INVESTIGATING FOOD SAFETY FACTORS THAT INFLUENCE CHILDCARE EMPLOYEES' SELF-COMMITMENT TO PERFORM SAFE FOOD HANDLING PRACTICES

Joel Reynolds, PhD[1*]; Lakshman Rajagopal, PhD[2]; Stephen Sapp, PhD[3]

[1]Assistant Professor, Niagara University, Niagara University, NY, USA
[2]Associate Professor, Iowa State University, Ames, IA, USA
[3]Professor, Iowa State University, Ames, IA, USA

ABSTRACT

Young children are considered a high risk population for foodborne illness. This study aimed to identify which food safety culture and social system factors affected childcare food handler's self-commitment to perform safe food handling practices in South Carolina licensed center-based childcare facilities. Results identified three factors, *manager/coworker support*, the ability to *speak freely*, and *communication* from managers to staff, had the highest correlations with *self-commitment*. However, *speak freely* and *communication* were the only factors with statistically significant effects on *self-commitment*. Conclusions and implications of the study are given.

Keywords: Childcare; Food safety; Organizational culture, Social system

INTRODUCTION

In 2013, over 15.6 million children under the age of five were in licensed center-based childcare facilities (i.e., commercial, church, and preschools) or home-based childcare facilities in the United States (U.S. Census Bureau, 2013). A licensed center-based childcare facility is defined as providing care and education to 13 or more children in a non-residence setting, operating more than four hours a day and more than two days a week (South Carolina Child Care, 2016). On average, children attending child care spend 33 hours per week in some type of childcare setting (U.S. Census Bureau, 2013). Breakfast, lunch, and snacks are prepared and served at most childcare facilities. Childcare employees are often involved in food preparation, serving, and cleanup which makes the need for safe food handling practices throughout the flow of food paramount (Todd, Greig, Bartleson, & Michaels, 2007).

Young children are considered a high risk population for foodborne illnesses (FBI) (Food and Drug Administration [FDA], 2009) because their immune systems are not fully developed, they have low body mass and reduced stomach acid production (Pew Health Group, 2014); as well as a lack of control over food handling practices (Center for Disease Control and Prevention, 2013). In 2010, the Center for Disease Control and Prevention (CDC), using population-based surveillance for laboratory-confirmed cases of infection, found that children ages four years and younger have 4.5 times the number of infection incidents transmitted through food than adults aged 20-49 years. Furthermore, children in licensed center-based childcare facilities are 3.5 times more likely to contract FBIs in comparison to children cared for in their own home (Lu et al., 2004). Yet, this could be drastically higher as many small FBI outbreaks go unreported (Painter et al., 2013). The size of the facility also impacts the frequency of infectious disease (Brady, 2005).

*Corresponding Author: Phone: (717) 649-8157 ; E-mail: jreynolds@niagara.edu

In the final phase of a ten-year study, the FDA observed within foodservice establishments a low level of compliance with food safety policies; the three highest non-compliance factors were time and temperature abuse, poor personal hygiene, and cross contamination (FDA, 2009). Yet, each of these non-compliance factors could be mitigated by improving employee food handling practices. However, research findings indicate that knowledge and training alone are not enough to improve safe food handling practices (Roberts et al., 2008; York et al., 2009). Food safety practices are influenced by more than just proper knowledge and attitudes; food safety practices are partly influenced by the prevailing cultural norms found within foodservice environments (Yiannas, 2015).

Food Safety Culture

Schein (1992) detailed organizational culture as "the pattern of basic assumptions that a given group has invented, discovered, or developed in learning to cope with its problems of external adaptation and internal integration which have worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to other problems" (p. 12). Within the last two decades there has been a shift in emphasis in safety literature, moving away from individual-level accident antecedent factors (e.g. error or non-compliance with safety procedures), and moving towards broader organizational factors (e.g. safety culture) (Zohar, 2010). "In safety culture the concept of organizational culture is taken and applied to one specific area of a business' activities, i.e. the safety of people working within a business or people who could be adversely affected by its existence, products or services" (Griffith, Livesey, & Clayton, 2010a, p.429).

Food safety research has only recently started to examine food safety practices through the organizational lens. Yiannas (2009) identified food safety culture as a specific form of organizational culture in which there are shared perceptions of food safety policies and procedures among members of an organization. Previously assessed food safety culture factors are identified in Table 1. In previous studies there are three major recurring factors of safety culture; management and coworker support, communication, and employees' attitudes and behaviors.

Management and Coworker Support. Hofmann and Morgeson (1999) defined perceived organizational support as a measure of the level of support that employees perceive the organization has provided to them. Medeiros, Cavalli, and Proenca (2012) identified specific managerial and organizational behaviors including providing supervisory and peer support, adequate resources, training, and a positive management culture. Management effectiveness was a significant overall factor contributing to the prevention of FBI outbreaks (Griffith, 2010). Furthermore, the strength of a food safety culture was correlated with how important management perceives food safety to be (Griffith, 2010).

Table 1: Previously Assessed Food Safety Culture Factors		
Authors	**Factors of food safety culture**	**Area adapted/Assessment instrument**
Ball, Wilcock, & Colwell (2010)	Management commitment; work unit commitment; food safety training; infrastructure; and worker food safety behavior	Food safety culture questionnaire
Cooper (2000)	Subjective internal psychological; and food safety behaviors; situational and environmental	Food safety culture questionnaire, observations, audits
De Boeck, Jacxsens, Bollaerts, & Vlerick, (2015)	Leadership; communication; commitment; resources; and risk awareness	Food safety culture questionnaire
Griffith et al. (2010a)	Management systems; leadership; communication; commitment; environmental and risk awareness; and perception and risk taking behavior	Food safety management
Jespersen, Griffiths, Maclaurin, Chapman, & Wallace (2016)	Perceived value; people systems; process thinking; technology enabled; and tools and infrastructure	Food safety maturity model
Neal, Binkley, & Henroid (2012)	Management commitment; and worker food safety behavior	Food safety culture questionnaire
Nyarugwe, Linnemann, Jan Hofstede, Fogliano, & Luning (2016)	organizational and administrative characteristics; technical facilities/resources; employee characteristics; food safety policy/procedure characteristics; and food safety performance	Food safety culture
Taylor (2011)	Knowledge; attitude/psychological; external; and behavioral.	Food safety management
Thogaru (2015)	Commitment; control; communication; and competence	Food safety culture questionnaire, audits
Ungku Fatimah et al. (2014b)	management and coworkers support; communication; self-commitment; environment support; work pressure; and risk judgment	Food safety culture questionnaire
Yiannas (2009)	Leadership; employee behavior; management support; accountability; and communication	Food science
Yiannas (2015)	Leadership; commitment; communication; continuous training; and attitude/psychological	Food science

Communication. Communication was a necessity in any discussion of culture. Yiannas (2009) argues that the way in which food handling practice messages are presented is crucial. Griffith (2010) reported the need for food handlers to "know what they need to know." It was essential for communication to occur to ensure food handlers have knowledge of food safety practices and how to use that knowledge. Knowledge of food safety/hygiene alone does not always translate into implementation of food safety practice, thus constant communication for new and tenured employees was needed (Griffith, 2010). Important to note was the significance of communicating to new employees who are learning the food safety culture (Griffith et al., 2010a).

Employees' Attitudes and Behaviors. Griffith et al. (2010a) stated that food safety culture requires contributions from people at all levels. Two variables found to be significant in foodservice employees' safe food handling practices were their attitude toward food safety and their level of perceived control (Clayton & Griffith, 2008). Cooper (2000) identified that different subcultures will emerge and form around different position levels in an organization. It has been shown that these subcultures may compete for priority within the organization. Griffith et al. (2010a) identified that a major barrier to food safety culture was a culture of saving money.

Social System. The aspects of the social system important to food safety culture include work pressures and environmental support. "The actual behavior of individuals, their symbolically oriented actions, may be to a widely varying degree congruent with the meanings of the cultural system" (Parsons, 1972, p. 255). The organizational environment has an influence on motivation and self-commitment to follow proper food safety practices (Yiannas, 2009). Work pressure and stress has an impact on work performance,

behavior, practices or behavioral norms (Griffith et al., 2010a). Previous research has shown that self-commitment is a key factor in influencing an organizations food safety culture (Ungku Fatimah, Strohbehn, and Arendt, 2014b).

Assessing Food Safety Culture and Social System
Griffith, Livesey, and Clayton (2010b) listed multiple reasons to assess food safety culture and social system: (1) to assess potential compliance with safety management systems to avoid error and food poisoning costs; (2) raise awareness of food safety; (3) benchmark for future comparisons; (4) make informed decisions about training; (5) promote commitment; and (6) identify weaknesses and evaluate risk. Assessing food safety culture will help foodservice organizations understand food handler behaviors (Ungku Fatimah et al., 2014b; Yiannas, 2009). Once an organization has identified which food safety factors positively influence employee's self-commitment to following recommended food safety practices, modifications should be made that will align the current culture with the identified influential factors. No known research has been conducted in regards to food safety culture and social system within childcare facilities. Thus, the purpose of this study was to investigate food handling employees' perceptions of food safety culture and social system in licensed center-based childcare facilities using a quantitative research approach. The specific research objective for the study was to identify which food safety culture and social system factors affect childcare food handling employee's self-commitment to perform safe food handling practices.

METHODS

Research Design
A quantitative approach, utilizing two separate paper-based questionnaires, was used to complete the study's research objectives. A childcare director questionnaire was used to collect childcare

facility organizational characteristics as well as food safety policies and training practices. A childcare food handling employee questionnaire was used to collect perceptions of food safety culture factors and employee demographics. Once both types of surveys were collected, director survey data (for each facility) was entered into the corresponding facility employee survey data. Approval from the Human Subjects Review Board was obtained prior to data collection.

Sample

The target population for this study was South Carolina licensed center-based non-supervisory childcare employees involved in food handling, as these employees handle food which the children consume. The setting for this study was South Carolina licensed center-based childcare facilities including commercial, church, and preschools. Licensed center-based childcare facilities provide care and education to 13 or more children in a non-residence setting, operating more than four hours a day and more than two days a week. All exempt (i.e. only operated less than 4 hours per day or on school holidays or no licensing or inspections required by law) facilities were eliminated as they are not required to be licensed or inspected by law. Additionally, home-based childcare facilities were eliminated as this type of facility often only has one or two employees, thus assessing food safety culture would be difficult.

As one of the study objectives was to compare food safety culture based on operational characteristics (size of childcare facility), a stratified random sampling technique was used to ensure the sample represented the population of 1,400 South Carolina licensed center-based childcare facilities (South Carolina Child Care, 2016). Maximum child capacity was the characteristic used to divide the 1,400 South Carolina licensed center-based childcare facilities into three separate strata: (1) small facilities (0-100 children); (2) medium facilities (101-200 children); and (3) large facilities (201+ children). From each of the three strata, 33 South Carolina licensed center-based childcare facilities were randomly selected to participate in the current study (total facilities=99). Random selection was conducted by alphabetically listing all South Carolina licensed center-based childcare facilities for each strata. Then starting at the fourth licensed center-based childcare facilities listed, each fifth facility was selected until 33 facilitates per strata were obtained.

Each of the 99 facilities were sent a packet containing one director questionnaire and ten employee questionnaires, therefore a total of 99 director questionnaires and 990 employee questionnaires were sent to licensed center-based childcare facilities for completion.

Research Instruments

Director. Based on the review of literature of childcare studies and food safety studies (Enke, Briley, Curtis, Greninger, & Staskel, 2007; Wohlgenant et al., 2014), the childcare director questionnaire was developed. The director questionnaire consisted of 21 questions to evaluate *childcare facility demographics, and childcare facility food safety policies and training practices.* The childcare facility demographics section contained 13 questions including: legal status (i.e. for profit, nonprofit); type of childcare facility (i.e. independently owned or operated, chain/franchise); number of full-time and part-time foodservice employees; number of food handling employees; number of meals served (i.e. breakfast, lunch, dinner); type of meal service; program affiliation (i.e. Head Start, Child and Adult Care Food Program [CACFP], National Association for the Education of Young Children [NAEYC]); child maximum capacity; and current enrollment. The childcare facility food safety practices section contained 8 questions pertaining to food safety policies (3 questions); food safety training (4 questions); and food purchasing (1 question).

Employee. The childcare employee questionnaire consisted of two sections. The first section assessed childcare food handlers' perceptions of factors pertaining to the organizational culture of food safety in describing their current childcare facilities. Respondents were asked to rate their level of agreement to each of the 31 statements which described their current work environment, using a seven-point Likert-type scale (1 = Strongly Disagree; 7 = Strongly Agree). The instrument was previously developed and validated in school and hospital foodservice settings (Ungku Fatimah, Arendt, and Strohbehn, 2014a). The 31 statements consisted of 7 food safety culture factors including *management and coworker support; speak freely; communication; self-commitment; environment support; work pressure; and risk judgment.* The factors *speak freely* and *communication* were previously one factor, called *communication*. The factors were separated to better assess the nuances of communication that occurs in the childcare setting. The following are descriptions of factors (Ungku Fatimah, et al., 2014a):

1. Management and coworkers support (10 statements) – This factor was related to managers and management roles in encouraging safe food handling practices and teamwork among coworkers.
2. Speak freely (2 statements) – This factor was related to management creating an environment in which employee's feel comfortable discussing food safety.
3. Communication (4 statements) – This factor was related to communication between management and employees as well as communication among coworkers.
4. Self-commitment (5 statements) – All items in this factor reflected employees' internal motivation to perform safe food handling.
5. Environment support (4 statements) – This factor represented measures on adequacy and quality of infrastructures that support safe food handling practices.
6. Work pressure (3 statements) – This factor described pressures in the workplace associated with time, work load and staff adequacy that affect safe food handling practices.
7. Risk judgment (3 statements) – This factor was associated with organization risk taking decisions when implementing and complying with food safety rules and regulations.

The second section consisted of 12 demographic questions to evaluate *childcare employee demographics*: sex, age, years' experience (4 questions), work status (2 questions), job title, and food safety training (3 questions).

Data Collection

Prior to data collection, experts in the area of food safety (n=3), child development (n=1), and survey design (n=1) reviewed the instruments. Minor modifications were made upon experts' feedback to better assess the food safety culture in the childcare setting. A pilot test was conducted with childcare employees (n=9) at one childcare facility to assess clarity of wording for both survey instruments.

Prior to survey distribution a gatekeeper sent an announcement email to all licensed center-based childcare facility directors detailing the study purpose, to "be on the look-out", and request participation. Additionally, a paper-based invitation letter was sent to the director of each selected license-based childcare center. A recruitment flier was also included, which detailed purpose and benefits of participating in the study as well as detailing process for completion and identifying a token of appreciation.

To reduce sampling error and increase participation rates a survey implementation plan was utilized (Dillman, Smyth, & Christian, 2014). In the first mailing a large packet, containing one director packet and

ten employee packets, was sent to each licensed childcare facility director. Childcare directors then distributed the employee packets to childcare employees fitting the following selection criteria: (1) participants must be a minimum of 18 years of age; and (2) participants must be involved in food handling (this could be food preparation and/or food service).

Follow-up contacts, spaced approximately one week apart for three weeks, were used to recruit participants (Dillman et al., 2014). A final telephone contact to childcare directors was made to those childcare facilities who had not yet responded. A five dollar electronic Target gift card was given to childcare food handling employees after returning a completed questionnaire, as well as a summary of results were offered to childcare directors who returned a completed questionnaire.

Statistical Analysis
Data were analyzed using SPSS (Version 23.0). Descriptive statistics including frequency, mean, and standard deviation were used to summarize the data. Negatively worded items were reverse coded. Reliability of the instrument was determined by measuring the internal consistency of each factor using the Cronbach's alpha. Alpha coefficients for each factor ranged from 0.713 to 0.892, all were above the 0.70 threshold for standard of reliability as suggested by Nunnally (1978). A bivariate correlation analysis was conducted to assess the relationship between each food safety culture factor (independent variables) and employee self-commitment (dependent variable) to following food safety practices. Furthermore, regression analysis was used to examine which food safety culture factors impact self-commitment to following food safety practices. Self-commitment was the dependent variable. Independent variables were the food safety culture factors. The 0.05 level of significance was used for analysis.

RESULTS
Of the 990 employee questionnaires sent, 287 were returned, with 271 being usable, resulting in a response rate of 27.4%. Of the 99 childcare directors contacted, 71 completed the director questionnaire, for a director response rate of 71.1%. All childcare facilities where the director completed the questionnaire at least one employee also completed a questionnaire. Employee questionnaires returned and usable ranged between one and 10 per facility.

Employee and Operational Characteristics
Childcare food handling employee respondents' (n=271) characteristics are shown in Table 2. The majority of respondents were female (97.8%) and between the ages of 18 and 29 (76.8%). Over half had between 1-4 years' food handling experience in childcare facilities. Respondents (77.1%) reported working in their current facility for less than 5, years and the majority (65.3%) stated having less than one year of foodservice experience. Only 5.5% reported working part-time. Respondents identified their job title as cook (6.6%), teacher (63.5%), assistant teacher (28.8%), and aide (1.1%). The majority (83.8%) reported receiving food safety training, yet only 8.1% reported a food safety certificate. Hours of training per year were identified as: none (16.6%), only periodic on-the-job (58.7%), less than 1 hour (17%), 1-2 hours (6.6%), and 3-5 hours (1.1%).

Of the 71 participating facilities (table 3), 97% of directors reported having food safety policies, yet only 74.5% reported having written food safety policies. Majority of directors (83.8%) reported receiving food safety training, with 70.8% also receiving food safety certification. Directors reported conducting food safety training on

cross contamination (46.9%), cleaning and sanitizing (85.2%), temperature danger zone (53.5%), handwashing (77.1%), glove use (62%), allergens (35.1%), and proper food storage practices (9.2%).

Table 2: Child Care Food Handling Respondents' Demographic Characteristics (n=271)		
Characteristic	**n**	**%**
Gender		
Male	6	2.1
Female	265	97.8
Age		
18-29 years	208	76.8
30-49 years	40	14.8
50-60 years	15	5.5
More than 60 years	8	3.0
Years of child care experience		
Less than 1 year	67	24.7
1-4 years	142	52.4
5-8 years	43	15.9
9-12 years	11	4.1
More than 12 years	8	3.0
Years of current child care facility experience		
Less than 1 year	98	36.2
1-4 years	142	52.4
5-8 years	21	7.7
9-12 years	8	3.0
More than 12 years	2	0.7
Years of food handling experience in child care		
Less than 1 year	67	24.7
1-4 years	142	52.4
5-8 years	43	15.9
9-12 years	11	4.1
More than 12 years	8	3.0
Years of experience in foodservice		
Less than 1 year	177	65.3
1-4 years	80	29.5
5-8 years	13	4.8
9-12 years	0	0
More than 12 years	1	0.4
Work status		
Full-time	256	94.5
Part-time	15	5.5
Hours worked weekly		
Less than 10 hours	1	0.4
10-20 hours	9	3.3
21-30	5	1.8
31-40	256	94.5
Job title		
Cook	18	6.6
Teacher	172	63.5
Assistant Teacher	78	28.8
Aide	3	1.1
Received food safety job training		
Yes	227	83.8
No	44	16.2
Received food safety certification		
Yes	22	8.1
No	249	91.9
Food safety training hours per year		
None	45	16.6
Only periodic on-the-job	159	58.7
Less than 1 hour	46	17.0
1-2 hours	18	6.6
3-5 hours	3	1.1

Over two-thirds of facilities were considered for profit (79.7%), and reported being independently owned/operated (64.9%). The majority of facilities had less than two full-time foodservice employees (77.9%), and less than two part-time foodservice employees (95.6%). However, 28.2% of facilities did not have a full-time or part-time foodservice employee. Although, 68% had over 11 food handling employees. Nearly all facilities reported serving morning snack, lunch, and afternoon snack. Facilities predominantly used family-style (82.2%) or pre-plated in kitchen (17%) meal service. Respondents worked in CACFP (50.5%), Head Start (12.9%), and NAEYC (4.4%) affiliated facilities, with some employees working in facilities that had several affiliations. While the remaining 40.2% worked in facilities with no program affiliation.

Food Safety Culture Factors
All statements per food safety culture factor were computed to identify each food safety culture factors overall mean scores. Each factor had an overall mean score above 5.0 (1=Strongly Disagree; 7=Strongly Agree) and Cronbach's alpha scores above 0.80 (see Table 4).

Correlation Results
The results of the bivariate correlation analysis showed that *management/coworkers support*, the ability to *speak freely*, and

Table 3: Childcare Facilities' Organizational Characteristics (n=271)					
Characteristic	**n**	**%**	**Characteristic**	**n**	**%**
Food safety policies			**Estimated breakfasts served daily**		
Yes	263	97.0	Fewer than 25	25	9.2
No	8	3.0	26-50	48	17.7
Written food safety policies			51-100	22	8.1
Yes	202	74.5	101-150	33	12.2
No	69	25.5	151-200	2	0.7
Director received food safety training			More than 200	0	0.0
Yes	227	83.8	Don't serve breakfast	141	52.0
No	44	16.2	**Estimated lunches served daily**		
Director received food safety certification			Fewer than 25	33	12.2
Yes	192	70.8	26-50	42	15.5
No	79	29.2	51-100	69	25.5
Food safety training topics[a]			101-150	76	28.0
Cross contamination	127	46.9	151-200	43	15.9
Cleaning and sanitizing	231	85.2	More than 200	6	2.2
Temperature danger zone	145	53.5	Don't serve lunch	2	0.7
Handwashing	209	77.1	**Estimated dinners served daily**		
Glove use	168	62.0	Fewer than 25	4	1.5
Allergens	95	35.1	26-50	0	0.0
Proper food storage practices	25	9.2	51-100	0	0.0
Legal Status			101-150	0	0.0
For profit	216	79.7	151-200	0	0.0
Non-profit	55	20.3	More than 200	0	0.0
Type of childcare operation			Don't serve dinner	271	98.5
Independently owned/operated	176	64.9	**Type of meal service**		
Chain/franchise	95	35.1	Family-style	223	82.2
Number of full-time foodservice employees			Pre-plated in kitchen	46	17.0
0	104	38.4	Lunch box	2	0.7
1	107	39.5	**Program affiliations**[a]		
2	57	21.0	Head Start	35	12.9
3	3	1.1	CACFP	115	42.4
Number of part-time foodservice employees			NAEYC	12	4.4
0	172	63.5	None	109	40.2
1	87	32.1	**Child maximum capacity**		
2	12	4.4	1-100	61	22.5
Number of food handling employees			101-200	130	48.0
Fewer than 5	28	10.3	More than 200	80	29.5
5-10	59	21.8	**Current child enrollment**		
11-15	89	32.8	1-100	98	36.2
16-20	24	8.9	101-200	134	49.4
21-25	21	7.7	More than 200	39	14.4
More than 25	50	18.5			
Meal periods served[a]					
Breakfast	114	42.1			
Morning snack	246	90.8			
Lunch	269	99.3			
Afternoon snack	267	98.5			
Dinner	4	1.5			

[a]Multiple responses provided

communication from managers to staff have moderate positive correlations with *self-commitment* (see, Table 5). As the aim of this study was to assess the relationship between food safety factors and self-commitment, further analyses of other correlating factors were not conducted, analyses of these factors will be reported in a forthcoming manuscript.

Regression Estimation

Preliminary evaluation of our model using linear regression revealed a negative valence for the parameter estimate of environmental support on self-commitment. This outcome, in conjunction with variance inflation factor related to this estimate, provided sufficient indication of collinearity to suggest that we combined the factors *environmental support* and *work pressures* into a single factor, entitled *social system*. This newly combined factor reflects the nature of the social system (i.e., quantity and quality of supplies and equipment, time to get work completed, and number of staff). The Cronbach's alpha score for this new factor was 0.843.

Food Safety Culture and Social System Factors Effect on Self-commitment

Upon further analysis the overall regression was significant. The analysis of variance was able to predict values of the outcome variable, $F=27.541$, $p=0.000$, and adjusted $R^2 = 0.330$. As the analysis of variance demonstrated significance, coefficients for the regression model were computed and presented in Table 6. The finding illustrates that two factors, *speak freely* ($t=2.783$, $p=0.006$) and *communication* ($t=4.796$, $p=0.000$) had significant effect on self-commitment to perform proper food safety practices. This analysis included assessments of collinearity and power. The variance inflation factor (VIF) indicates the extent to which the variance of a parameter

Table 4: Employee's Mean Agreement Scores for Food Safety Culture Factors (n=271)	
Factor and item	Mean[a] ± SD
Factor 1: Management and coworker support (α = 0.891)	**5.59 ± 1.20[b]**
There is good cooperation among employees to ensure that children receive safely prepared food.	5.89 ± 1.33
When lots of food preparation and service work needs to be done quickly, employees work together as a team to get the tasks completed safely.	5.82 ± 1.47
My coworkers are supportive of each other regarding food safety.	5.75 ± 1.50
Employees remind each other about following food safety practices.	5.68 ± 1.65
New employees and experienced employees work together to ensure food safety practices are in place.	5.66 ± 1.61
Employees are disciplined or reprimanded when they fail to follow food safety practices.	5.59 ± 1.70
My supervisor watches to see if employees are practicing safe food handling.	5.51 ± 1.72
Supervisor(s) enforce food safety rules consistently with all employees.	5.43 ± 1.91
My supervisor inspires me to follow safe food handling practices.	5.34 ± 1.98
My supervisor is actively involved in making sure safe food handling is practiced.	5.28 ± 1.90
Factor 2: Speak freely (α = 0.713)	**5.72 ± 1.60[b]**
I can freely speak up if I see something that may affect food safety.	5.72 ± 1.62
I am encouraged to provide suggestions for improving food safety practices.	5.71± 1.57
Factor 3: Communication (α = 0.845)	**5.31 ± 1.89[b]**
All of the necessary information for handling food safely is readily available to me.	5.48 ± 1.80
My supervisor generally gives appropriate instructions on safe food handling.	5.46 ± 1.79
My supervisor provides adequate and timely information about current food safety rules and regulations.	5.28 ± 1.92
All supervisors give consistent information about food safety.	5.02 ± 2.05
Factor 4: Self-commitment (α = 0.838)	**6.02 ± 1.03[b]**
I am committed to following all food safety rules.	6.10 ± 1.20
I keep my work area clean because I do not like clutter.	6.08 ± 1.28
I follow food safety rules because it is my responsibility to do so.	6.08 ± 1.25
I follow food safety rules because I think they are important.	5.96 ± 1.38
Food safety is a high priority to me.	5.88± 1.50
Factor 5: Environment support (α = 0.869)	**5.55 ± 1.39[b]**
I am provided with quality supplies (e.g. gloves, serving utensils) that make it easy for me to follow safe food handling practices.	5.61 ± 1.76
Facilities are of adequate quality to follow safe food handling practices.	5.60 ± 1.59
Equipment items needed to prepare/serve food safely (e.g. handwashing sinks) are readily available and accessible.	5.53 ± 1.62
Adequate supplies are readily available to perform safe food handling practices.	5.47 ± 1.60
Factor 6: Work pressure (α = 0.845)	**5.56 ± 1.48[b]**
My work load does not interfere with my ability to follow safe food handling practices.	5.57 ± 1.71
The number of staff scheduled at each shift is adequate for me to get my work done and handle food safely.	5.57 ± 1.67
I always have enough time to follow safe food handling procedures, even during rush hours.	5.56 ± 1.71
Factor 7: Risk judgement[c] (α = 0.892)	**5.15 ± 1.87[b]**
I am sometimes asked to cut corners with food safety so we can save costs when preparing food. [c]	5.30 ± 2.07
When there is pressure to finish food production/service, supervisors sometimes tell us to work faster by taking shortcuts with food safety. [c]	5.20 ± 1.98
I believe that written food safety policies and procedures are nothing more than a cover-up in case there is a lawsuit. [c]	4.96 ± 2.13

[a]7-point Likert scale used (1 = Strongly Disagree; 7 = Strongly Agree)
[b]Overall factor mean
[c]Items were reverse coded

Food safety culture factor	Self-commitment	Management/ coworker support	Speak freely	Communication	Environmental Support	Work pressures	Risk judgement
Table 5: Food Safety Culture and Social System Factors Correlation (n=271)							
Self-commitment							
Correlation	1	0.447**	0.493**	0.493**	0.155**	0.353**	0.220**
Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.000	0.000
Management/ coworkers support							
Correlation	0.447**	1	0.598**	0.631**	0.260**	0.498**	0.347**
Sig. (2-tailed)	0.000		0.000	0.000	0.000	0.000	0.000
Speak Freely							
Correlation	0.493**	0.598**	1	0.647**	0.258**	0.456**	0.251**
Sig. (2-tailed)	0.000	0.000		0.000	0.000	0.000	0.000
Communication							
Correlation	0.550**	0.631**	0.647**	1	0.218**	0.449**	0.345**
Sig. (2-tailed)	0.000	0.000	0.000		0.000	0.000	0.000
Environmental support							
Correlation	0.155*	0.260**	0.258**	0.218**	1	0.389**	0.082
Sig. (2-tailed)	0.011	0.000	0.000	0.000		0.000	0.177
Work pressure							
Correlation	0.353**	0.498**	0.456**	0.449**	0.389**	1	0.268**
Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000		0.000
Risk judgement							
Correlation	0.220**	0.347**	0.251**	0.345	0.082	0.268**	1
Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.177	0.000	

** Correlation is significant at 0.01 level (2-tailed)
* Correlation is significant at 0.05 level (2-tailed)

estimate for an independent variable might be affected by the extent of its correlation with other independent variables in the regression model (Belsley, Kuh, & Welsch, 1980). Typically, a VIF of 10 or above is interpreted as a reason to use caution in relying upon regression results, although recent research indicates that much higher scores for VIF do not necessarily indicate significant problems with collinearity (O'Brien, 2007). As shown in Table 6, the VIF's for our model variables ranged in size from 1.174 to 2.115. Statistical power for multiple regression indicates the probability that a test correctly rejects the null when, at a stated level of the alpha, the null should be rejected. Given the sample size here of 271 and the relatively few number of independent variables, the power of our estimation procedure is high (.99).

DISCUSSION

The purpose of this study was to assess food safety culture factors effect on childcare food handlers' self-commitment to perform safe food handling practices. Results showed that *management/coworkers support*, the ability to *speak freely*, and *communication* from managers to staff had the highest correlations with employees' *self-commitment* to following proper food safety practices. Researchers have previously shown "The manager plays a key role in the food safety culture by establishing policies and standards, expecting accountability, serving as a role model, controlling rewards and punishment, providing training, and providing needed resources to follow food safety practices," (Arendt, Paez, & Strohbehn, 2013, p. 126).

Table 6: Food Safety Culture and Social System ANOVA and Regression Analysis (n=271)

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	98.436	5	19.687	27.541	0.000[b]
	Residual	189.431	265	.715		
	Total	287.867	270			

coefficients

Factor[a]	β	t	p	VIF
Management/coworkers support	0.089	1.266	0.207	2.003
Speak freely	0.195	2.783	0.006*	1.973
Communication	0.348	4.796	0.000*	2.115
Social system	0.040	0.688	0.492	1.343
Risk judgement	0.012	0.216	0.829	1.174

[a]Dependent Variable: Self-Commitment
[b]Predictors: Risk Judgment, Social System, Speak Freely, Management/coworkers support, Communication
*$p<0.05$

Regression analysis showed that the two variables related to communication (*speak freely* and *communication*) are the only two variables with statistically significant effects on *self-commitment*. The factor *speak freely* pertained to food handling employees ability to openly speak about food safety and give suggestions to improve food safety practices. For example, the need to establish an environment in which childcare food handlers feel comfortable discussing food safety issues with coworkers and the director. Griffith (2006) detailed the need for active engagement on many fronts, including two-way communication between management and employees about food safety practices.

The factor *communication* pertained to the way management (i.e. director) communicates to employees about food safety information. For example, ensuring that all necessary food safety information is given to employees as well as in a timely manner. This factor also relates to directors giving appropriate instruction as well as constancy of food safety information given. Similar to previous findings (Arendt et al., 2013), the current study shows the need for proper communication from childcare directors not just on the "how" but also the "why" childcare food handlers should follow proper food safety practices is important. Previous research identified that effective management communication was a significant overall factor contributing to the prevention of foodborne illness outbreaks (Griffith, 2010).

The influence of the director on food safety practices is important through their support in encouraging safe food handling practices and consistent communication about proper food safety practices. A cost effective approach to ensuring consistent food safety communication is through written food safety policies. Previous research has examined hygiene and sanitation practices in childcare facilities (n=51), which results showed less than half of facilities examined had written food safety policies (Wohlgenant et al., 2014). With written food safety policies consistent information is possible. Additionally, Rajagopal, Arendt, Shaw, Strohbehn, and Sauer (2016) developed and observed the use of minimal-text educational food safety posters in foodservice operations, findings identified the use of the posters had a positive impact on both microbial levels and food safety behaviors. This would suggest that the use of posters may be a good tool for increasing communication about food safety. Previous microbial analysis of childcare facilities with and without written food safety policies showed the lack of written procedures for food preparation and service areas to be a potential reason for high-microbial contamination. Findings showed the need for written policies as well as ongoing training to ensure these policies are being followed (Li et al., 2014). Food safety policies must be documented and clearly defined for new and current employees to fully understand what proper food safety practices are and why they must be followed (Yiannas, 2009). Yet, sometimes management (director) "actions speak louder than words." Directors must also remember that "leading by example" is a non-verbal form of communication. Directors can communicate proper food safety practices by performing these practices properly themselves.

Respondents were predominantly woman between the ages of 18 and 29 with less than five years childcare experience. Taylor, Adams, and Ellis (2008) identified that inexperienced childcare employees need further communication and assistance from more vested employees to assist in decision-making *for controlling enteric illness in the childcare settings.* Therefore, directors should be mindful that these less experienced employees may need additional attention and communication than more tenured employees.

The majority of childcare food handlers reported being teachers or assistant teachers. It is important to note that childcare food handling employees have many responsibilities in addition to handling food safely, primarily caring for the children and ensuring their safety. Thus, food safety practices are likely not the principal responsibility. During meal service food handling employees often have many responsibilities including serving children, educating on proper feeding cues, and encouraging appropriate eating habits (Ramsay, et al., 2010). The American Academy of Pediatrics recommends director communicate to employees the importance of prevention of foodborne illness contamination during food preparation and family-style meal service (Aronson & Shope, 2013).

Additionally, directors reported 28.2% of participating facilities did not have a designated full-time or part-time foodservice employee (i.e., cook). Thus, many facilities require childcare food handlers (teachers and assistant teachers) to have several jobs, such as preparing food and caring for children in the same day. This situation is distinctly different than commercial foodservice establishments (i.e., restaurants), in which the foodservice employees are primarily responsible for preparing the food and not serving and cleaning. Understanding this, directors should make efforts to continuously encourage food handling employees to follow safe food handling practices and communicate consistently regarding food safety practices as well as create an atmosphere where staff feel comfortable in speaking freely.

CONCLUSIONS AND APPLICATIONS

This study assessed food safety culture factors in licensed center-based childcare facilities affecting food handling employees' self-commitment. Findings showed factors related to employee's ability to speak freely about food safety practices and communication from directors to employees had an effect on employees' self-commitment to follow food safety practices. Therefore, directors should reevaluate their level of engagement about food safety practices with their food handling employees and remain consistent on food safety information communicated. Directors need to ensure employee perceive an open line of communication between employees and management. Increased communication about food safety practices has to start at the management level. Yiannas (2009) stated only management can truly influence, strengthen, or change safety culture; "they're the leaders."

Childcare directors should review these findings to help develop interventions aimed at increasing communication from all employees in childcare facilities. For example, food safety signage that communicates important food safety topics can be placed in strategic positions. Hedin, Petersson, Cars, Beckman, and Hakansson (2006) showed through the use of food safety related posters in childcare facilities communication between parents and teachers increased and food safety prevention knowledge increased. Using signage could be an inexpensive and effective way to create discussions about food safety and help to facilitate speech about food safety issues that food handling employees may have.

Another intervention approach to increase food safety communication could be having a brief meeting each day during nap hours with each room to discuss food safety topics. This time could also be used to encourage employees to speak freely about food safety concerns or areas for improvement. In turn this will potentially increase their self-commitment to perform food safety practices.

Additionally, directors should develop written food safety policies, this will help directors ensure consistent food safety information is

being distributed to all employees. It is important to note, that developing food safety policies is one form of communication that may increase employees' self-commitment and does not incur any cost to the facility. With directors communicating proper food safety practices along with coworker support and a culture of encouragement pertaining to openly speaking about food safety issues and potential improvements, employee self-commitment to following safe food handling practices can potentially be improved.

This study has some limitations. First, the sample population was contained to South Carolina and generalization of results to other states should be done with caution as regulations are different from state-to-state. Additionally, only center-based facilities were included in this study, therefore generalizations to other types of childcare setting (i.e. home based) cannot be inferred. Combining the factors environmental support and work pressure due to (multi) collinearity during regression analysis hindered the ability to interpret the nuances of these factors independently. Finally, the use of a quantitative survey based design only gathered the food safety culture and social system for one moment in time and results are not able to identify the prevailing food safety culture and social system over time. Therefore, future studies could use a qualitative approach and collect observations and interviews to further explain results of this study. Other research in the childcare setting could assess barriers and key motivators to following food safety practices, as identification of these could help directors to improve overall food safety.

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