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).

REFERENCES

Arbuckle, J.L.(1997). *Amos Users' Guide Version 3.6*. Chicago, IL: Small Waters Corporation.

Arendt, S., & Sneed, J. (2008). Employee motivators for following food safety practices: Pivotal role of supervision. *Food Protection Trends*, *28*, 704-711.

Arendt, S., Strohbehn, C. Ellis, J., Paez, P., & Meyer, J. (2011). Development and use of an instrument to measure retail foodservice employees' motivation for following food safety practices. *Journal of Foodservice Business Research, 14*, 68-85.

Babbie, E. (2001). *The Practice of Social Research* (9th Eds). Belmont, CA: Wadsworth Thomson.

Bagozzi, R.P., &Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science, 16*, 74–94.

Ball, B., Wilcock, A., & Aung, M. (2010a). Background factors affecting the implementation of food safety system. *Food Protection Trends, 30*, 78-86.

Ball, B., Wilcock, A., & Colwell, S. (2010b). Tool for measuring food safety climate. *Journal of Food Protection, 73*(Sup.A), 84.

Centers for Disease Control and Prevention. (2007). Surveillance for Norovirus outbreaks. Retrieved July 6, 2011 from http://www.cdc.gov/Features/dsNorovirus/.

Centers for Disease Control and Prevention. (2011). Vital signs: Incidence and trends of infection with pathogens transmitted commonly through food - Foodborne diseases active surveillance network, 10 U.S. sites, 1996-2010. *Morbidity and Mortality Weekly Report, 60*, 749-755. Retrieved July 8, 2011 from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6022a5.htm?s_cid=mm6022a5_w.

Clarke, S. G. (2000). Safety culture: Underspecified and overrated? *International Journal of Management Review*, *2*(1), 65-90.

Coyle, I. R., Sleeman, S. D., & Adams, N. (1995). Safety climate. *Journal of Safety Research, 4*, 247-254.

Creswell, J. W. & Clark, V. L. (2007). Mixed methods research. Thousand Oaks, CA: Sage Publications.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika 16(3),* 297–334.

DeVellis, R. F. (2003). *Scale development: Theory and applications* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Dillman, D.A. (2007). Mail and Internet surveys: The tailored design method (2nd Ed.). New York: John Willey and Sons.

Fereday, J. & Muir-Cochrane, E. (2006). The role of performance feedback in the self-assessment of competence: A research study with nursing clinicians. C*ollegian, 13*, 10-15

Flin, R. (2007). Measuring safety culture in healthcare: A case for accurate diagnosis. *Safety Science, 45*, 653-667.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equations models with unobservable variables and measurement error. *Journal of Marketing Research, 18,* 39-50.

Ginsburg, L., Gilin, D., Tregunno, D., Norton, P. G., Flemons, W., & Fleming, M. (2009). Advancing measurement of patient safety culture. *Health Service Research, 44,* 205-224.

Green, L., Radke, V., Mason, R., Bushnell, L., Reimann, D., Mack, J., Motsinger, M., et al. (2007). Factors related to food worker hand hygiene practices. *Journal of Food Protection, 70,* 661-666.

Griffith, C. J., Livesey, K. M., & Clayton, D. (2010a). Food safety culture: the evolution of an emerging risk factor? *British Food Journal*, *112*, 439-456.

Griffith, C. J., Livesey, K. M., & Clayton, D. (2010b). The assessment of food safety culture. *British Food Journal*, *112*, 439-456.

Guldenmund, F. W. (2007). The nature of safety culture: A review of theory and research. *Safety Science, 34*, 215-257.

Hair, J. F., Blank, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate data analysis* (6th ed.). New Jersey: Prentice Hall, Inc.

Howells, A., Roberts, K., Shanklin, C., Pilling, V., Brannon, L., & Barrett, B. (2008). Restaurant employees' perceptions of barriers to three food safety practices. *Journal of the American Dietetic Association*, *108,* 1345-1349.

Hoyle, R. H., & Panter, A. T. (1995). Writing about structural equation models. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp.158-176). Thousand Oaks, CA: Sage.

Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, 39(1), 31-36.

Merriam, S. B. (2002). Assessing and evaluating qualitative research. In S. B. Merriam (Ed.), *Qualitative research in practice: Examples for discussion and analysis*. San Francisco, CA: Jossey-Bass.

Mitchell, R. E., Fraser, A. M., & Bearon, L. B. (2007). Preventing food-borne illness in foodservice establishment: Broadening the framework for intervention and research on safe food handling behaviors. *International Journal of Environmental Health Research, 17*(1), 9-24.

Morgan, D. (1998). *Planning Focus Group*. Thousand Oak, CA: Sage Publications

Neal, J. A., Binkley, M., & Henroid, D. (2012). Assessing factors contributing to food safety culture in retail food establishments. *Food Protection Trends, 32*, 468-476.

Nunnally, J. (1978). Psychometric theory. New York, NY: McGraw-Hill

Nunnally, J., & Bernstein, I. H. (1994). *Psychometric Theor*y (3rd ed.). New York: McGraw-Hill.

Patton, M. Q. (2003). *Qualitative Research and Evaluation Methods* (3rd ed). Thousand Oaks, CA: Sage Publications.

Pedhazur, E. J., & Schmelkin, L. (1991). *Measurement, design, and analysis: An integrated approach*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Powell, D., Jacob, C., & Chapman, B. (2011). Enhancing food safety culture to reduce rates of foodborne illness. *Food Control, 22*, 817-822.

Pragle, A. S., Harding, A. K., & Mack, J. C. (2007). Food workers' perspectives on hand washing behaviors and barriers in the restaurant environment. *Journal of Environmental Health*, *69*, 27-31.

Roberts, K., Arendt, S., Strohbehn, C., Ellis, J., & Paez, P. (2012). Educating future managers to motivate employees to follow food safety practices. *Journal of Foodservice Management and Education, 6*, 1-8.

Scallan, E., Griffin, P. M., Angulo, F. J., Tauxe, R. V., & Hoekstra, R.M. (2011a). Foodborne illness acquired in the United States – unspecified agents. *Emerging Infectious Disease, 17,* 16-22.

Scallan, E., Hoekstra, R.M, Angulo, F. J., Tauxe, R. V., Widdowson, M-A., Roy, S. L., Jones, J. L., & Griffin, P. M. (2011b). Foodborne illness acquired in the United States – major pathogens. *Emerging Infectious Disease, 17*, 7-15.

Schein, E. H. (1985). *Organizational Culture and Leadership*. San Francisco: Jossey-Bass.

Scheule, B. (2000). Food-safety educational goals for dietetics and hospitality students. *Journal of American Dietetics Association, 100*, 919-927.

Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research project. *Education for Information, 22*, 63-75.

Strohbehn, C., Sneed, J., Paez, P., & Meyer, J. (2008). Hand washing frequencies and procedures used in retail food services. *Journal of Food Protection, 71*, 1641-1650.

Tabachnick, B. G., & Fidell, L. S. (1996). *Using multivariate statistics* (3rd ed.) New York: Harper Collins.

Taylor, J. (2008). HACCP for the hospitality industry: A psychological model for success. *International Journal of Contemporary Hospitality Management*, *20*, 508-523.

Taylor, J. (2011). An exploration of food safety culture in a multi-cultural environment: Next steps? *Worldwide Hospitality and Tourism Themes, 3*, 455-466. doi:10.1108/17554211111185836

Ungku Zainal Abidin, U.F., Arendt, S.W., & Strohbehn, C.H. (2013). Exploring the culture of food safety: The role of organizational influencers in motivating employees' safe food handling practices. *Journal of Quality Assurance in Hospitality and Tourism, 14,* 321-34.

U. S. Food and Drug Administration (2009). FDA report on the occurrence of foodborne illness risk factors in selected institutional foodservice, restaurant, and retail food store facility types. Retrieved August 20, 2011 from http://www.fda.gov/Food/FoodSafety/RetailFood

Protection/%20FoodborneIllnessandRiskFactorReduction/RetailFoodRiskFactorStudies/ucm224321.htm.

Yiannas, F. (2009). *Food safety culture: Creating a behavior-based food safety management system* (pp. 11-14). New York, NY: Springer.

Zohar, D. (2003). Safety climate: Conceptual and measurement issues. In J. Quick & L. Tetrick (Eds.), *Handbook of occupational health psychology association* (pp.123-142). Washington, DC: American Psychological Association.