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## Food Safety Practices: Exploratory Assessment of South Carolina Child-care Facilities Health and Safety Inspection Data

### ABSTRACT

Health and safety inspection reports of 300 South Carolina licensed center-based child-care facilities were evaluated to identify gaps in current food-handling practices by documenting the frequency of food safety violations. Based on the South Carolina child care licensing policy manual, 13 food safety violation categories were established, with each category containing individual food safety violations. Of the 300 health and safety inspection reports evaluated, a total of 453 food safety violations were identified. The majority (88.6%) of child-care facilities had fewer than three food safety violations. The frequency of food safety violations within each category ranged from 6 to 98. The three most prevalent food safety violation categories were “*lack of labeled food & beverages*” (n = 98, 21.6%), “*lack of temperature controls*” (n = 75, 16.6%), and “*improper cleaning & sanitizing*” (n = 67, 14.8%). The three least prevalent food safety violation categories were “*inadequate heating & cooling of*

*food*” (n = 6, 1.3%), “*evidence of pest infestation*” (n = 7, 1.5%), and “*lack of nutritional guidelines*” (n = 10, 2.2%). Results identified areas of food safety violations in child-care facilities that can serve to inform practitioners, educators, and researchers seeking to develop interventions that can address these gaps.

### INTRODUCTION

The Center for Disease Control and Prevention (CDC) estimates that 48 million Americans contract foodborne illnesses (FBIs) in the United States each year. In addition, 128,000 Americans are hospitalized and 3,000 more die from FBIs annually (29, 30). Five pathogens alone (*Salmonella*, *Toxoplasma gondii*, *Listeria monocytogenes*, *Campylobacter*, and *Norovirus*) are responsible for causing 90% of all identified FBIs. Although easily preventable if proper food safety habits are practiced, FBIs are very easily spread from person to person. During a ten-year, multiple-phase study conducted between 1998 and 2008, the U.S. Food and Drug Administration (FDA) observed a low level

of compliance with food safety policies within foodservice establishments (37). The three areas with the highest rates of non-compliance were holding time and temperature, personal hygiene, and cross-contamination (37). Following proper food-handling practices can reduce the level of non-compliance in all three of these.

Certain populations are more susceptible to foodborne illness than others, including the elderly, pregnant women, immunocompromised individuals, and young children (37). Research on reported foodborne illness outbreaks has shown that children under the age of five years are disproportionately affected by foodborne illness, with 69.5 infections per 100,000 children (30). Among American children under five years of age, *Norovirus* is the leading cause of medical visits for acute gastroenteritis (23), with costs of an estimated \$273 million attributable to 14,000 hospitalizations, 281,000 emergency room visits, and 627,000 outpatient visits annually. It has also been estimated that acute gastrointestinal illnesses associated with child-care facilities cost over \$2.3 billion annually (31).

This population also experiences the highest rates of laboratory-confirmed infections from eight of the ten major foodborne pathogens (24), due in part to low body mass, underdeveloped immune systems, and reduced stomach acid production. Additionally, children have a lack of control over food-handling practices (4, 6) and are more susceptible to FBIs due to additional issues specific within child-care facilities. The transmission of enteric pathogens in child-care facilities occurring from person-to-person contact due to the close interaction necessary in the care of children, particularly in diapering and toileting, is also a major factor (17).

### **Child-care organizations**

Child-care facilities generally fall under one of three nutrition policies: a) Child and Adult Care Food Program (CACFP); b) Head Start; or c) state licensing requirements only (10). The CACFP is a federally-funded state-run program that provides aid to more than 3.3 million children and 120,000 adults in care institutions and family or group child-care homes daily (7). The Head Start program, created in 1965, focuses on the health of children, and is specifically designed to serve economically disadvantaged children (15). The National Association for the Education of Young Children (NAEYC) (21), a leading organization in child care and early childhood education, recommends annual training for managers and employees based on the needs of the program and the pre-service requirements.

### **Child-care food safety**

According to the 2013 U.S. Census, over 15.6 million children under the age of five are in a regular arrangement for child care in the United States. On average, children spend 33 hours per week in a child-care facility (36). Many child-care facilities provide breakfast, lunch, and snacks.

Some have designated foodservice employees, while others utilize teachers or parents to prepare or supply the food. Each of these methods is susceptible to unsafe food handling resulting from poor personal hygiene, time-temperature abuse, improper cleaning or sanitizing, cross-contamination, and possibly other reasons. The size of the facility also impacts the frequency of infectious disease in child-care facilities (3). Therefore, ensuring the safety of food served to children in all establishments, including those that specifically cater to young children, is critical for reducing serious health consequences and associated costs (24).

Children in center-based childcare are reported to be 2.2–3.5 times more likely to get symptoms of acute gastrointestinal illness than those cared for in their own homes (18). Lee and Greig (17) conducted a systematic review of enteric outbreaks in child-care facilities between January 1996 and November 2006. For bacterial outbreaks, the modes of transmission were person-to-person (43%), food (29%), animal contact (11%), and unknown (17%). The mode of transmission was largely unknown (51%) for viral outbreaks. The most frequently identified effective management practices included management of symptomatic cases (35 practices), enhanced hand hygiene (24), safe food-handling practices (19), and enhanced environmental cleaning (17).

### **Food safety inspections in child-care facilities**

In the United States, food safety is a responsibility shared among the federal, state, and local levels of government. The role of the health inspector is also essential in protecting the public through the identification of improper food-handling practices. Powell et al. (26) reviewed three types of inspections: self-inspections (internal review of food safety practices and policies), second-party inspections (used by a downstream company on a supplier to ensure food safety practices are being followed), and third-party inspections (performed by an external organization to verify food safety practices and policies are being followed by the organization). Results showed all three types of inspections are useful only if results are reviewed by the organization and corrections are implemented. Yiannas (40) emphasized the use of inspections as part of a multi-factorial food safety approach to help understand and identify gaps in food safety practices.

Previous research has shown that a lack of consistency between health inspectors was a problem in food safety assessment (25). The inconsistency in interpretation of food code regulations at the state and local levels furthers this issue. Communication has been shown to be a key issue during food safety inspections between the inspector and facility manager (25). Pham et al. (25) explored key food safety issues and pathogens of concern to health inspectors through focus groups. Five themes emerged from the discussions: time-temperature abuse, inadequate

handwashing, cross-contamination, the lack of food safety knowledge by food handlers and foodservice managers, and the lack of food safety information and knowledge about specialty foods (i.e., foods of different cultures).

Unlike restaurants, licensed center-based child-care facilities are not inspected for food safety alone (19). Child-care facilities have one general health and safety inspection yearly, with food safety being only part of this inspection. To be in compliance with U.S. Food and Drug Administration (FDA) and state and local standards, child-care facilities must conform to the applicable portions of the FDA 2013 Food Code for food safety and sanitation standards (38) as well as all applicable state and local foodservice regulations regarding safe food protection and sanitation practices.

The first step to improving an organization's food safety culture is to identify gaps in current food-handling practices (40). Research has shown that restaurant inspection reports are a key source of information for the general public to evaluate the safety of food in restaurants (8). Kwon et al. (16) demonstrated the need for evaluating health and safety inspection reports in the restaurant setting to identify gaps in food safety practices. However, little research has evaluated health inspections in the child-care setting (9) and none have evaluated food safety practices through review of child-care health and safety inspection reports.

The purpose of this study was to evaluate child-care health and safety inspection reports to identify gaps in current food-handling practices, specifically, the frequency of food safety violations in South Carolina licensed center-based child-care facilities.

## **MATERIALS AND METHODS**

### **Study sample**

The sample was drawn from the list of licensed center-based child-care facilities in the ten most populated South Carolina counties that were subject to the South Carolina Department of Social Services (SCDSS) health and safety inspections. In South Carolina, SCDSS (33) oversees child-care facilities and conducts health and safety inspections. Child-care health and safety inspection reports, which are publicly accessible, were collected from the SCDSS regional manager.

From the list of all child-care facilities ( $n = 831$ ) within the ten counties, all registered faith-based (i.e., religious organization), family home, and exempt (i.e., operated only less than 4 hours per day or on school holidays, or with no licensing or inspections required by law) facilities were eliminated. These types of child-care facilities are not required to follow the same inspection regulations that licensed center-based facilities (i.e., commercial, church, and preschools) follow. Of the 547 remaining child-care facilities, 300 licensed center-based (i.e., commercial, church, and preschools) facilities were randomly selected as the study sample. Random selection was conducted by selecting every

third facility from the list of 547 remaining facilities until 300 were chosen.

Approval from the Institutional Review Board was not needed, as no data were collected from human subjects; only secondary data were utilized.

### **Variables**

A data collection form was created using Microsoft Excel, and each food code violation received a coding number to ensure consistency in collecting all the necessary data on facility demographics, DSS inspector information, dates of inspections (day, month, and year), and food safety violations.

Child-care facility child maximum capacity information was collected from the SCDSS child care health and safety reports database. The child maximum capacity data for each facility (e.g., 127 children) was then transformed into increments of 50 (i.e., 0–50, 51–100 etc.) for ease of analysis. Additionally, child-care facility operational type was identified as either independently owned/operated or chain/franchise from the SCDSS child-care health and safety reports database.

To identify categories for the food safety violations, the SCDSS child-care licensing policy manual (33) was accessed. Based on this manual, 13 food safety violation categories were established: "Nutritional Guidelines," "Hand Hygiene," "Personal Hygiene," "Heating & Cooling Food," "Temperature Controls," "Food Service," "Labeled Food & Beverages," "Food & Beverage Storage," "Chemical Storage," "Cleaning & Sanitizing," "Evidence of Pest Infestation," "Expired Food & Beverages," and "Waste Storage." Each of the 13 food safety violation categories contained individual violations; for example, the category "Hand Hygiene" contained individual items such as (a) adequate hand-washing facilities, (b) hot water temperature, (c) provision of sanitary soap and towels, (d) use of utensils to minimize bare hand contact with food, (e) requirement that staff thoroughly wash their hands and exposed areas of the arm with soap and water when necessary, and (f) requirement that staff keep fingernails clean and trimmed.

To identify each licensed child-care facility's accreditation (i.e., NAEYC, Head Start, CACFP, or none) several databases were used: the NAEYC accreditation website (22), the Head Start Locator website (14), and the Child and Adult Care Food Program South Carolina database (file sent via e-mail by Director of CACFP, on April 10, 2016). Facility characteristics are shown in *Table 1*.

### **Data collection**

For each of the 300 licensed center-based child-care facilities, the inspection with the greatest number of food safety violations between January of 2013 and December of 2015 was collected from the SCDSS child-care health and safety inspections database (file sent via e-mail by SCDSS Regional Manager, on April 4, 2016). Following

**TABLE 1. Characteristics of licensed center-based child-care facilities (n = 300)**

Characteristic	n (%)
<b>Organizational Accreditation</b>	
NAEYC	12 (4)
CACFP	84 (28)
Head Start	31 (10.3)
No affiliation	173 (57.7)
<b>Facility Child Capacity</b>	
Less than 50	38 (12.7)
51–100	85 (28.3)
101–150	71 (23.7)
151–200	49 (16.3)
201 or more	57 (19)
<b>Facility Operational Type</b>	
Independently Owned/Operated	261 (87)
Chain/Franchise	39 (13)

the procedure established by Kwon et al. (16), for each facility, the inspection with the most violations was selected, as follow-up inspections usually appear better than the preliminary inspection and do not fully reflect all possible food safety violations. The researcher reviewed the SCDSS child-care health and safety inspection database and completed the data collection form for all randomly-selected facilities, inputting the data into the Excel spreadsheet. The completed information was then cross-checked by another researcher for accuracy.

#### Data analyses

The data was then transferred to SPSS Version 23.0 for analysis. Descriptive statistics, consisting of frequencies, cross-tabulations, and percentages of continuous variables (i.e., number of food safety violations), were calculated. Frequency of organizational characteristics was also quantified.

## RESULTS AND DISCUSSION

For all the licensed center-based facilities health and safety inspection reports (n = 300), organizational accreditations, facility child capacity, and facility operation type were reported.

#### Number of food safety violations per category

The frequency of food safety violations per category are shown in *Table 2*. A total of 453 food safety violations were identified. The three most prevalent food safety violation categories were lack of “*Labeled Food & Beverages*” (n = 98,

21.6%), lack of “*Temperature Controls*” (n = 75, 16.6%), and improper “*Cleaning & Sanitizing*” (n = 67, 14.8%). In contrast, the three least prevalent food safety violation categories were “*Heating & Cooling Food*” (n = 6, 1.3%), “*Evidence of Pest Infestation*” (n = 7, 1.5%), and “*Nutritional Guidelines*” (n = 10, 2.2%).

The frequencies of food safety violations as related to child-care accreditation are reported in *Table 3*. Overall, the child-care facilities accredited by NAEYC (n = 12), Head Start (n = 31), and CACFP (n = 84) had 19, 25, and 140 food safety violations, respectively. Furthermore, 40.6% of all food safety violations identified in this study were associated with child-care facilities accredited by NAEYC (4.2%), Head Start (5.5%) or CACFP (30.9%), while the remaining 59.4% of food safety violations identified were associated with non-accredited facilities.

The frequency of food safety violations per inspection are reported in *Table 4*. Head Start programs had the highest number of child-care facilities with no food safety violations (n = 16), while both NAEYC and CACFP child-care programs had at least one food safety violation per inspection. Furthermore, Head Start and NAEYC programs did not have any inspections with more than three violations. Overall, the majority of child-care facilities (n = 214) had only one food safety violation per inspection.

The purpose of this study was to evaluate child-care health and safety inspection reports in order to identify gaps in current food-handling practices. More specifically, the purpose was to discover the frequency of food safety



**TABLE 2. Frequency of food safety violations per category (n = 453)**

Food Safety Violation Category	n (%)
Labeled Food & Beverages	98 (21.6)
Temperature Controls	75 (16.6)
Cleaning & Sanitizing	67 (14.8)
Food & Beverage Storage	41 (9.1)
Chemical Storage	32 (7.1)
Waste Storage	30 (6.6)
Hand Hygiene	27 (6)
Expired Food & Beverages	27 (6)
Food Service	20 (4.4)
Personal Hygiene	13 (2.9)
Nutritional Guidelines	10 (2.2)
Infestation	7 (1.5)
Heating & Cooling Food	6 (1.3)

**TABLE 3. Frequency of food safety violations and child-care facility accreditation**

Food Safety Violation Category	NAEYC (n = 12) n (%) <sup>a</sup>	Head Start (n = 31) n (%) <sup>a</sup>	CACFP (n = 84) n (%) <sup>a</sup>	No Accreditation (n = 173) n (%) <sup>a</sup>
Labeled Food & Beverages	7 (7.1)	4 (4.1)	32 (32.7)	55 (56.1)
Temperature Controls	3 (4)	2 (2.7)	15 (20)	55 (73.3)
Cleaning & Sanitizing	1 (1.5)	9 (13.4)	23 (34.3)	34 (50.8)
Food & Beverage Storage	1 (2.4)	1 (2.4)	15 (36.6)	24 (58.6)
Chemical Storage	2 (6.3)	6 (18.7)	10 (31.2)	14 (43.8)
Waste Storage	0 (0)	0 (0)	7 (23.3)	23 (76.7)
Hand Hygiene	1 (3.7)	1 (3.7)	8 (29.6)	17 (63)
Expired Food & Beverages	0 (0)	0 (0)	10 (37)	17 (63)
Food Service	1 (5)	1 (5)	5 (25)	13 (65)
Personal Hygiene	2 (15.4)	1 (7.7)	7 (53.8)	3 (23.1)
Nutritional Guidelines	1 (10)	0 (0)	4 (40)	5 (50)
Infestation	0 (0)	0 (0)	2 (28.6)	5 (71.4)
Heating & Cooling Food	0 (0)	0 (0)	2 (33.3)	4 (66.7)

Note: <sup>a</sup>Child-care accreditation food safety violation number divided by overall food safety violations per category

violations in licensed child-care facilities. Although these inspections were only a snapshot of current food-handling practices, the health and safety reports helped identify food-handling practices that were lacking or improper. Findings revealed that the majority (88.6%) of child-care

facilities had fewer than three food safety violations on the health and safety inspection report examined in this study. However, this study identified a need for training in specific food safety categories to reduce the incidence of food safety violations.

**TABLE 4. Frequency of food safety violations per inspection**

Frequency of Food Safety Violations	NAEYC (n = 12)	Head Start (n = 31)	CACFP (n = 84)	No Affiliation (n = 173)
0 per inspection	0	16	0	2
1 per inspection	6	7	47	100
2 per inspection	5	6	23	54
3 per inspection	1	2	10	10
4 per inspection	0	0	3	4
5 or more per inspection	0	0	1	3

The three most prevalent food safety violations found in this study have been identified as being among the top five factors contributing to a foodborne illness outbreak as well as being preventable by employees if proper food safety practices are followed (37). The most cited food safety violation category was “*Labeled Food & Beverages*,” at 21.6% of all violations. This result is in contrast to findings of a study by Kwon et al. (16), who reviewed Kansas’s restaurant health inspection scores and found food labeling to be an infrequently cited violation. This category consisted of two major violations: lack of labeled (i.e., product name and date) food and beverages prepared at the facility and lack of labeling (i.e., child’s name and date) on food and beverages sent by parents. In a previous child-care study (39) 20 of 27 (74.1%) center-based child-care facilities reported serving food sent by parents. Therefore, it is important to note that child-care employees have little control over the labeling of foods and beverages brought from home. Yet, the need for labeling of children’s bottles and cups is necessary, as the potential for cross-contamination of breast milk and other liquids is high. In a recent study of Connecticut child care health and safety reports, Crowley et al. (9) found unlabeled bottles brought by parents were cited on 41 reports.

The second most cited food safety violation, “*Temperature Controls*,” at 16.6% of all violations, was identified by the CDC (5) as one of the most common risk factors of foodborne illness outbreaks. Kwon et al. (16) found similar results in the restaurant setting, with nearly 40% of the sample restaurants being cited for violating time and temperature control of potentially hazardous foods. The temperature controls category consisted of two major violations: lack of thermometer in refrigerator/freezer, and temperature of refrigerator/freezer at unacceptably high temperature. Moreover, the FDA (37) found that time and temperature abuse is a leading factor in non-compliance of food-handling practices and among the top 5 contributors to FBI.

In a recent study, Wohlgenant et al. (39) examined the hygiene and sanitation practices of child care employees. Findings were consistent with results from the current

study, in which a lack of food thermometers was noted. Furthermore, Fan (12) measured food safety knowledge and observed food-handling behaviors of child-care facility foodservice employees and teachers and found gaps between food safety knowledge and actual food-handling behaviors, specifically in handwashing and time and temperature control. Furthermore, a study (1) measuring temperature of foods in children’s sack lunches shortly before consumption at child-care centers found fewer than 12% (n = 83) of lunches were stored in refrigerators, while the remainder (n = 622) were stored at ambient classroom temperature. In addition, only four (0.9%) of the 458 items in 83 sack lunches located in refrigerators were in an acceptable temperature range.

The third most cited food safety violation was “*Cleaning & Sanitizing*,” at 14.8% of all violations. This category ranged from cleaning and sanitizing equipment in the kitchen to properly cleaning the table and chairs in the classrooms where children eat. The high frequency of improper cleaning & sanitizing is cause for alarm; the American Academy of Pediatrics (AAP) notes the close proximity of children in child-care facilities and their natural curiosity to touch a wide range of objects and surfaces heightens their risk of infection (2). In a recent study, Fraser et al. (13) used observations to identify frequency of surfaces touched by child-care providers and found that the two most frequently touched surfaces were children’s clothes and food contact surfaces. Pathogen spread is common in child-care facilities; therefore, it is recommended that training be targeted to education on proper cleaning and sanitizing practices and that written policies be available on when and how to clean all types of surfaces.

Wohlgenant et al. (39) pointed out that improved written policies for food preparation and increased education for employees, focusing on gaps identified, could potentially prevent the spread of foodborne illness to children. Once an establishment has assessed current food safety practices, gaps can be identified and tailored interventions can be implemented (27). A recent study assessed the influence of theoretical and practical food safety training based on

the microbiological counts on food contact surfaces and hand-washing practices. Results showed that the success in microbiological reduction could be attributed to the tailored practical approach of the training program, which did not focus on just theoretical concepts (32). Furthermore, a manager's perceived lack of tailored food safety training as well as the inadequacy of the one-size-fits-all approach was a leading negative factor on a manager's influence on employee motivation to follow food safety practices (28).

The three least cited food safety violation categories were "Heating & Cooling Food" (2.2%), "Evidence of Pest Infestation" (1.5%), and "Nutritional Guidelines" (1.3%). Kwon et al. (16) obtained similar results in the restaurant setting pertaining to low frequency of heating and cooling food violations. This could potentially be contributed to health and safety inspections being conducted when little food is being reheated or cooled, as inspections are only a snapshot in time. For example, the average child care health and safety inspection is two hours for an unannounced inspection and three hours for a license renewal visit (33). Interesting to note is the low frequency of personal hygiene violations (2.9%), which include coming to work sick and not wearing a hairnet while handling food. These findings are in stark contrast to those of previous research, which found that the majority of child-care facilities were not in compliance with requirements that food handlers wear effective hair restraints and use gloves properly (11, 39).

The low number of NAEYC accredited child-care facilities ( $n = 12$ ) in the current study is similar to results of other studies, in which only 37 of 118 child-care facilities were NAEYC accredited (11). This is important to note, as NAEYC has stringent training requirements for child-care employees to increase knowledge and increase adherence to proper practices in the areas of nutrition and safety. NAEYC recommends training in the following areas: health and safety; poison prevention and poison safety; child growth and development, including motor development and appropriate physical activity; nutrition and feeding of children; planning learning activities for all children; guidance and discipline techniques; linkages with community services; communication and relations with families; detection and reporting of child abuse and neglect; advocacy for early childhood programs; and professional issues (20). Additionally, Head Start facilities have similar supplementary requirements for training of child-care employees. This may partially explain why facilities with these two child-care accreditations had low frequencies of food safety violations, with no facilities having more than three food safety violations per inspection. Therefore, ongoing training is important to facilitate health and safety in the child-care setting. For example, researchers found a positive association between staff continuing education and compliance with health and safety regulations in the child care setting (9). However, the lower number of facilities per

group (NAEYC and Head Start) may also partially explain why facilities with these two child-care accreditations had low frequencies of food safety violations.

Yiannas (40) argued that, historically, foodservice organizations use training programs and inspections as food safety culture indicators for prevention of FBI outbreaks. As previously reviewed, training and knowledge assessment alone is not enough to fully understand or change food safety behaviors, just as inspections alone are not sufficient to ensure food safety (26). The reinforcement of knowledge is one factor that can help to cause positive changes in behavior. Assessing food safety cultural factors that influence organizational norms may help to identify best practices in child-care settings so as to establish a positive food safety culture.

Because organizational factors influence employee behavior (40), facilitators should specifically investigate the culture of food safety within their child-care facilities. For example, Thogaru (34) developed a questionnaire that assessed food safety culture and identified areas that needed to be improved within the culture. Similarly, hospital and school foodservice employees identified six relevant factors of food safety culture: management and co-worker support, communication, self-commitment, environmental support, work pressure, and risk judgment (35). Four major components that strongly impacted the food safety culture were identified as commitment, control (leadership), communication, and competence. A comparison between restaurant inspection scores and food safety questionnaire scores revealed that restaurants with the highest scores on the questionnaire also had the highest inspection scores and the fewest food safety violations.

## CONCLUSIONS

This study is not without its limitations. Results of this study are specific to licensed center-based child-care facilities in 10 South Carolina counties. As each state has its own regulations for child-care facilities, generalizing of the results to other states must be done with caution. Additionally, the findings are limited to licensed center-based facilities, and therefore generalization to other types of child-care facilities, such as faith-based or family home types, also must be done cautiously.

The results of this study have important implications for policymakers as well as parents. The findings should be used by child care facility directors for the purpose of identifying potential gaps in food-handling practices within their facility. They could also assist child-care directors and practitioners to develop educational interventions to close those gaps in food safety.

Although this study identified the frequency of food safety violations within child-care facilities, the need for further research on proper food safety handling practices within the child-care setting is imperative because of

the high-risk population these facilities serve. Future research should address both motivators and barriers to following recommended food-handling procedures in child-care facilities. Focusing on both barriers

and motivators will provide valuable insight to those educating their employees and will enhance the learning experience and comprehension of safe food-handling practices for employees.

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## ***Join Us for a PDG Organizational Meeting at IAFP 2017***

### **Food Safety Culture Professional Development Group**

**Sunday, July 9, 1:00 p.m. – 3:00 p.m.**

This PDG is intended to address the advancement and evolution of this emerging subfield of food safety.



For a complete committee meeting schedule, visit our Web site at [www.foodprotection.org](http://www.foodprotection.org).