CONCLUSIONS AND APPLICATIONS

Findings from this case study review of five school districts found that schools indeed have security measures in place that could strengthen food defense, but administrators lack an understanding of the broader utility of these practices. In this purposive sample of five districts, foodservice directors were not routinely involved in discussions about school security, which prevented security resources from being used effectively to mitigate threat of intentional food contamination. Findings showed there is a need for all school district administrators and emergency responders to be educated about the topic and encouraged to recognize their roles in maintaining food defense. Awareness of food defense did not appear to be related to size of school district or type of production system. Further, responses to risk perception questions indicated a general lack of concern about food tampering and food terrorism. Currently, food defense was viewed as the responsibility of the child nutrition program whereas it is a safety issue in which district-wide precautions, similar to fire safety or building security, should be taken.

The best practice is to control access to food and chemical storage areas; observations showed there is limited implementation of this

Table 5: Sub-themes and Illustrative Quotations for Theme "Conflicting Priorities and Expectations Influence Security"

Sub-theme	Sample illustrative quotations
Security is designed to protect children, not food	• School security is more important for students. So what we can do is monitor, keep an eye [out]… and do the best that we can. (foodservice director) • First of all, the cameras are more meant for after the fact. And it's meant for security and it's also, in the middle school, it's used for student issues so there is nobody monitoring the cameras until there is an incident. (principal)
Community expectations can impede food defense	• It's actually been kind of a push to get this level of security to this point because we suggested it in the past, again there's financial things and that's not how we operate attitude. You know, small town and so just getting the outside door secured is a big step. (security consultant) • Well the barrier is just ecology. Ecology and cost. So there's a cost to all the disposable items we would use [to provide individual sealed portions of foods currently served on self-serve bars] and there's a huge concern for the community and the citizens in this area that we behave responsibility for the environment, so we try to be environmentally friendly and that means using the least disposable products. (foodservice director)

Table 6: Observed Frequency of Implementation of Food Defense Practices at Seven Buildings in Five Districts

Food defense practice	Practice implemented	Practice not implemented	Not observed	Not applicable
Emergency contact list is available to all employees.	2	1	3	1[a]
The outside of facility is adequately lighted.	2	0	5	
Employees issued photo ID badges	7[b]		0	
Exterior doors from public areas are locked at all times (except for main entrance)	4	3	0	0
Receiving entrances are locked.	1	6	0	
Customers are restricted from entering storage and preparation areas.	5	2	0	
Storage is provided for employees' personal items so that these are not allowed in preparation areas.	4[c]	2	1	
Self-service stations are monitored at all times by foodservice employees.	6	0	0	1[d]
Access to all food product storage areas is secured and controlled.	2	4	1	
Chemicals are stored in a locked cabinet.	1	6	0	
Outside air intake fenced and locked.	3	0	4	

Note: Practices from Food *Defense Checklist for Retail Foodservices,* (Strohbehn, Sneed, Paez, & Beattie, (2007)

[a]One Food Service Director instructed employees to contact their supervisor in the event of an emergency and did not make emergency contacts available

[b]Badges available but not worn

[c]One not used by employees due to remote location and lockers provided in production area at one site

[d]No food served at central kitchen

food defense practice. In observations at all seven buildings, it was found employee photo identification badges were issued; yet these were not always worn. Employees know who their coworkers are and exterior doors from public areas do provide some limiting of access from nonemployees. Further, 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. In addition, intentional contamination of food may not always be initiated by an outsider; screening of potential employees is a critical part of the hiring process.

Stakeholders' beliefs about the vulnerability of their school foodservice operations to incidents of food tampering are inconsistent with reported food tampering experiences. Interviewees reported six incidents of food tampering in schools; each occurred while it was under the control of the foodservice operation. Interview findings indicated a belief that food was not vulnerable once it was delivered to the kitchen. Interviewees expressed beliefs that intentional contamination would occur elsewhere, not locally, yet an incident of food tampering was reported in four of the five school districts in this study. Although all food tampering incidents were handled internally, food tampering by students was treated as a prank. Employees were suspected in two of the incidents. These past food tampering incidents, although not resulting in harm, point out vulnerabilities that exist within child nutrition programs and indicate not only a need for school districts to practice good hiring procedures but also to include food tampering in crisis management plans.

Results of this study showed current crisis management planning activities failed to identify food-related emergencies as a threat. These results suggest that an effective threat appraisal should include multiple stakeholder groups, including production workers. Because of the potential for widespread effects, there is a need for school personnel and emergency responders to agree on procedures for responding to acts of food tampering that occur in schools. Findings indicated a need to identify district level avenues of communication about food defense among stakeholders. District emergency response planning and training activities offer an opportunity to open or strengthen communication between the foodservice operation, school administration, and community emergency response teams. In situations where community expectations may conflict with food defense practices, inclusion of multiple perspectives will ensure children are protected.

Although production workers and foodservice directors interviewed identified the food supply chain and food deliveries as vulnerable to food tampering, access to the building via receiving entrances was unrestricted in six sites. 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 food is arriving from a vendor or from a centralized warehouse or production kitchen.

The food tampering experiences related by the interviewees suggest a need to challenge stakeholders' assertions that intentional food contamination would only happen somewhere else, that food is most vulnerable to attack before it arrives to the school district, and that co -workers are unlikely to be perpetrators of food tampering. There is a need for administrators and foodservice personnel to receive training to increase their level of awareness and concern for a threat of food tampering at multiple points of the flow of food.

ServSafe® (National Restaurant Association Education Foundation, 2012) and the district's HACCP-based food safety plan can prepare foodservice production workers 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 the district's custody and provide a communication tool with written standard operating procedures within the district. Districts' food safety trainings and HACCP plans should be expanded with input from all district stakeholders to include food defense. Further, a board-level food safety policy that addresses protection from both intentional and unintentional food contamination is recommended. Board level policies provide "vision and structure" for an organization and can guide development of standard operating procedures. A Model District Food Safety Policy is available on the Iowa State University HACCP web site at www.iowahaccp.iastate.edu. In-service trainings might include a self-audit of the district's food defense practices using one of multiple checklists such as those from USDA, National Food Service Management Institute, or Iowa State University.

Practices that achieved district goals of physical security and loss prevention were frequently implemented, but as noted by

interviewees; these practices were not recognized as food defense measures. District administrators must be made aware of the threat of intentional food contamination and the risk of catastrophic consequences so district security measures already in place can be effectively used for food defense. Inclusion of food defense awareness into staff trainings will broaden effectiveness of controls. It was noted in one case where an organized group attempted to contaminate food in a school cafeteria, perpetrators were stopped because school personnel were observant (Carus, 2009). Thus, food defense is part of a district's effort to protect children during the school day.

The purpose of this study was to determine the extent to which food defense best practices are currently implemented in U.S. schools, with specific objectives of observing current implementation in five school districts and to investigate reasons why communication and physical security are aspects infrequently implemented. Use of a qualitative approach with structured assessment tools helped meet these objectives. Findings from this study contribute to the limited body of knowledge regarding implementation of food defense practices in schools.

Limitations of the Study

Although the study was limited to five case districts, the rigor was strengthened by using methods recommended by Yin (2009), including multiple sources of evidence, creating a case study database, and maintaining a chain of evidence. The combination of structured interview guides, digital recordings, transcriptions of interviews, observations based on a standard food defense checklist, and documenting food defense practices or lack thereof provided a durable body of evidence.

Case study visits were made during the months of May and October of two different academic years, which may have led to differences in the data collected due to staff turnover or implantation of new procedures. All interviews were conducted by the primary researcher using an interview guide with structured questions, but as interviews progressed, the use of follow-up questions by the primary investigator increased. Merriam (2009) explained that it is common for interviewers to become less dependent on the interview guide as they become more comfortable with the interview process and content. The knowledge and experience gained by the primary investigator from the first three site visits enhanced the quality of the data.

Recommendations for Further Research

This study points to a need to open avenues of communication between administrators, emergency responders, and foodservice directors with the purpose of achieving strong food defense within districts with the least expenditure of resources. Production workers are the main line of defense in the kitchen and storeroom settings; it is their vigilance that maintains food defense in these areas. Production workers' understanding of food defense threats, knowledge of practices to reduce the threat, and motivation to perform food defense practices is not known.

Central kitchen production systems use economies of scale to reduce production costs of school meals. This type of system has characteristics making it possible for an incident of food tampering to affect a large number of children during a short period of time. Production workers in central kitchens have no contact with their customers, the school children, and may feel a different level of motivation to maintain food defense compared to workers in on-site kitchens who interact with children daily. Research is needed to assess employees' motivations to maintain food safety and defense in this setting; particularly to assess the workplace culture and employee job satisfaction in central kitchens. A disgruntled employee working in a central kitchen has the potential to harm many students or cause widespread damage to the reputation of the child nutrition program.

The results of this study indicated that other stakeholder groups, not just child nutrition program personnel, are viewed as having responsibilities to maintain food defense or responding to a food tampering incident in a district. Yet principals and other administrators had limited understanding of the scope of food defense, perceiving it as a responsibility that could be assumed by the foodservice director alone. School nurses have responsibilities to identify student illnesses, custodians may require access to food production and storage areas; yet these employees are not under the authority of the foodservice director. Thus, research is needed to determine the levels of awareness and importance that district administrators, school nurses, and other noncertified staff hold regarding food defense practices, and to determine how food defense practices are included in job preparation training materials.

Emergency responders, principals, foodservice directors, and production workers in this study demonstrated knowledge and expertise that contributed to a safe school environment for students. Research funds could support pilot projects that develop and assess the effectiveness of various communication tools to increase awareness of food defense among broader populations of district stakeholders.

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