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# An assessment of food safety knowledge and practices of catering employees

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## Abstract

**Purpose** – The purpose of this paper is to analyze the food safety knowledge and practices of catering employees in one city in the Southwestern United States.

**Design/methodology/approach** – The researchers administered a 20-question food safety survey to catering employees and observed their actions while performing catering duties.

**Findings** – The paper finds that employees earned a mean score of 71.5 per cent on the 20-question survey. They were most knowledgeable about personal hygiene, but did not practise proper hygiene during the catering functions. The most common food safety violations were not wearing gloves when required, not washing hands, not checking food temperatures, and not properly covering foods in warming and/or refrigeration units.

**Research limitations/implications** – Lack of interest and concern about bad publicity prevented many caterers from participating in the study. The presence of observers during a catering event could have affected employees' performance.

**Practical implications** – The results showed need for improvement in both knowledge and practice of food safety and sanitation and significant differences in knowledge between English- and Spanish-speaking respondents and employees of independent versus corporate operations.

**Originality/value** – The paper reveals that the US Food and Drug Administration has a goal of reducing the five risk factors of food-borne illness by 25 percent by 2010. Catering operations face great challenges in minimizing these risks.

**Keywords** Food safety, Catering industry, Training, United States of America

**Paper type** Research paper

## Background

Approximately 76 million people in the USA contract diseases from food each year. Over 79 percent of these illnesses originate from food consumed in commercial and institutional foodservice establishments (Center for Disease Control, 1999). Research on foodborne illness risk factors indicates that most outbreaks associated with food service establishments can be attributed to food workers' improper food preparation practices (Bryan, 1988). More recent data show declines in the incidence of foodborne infections caused by organisms such as *Listeria*, *Salmonella*, and *Escherichia Coli* 0157. However, the Center for Disease Control (2005) notes that "further efforts are needed to sustain these declines and to improve prevention of food infections" (p. 1).

US Food and Drug Administration (2000) found that the majority of foodborne illnesses can be attributed to five risk factors: food from unsafe sources, inadequate cooking, improper holding temperatures, contaminated equipment, and poor personal



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hygiene. Over 40 percent of 17,400 institutional and commercial foodservice businesses studied were out of compliance with the Model Food Code on such basic standards as cold holding of potentially hazardous food (PHF) and ready-to-eat (RTE) foods at 41°F (5°C), date marking PHF and RTE foods, sanitizing surfaces and utensils, and proper, adequate handwashing. The committee established a goal of reducing these risk factors by 25 percent by 2010 (US Food and Drug Administration, 2000). To achieve this decrease, it is imperative that foodservice operators know the standards, teach them to their employees, provide the resources and materials that employees need to perform their jobs properly, and continually monitor compliance with the standards.

US Census Bureau (1997) defines caterers as businesses that are “engaged in providing single event-based food services” including banquet halls and operations that transport food and/or prepare food at an off-premise site. The National Restaurant Association’s Restaurant Industry Forecast calls these businesses “social caterers” and predicts that revenues for this foodservice category in the USA will reach \$5.7 billion in 2006 (National Restaurant Association, 2006, p. 10). However, that figure does not include sales for the banquet operations of hotels and restaurants, which also engage in catering through their banquet functions. For the remainder of this paper, the term “caterer” will be used generically to include any business providing single-event foodservice, whether an independent operator or a corporate restaurant, hotel or casino.

The most recent US statistics on the type of establishment involved in foodborne illness outbreaks are from 1997 and do not list caterers as a separate category (Center for Disease Control, 1999). However, due to their style of food production and service, caterers face many challenges in controlling the risk factors of foodborne illness. The dangers multiply for operators performing off-premise catering. Some chefs refer to off-premise catering as “combat cooking” indicating the difficulties of maintaining sanitation standards when basic factors such as on-site availability of electricity, refrigeration, and potable water are not under their control. Special precautions must be taken when wrapping, labeling, cooling, storing, and reheating product to compensate for the difficulties in transporting product and serving it in an unfamiliar location (Hume, 2001).

Sanitation concerns are not limited to caterers operating in the USA. As of 1993, the European Union’s Directives on Food Hygiene established general hygiene principles applicable throughout the food chain. The UK expanded these principles in its Industry Guide, which establishes specific instruction/training levels for different categories of food handlers (Worsfold, 1996). However, training does not guarantee good practices. In 2002, the UK’s Food Standards Agency found that 39 percent of 539 managers and 477 staff of catering companies in Great Britain and Northern Ireland did not wash their hands after visiting the lavatory and 53 percent did not wash their hands before preparing food. While 64 percent of the managers had a general understanding that employees should wash their hands, “only 5 percent of catering workers and managers made the link between washing hands and personal hygiene or recognized it as something specific to take care of in the workplace” (Food Standards Agency, 2002).

In the USA, lack of food safety training may be a significant contributor to the prevalence of the risk factors of foodborne illness. The USA does not have national standards for food safety training or certification of foodservice managers; regulations vary on a state-to-state basis. Almanza and Nesmith (2004) found that only 17 of 50

states require mandatory food safety manager certification in their state food codes. Again, the impact of this training is questionable. Ravel-Nelson and Smith (1999) found that employees certified in food safety in Philadelphia had greater food safety knowledge than non-certified employees. However, Fransh *et al.* (2006) found that the presence of certified managers did not increase health inspection scores and one Florida study found that after training the incidence of many factors that contribute to foodborne outbreaks actually increased (Hammond *et al.*, 2005).

The National Restaurant Association Educational Foundation (NRAEF) sponsors the country's most prominent food safety training program – ServSafe. To receive certification, which is valid for five years, a 90-question exam must be passed with a score of 75 percent or higher. Over a million people currently hold certification. The NRAEF does not calculate statistics of the number of certifications by type of foodservice establishment or job category (Kate Piche, 2002, personal communication). Therefore, it is not possible to determine how many catering establishments have ServSafe certified employees.

A positive indicator that future foodservice workers and managers have received training is that 45 percent of hospitality faculty surveyed reported that food safety certification was required for graduation (Scheule, 2000, p. 923). Hertzman (2007) found that 93.1 percent of associate degree culinary arts programs in the USA required a course in foodservice sanitation and safety.

Local regulations for the location of this study, Las Vegas, Nevada require that all food handlers possess a health card prior to employment. However, to obtain the card workers only have to receive a Hepatitis A shot and watch a one-hour food safety movie. They do not undergo more extensive training or testing (Southern Nevada Health District, 2005).

Due to fluctuations in business volume, many caterers rely on part-time, temporary, or contract employees. In general, companies invest little effort in training or providing guidance and support to temporary employees (Cregar, 1989; Nickle, 1989). These part-time workers have also been found (De Gilder, 2003) to lack commitment to the organization and displayed less favorable behaviors than full-time employees. Due to high turnover among these employees, many companies consider them less valuable and not worth the investment in training (Foote, 2004). These factors contribute to the lack of food safety knowledge and skills needed for catering employees.

### **Purpose of the study**

Caterers can experience great difficulties adhering to proper food safety procedures, in part due to the nature of their business and the use of large numbers of part-time and temporary employees. The problems can be exacerbated by lack of training and extensive certification requirements. This study sought to evaluate potential food safety problems among caterers in one Southwestern city in the USA. The specific research objectives of this study were to identify specific deficits in food safety knowledge and practices of catering employees. The results were used to develop educational materials for these employees, including training plans, instructional materials, and short surveys, which will be available in print as well as via a web-based system to increase availability and access by caterers.

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## Methodology

### *Overview*

The researchers attended catering events, distributed food safety surveys (in English and Spanish), and observed sanitation practices using the instruments described below. The researchers considered observations necessary to determine whether food handlers actually followed the proper practices. Previous research (Howes *et al.*, 1996; Manning and Snider, 1993; Oteri and Ekanem, 1989 as cited in Clayton and Griffith (2004)) has shown that self-reported information about following proper food safety practices is often inaccurate.

### *Population and participant contacts*

The population for this study was all social caterers and restaurants, hotels, and casinos with catering services in the Las Vegas, Nevada metropolitan area. The study was designed to use simple random sampling. A list of potential participants was assembled from the local telephone book, including the names of independent caterers and restaurants and hotels with banquet departments, and the membership roster of the local chapter of the National Association of Catering Executives (NACE). However, it quickly became apparent that “cold calls” to these establishments would not yield people willing to participate in the study. Although researchers assured caterers that the information collected would only be used in the aggregate and that none of their names or companies would be reported in any study or report, many caterers still refused to participate in the study. They may have been fearful of the lack of knowledge or skills of their employees or of the lack of safety and sanitation operating procedures being used.

Therefore, the researchers reluctantly relied on a convenience sample of caterers with whom they had personal contacts. They also incorporated elements of snowball sampling as participants offered the names of other caterers they felt might be willing to participate. The goal was to recruit an equal number of independently-owned and corporate-owned businesses.

All materials for the project were approved by the University of Nevada Las Vegas (UNLV) Institutional Review Board. In accordance with its standards, all participating companies signed an agreement that they would be willing to let the investigators administer a food safety survey to their employees and observe them while performing catering duties. The researchers ensured potential participants that all results would be strictly confidential, the names of the companies and the staff would not be published in any way, and that no information would be shared with the local health department. Despite these reassurances, the majority of companies contacted declined to participate in the study.

The investigators used telephone calls, e-mail, and personal visits to contact the owner or manager who could give authorization for participation. Often, it would take over ten contacts to receive a commitment of participation and to schedule specific dates for observations. Many participating companies also sought permission from the event client/host before agreeing to allow observations of specific functions.

### *Instruments*

The food safety survey consisted of 20 multiple-choice questions testing employees' food safety knowledge. There were five questions in each of the following four areas:

personal hygiene, cooking foods, holding foods, and equipment. To ensure the validity of the questions, the survey consisted of questions adapted from the NRA's ServSafe Coursebook Instructor's Guide.

Two separate worksheets were used for the event observations. To ensure validity of the observation sheets, five food safety instructors at UNLV reviewed the documents. The Event Site Observation Sheet asked 20 questions concerning the set-up of the event site. In total, 16 required yes/no answers while four asked the observer to circle an answer. Sample questions included: did the manager discuss sanitation issues with their employees at the pre-shift meeting, did the caterer provide the appropriate sanitizers, and were a three-compartment sink, hand-washing sink, and potable water available on the premises? The sheet contained additional questions for buffets and off-premise functions, such as: did the caterer have chafing dishes to keep the food warm, did the buffet have the proper serving utensils, did the caterer use a truck to transport food and equipment, and where was the food for the function cooked? The observers were also asked to list the preparation and holding equipment available and the menu for the event.

The second worksheet, the Occurrence of Violations Observation Worksheet, contained check off boxes for the number of violations in 42 different areas divided into the same four categories as the food safety survey: personal hygiene, cooking foods, holding foods, and equipment. The researchers chose to use a traditional checklist approach for determining the performance of catering employees, even though other researchers (Clayton and Griffith, 2004) used the more sophisticated method of notational analysis. However, Clayton and Griffith (2004) found that their technique did not offer an advantage over a traditional checklist approach in any category except in cross-contamination.

Under personal hygiene, potential violations included employees not washing hands before work or after returning from breaks, improper uniform or hair restraints, and eating or drinking in food preparation or service areas. Potential violations under the other areas included not checking temperatures before serving food, storing hot or cold food improperly, using incorrect cooking or service equipment, and not properly cleaning and sanitizing equipment. In addition, a miscellaneous category allowed the opportunity to record incidents of cross-contamination and other violations not specifically listed on the worksheet.

Effective observational research depends on using qualified observers, training on the procedures for completing forms, and ensuring the reliability of the documents. In addition to the two principle investigators (PIs), four graduate and five undergraduate UNLV students assisted with the project. All were personally selected by the PIs based on their high grade point average, industry experience, professionalism, and interest in food safety. All had scored 90 per cent or above on the NRA ServSafe exam, qualifying them to be registered instructors for the certification course. The students participated in the development of the two worksheets and in training sessions on the definition of all terms used and types of violations. All performed three pilot observations at functions catered by the UNLV food and beverage management department. Although statistical reliability tests were not conducted, these pilot observations allowed the researchers to identify potential worksheet completion problems and to conduct further training so that the checklists would be consistent regardless of the observer completing them.

*At the events*

The type of activities observed included kitchen preparation prior to an event, kitchen preparation at the event, set-up and breakdown of the dining areas, and service to the guests. The researchers studied events conducted at the actual restaurant, hotel, or main catering facility (on-premise) and events held at remote locations (off-premise). The number of observers at each event varied according to the amount of activities being conducted and the size of the event. A PI was present and considered an observer at all events. For other events, one to three student completed observations along with one PI. Table I illustrates the number of observers per event.

When the observer(s) arrived, they checked in with the event supervisor. They asked permission to administer the food safety survey to the employees immediately. In total, 80 percent of employees completed the survey prior to the beginning of the observation. Another 10 percent were too busy at that point, but took the survey during a break period. A total of 10 percent were either unwilling to complete the survey or when multiple events from a single caterer were observed, the employees had completed the survey previously and were ineligible to fill it out a second time.

The Hawthorne Effect, where just the presence of observers affects the observees' performance, is a significant concern with any type of observational research (Clayton and Griffith, 2004). To avoid this, the observers wore appropriate professional clothing to look like employees – chef's jacket and pants for kitchen observations, suit or white service shirt and black pants for dining room observations, or polo shirt and black pants for more casual outside events. The observers tried to be as unobtrusive as possible and ensured they did not interfere with the employees' ability to accomplish their tasks. Unfortunately, this blending-in technique frequently resulted in the observers being asked by event guests to provide service to them at which point a catering employee was summoned to perform the requested service by the guest.

**Results**

*Characteristics of the sample*

The researchers and their staff of students distributed food safety surveys at and observed 23 catering events. The events ranged in size from 30 guests to 700 guests, with between one and 18 employees at each event. An event was considered on-premise if the food was prepared and served at the same facility. If the food was prepared at one facility and served at a different facility, the event was described as off-premise. Employers that were considered corporate included hotels, restaurants and institutional companies (i.e. ARAMARK). Employers that were considered independent included local catering companies that did not serve daily to the public.

Type of event	Number of guests	Areas of observation	Number of observers
Pre-event food preparation	30-100	Kitchen	1 PI
Plated meal		Kitchen, dining area	1 PI
Reception or buffet		Buffet, dining area	1 PI
Plated meal	101-500	Kitchen, dining area	1 PI, one student
Reception or buffet		Kitchen, buffet, dining area	1 PI, two students
Plated meal	501-700	Kitchen, dining area	1 PI, two students
Reception or buffet		Kitchen, buffet, dining area	1 PI, three students

**Table I.**  
Number of observers per  
event

These independent caterers had their own kitchens and some had dining room facilities but they were only used when the caterer had a scheduled one-time event. The breakdown by type of event and operation is seen in Table II.

*Survey results*

The researchers distributed the survey to all front- and back-of-the-house employees. They collected 84 surveys and of those 81 were considered usable. The average score for all respondents was 71.48 percent. However, of the usable surveys, 30.8 percent of the respondents scored below 70 percent. There were eight questions (40 percent of the total) on which less than 68 percent of the 81 respondents answered correctly (see Table III). Three of these eight questions concerned adequate cooking temperature, two concerned proper equipment use and maintenance, two concerned proper holding temperatures and one discussed personal hygiene.

The researchers distributed surveys in both English and Spanish and the difference in the average scores among respondents is shown in Table IV. To determine if this observed difference was significant, a *t*-test for equality of means was conducted using SPSS software and the difference in scores was deemed significant at an alpha level of 0.01 ( $p = 0.003$ ).

**Table II.**  
Types of catering events

Type of event	Corporate	Type of operation Independent	Total
Off-premise	4	8	12
On-premise	9	2	11
Total	13	10	23

**Table III.**  
Percent of respondents  
correctly answering each  
survey question

Question no.	Percent correct (%)	Category
20	98.77	Equipment
6	98.77	Holding
7	98.77	Personal hygiene
3	96.30	Personal hygiene
14	95.06	Cooking
4	93.83	Personal hygiene
8	93.83	Personal hygiene
2	88.89	Equipment
15	82.72	Holding
13	77.78	Holding
5	76.54	Equipment
1	72.84	Cooking
19	67.90	Cooking
11	67.90	Cooking
9	65.43	Equipment
12	55.56	Holding
16	53.09	Personal hygiene
10	33.33	Cooking
17	6.17	Holding
18	6.17	Equipment

The researchers evaluated the difference in scores based on whether the event was on- or off-premise and whether the organization at which the respondent was employed was corporate or independent. There was an observed difference between the scores earned by employees based on both type of event and type of organization. *T*-tests for equality of means were conducted to determine whether these observed differences were significant. For type of event, the *p*-value returned was 0.4692. Therefore, the difference of whether the event was on- or off- premise was not deemed statistically significant. However, at an alpha level of 0.05 ( $p = 0.009$ ), there was a significant difference based on type of operation with employees of independent operations scoring higher than those of independent operations. Table V shows the scores based on these factors.

**Event evaluations**

The Event Site Observation Sheet evaluated the setup and overall food safety preparation of the event. Of the 23 events observed, only three events had pre-shift meetings and of those, at only two were sanitation issues discussed during the meeting. Only nine events, three off-premise and six on-premise, had a first aid kit on-hand at the event. The remaining 14 functions did not have a first-aid kit on-hand in case of an emergency. Also noteworthy was the fact that only 15 functions used sanitizing solution; of those ten were on-premise functions and five were off-premise. At the remaining seven functions, no sanitizing solution was available for use during the event.

All of the events had a potable water source available and at all of the on-premise functions there was both a three-compartment and hand-washing sink. However, of the 12 off-premise functions, only five had a three-compartment sink and only eight had a hand-washing sink available at the site of the function. All 23 functions used various types of hot and cold holding equipment. However, this equipment was properly pre-heated or pre-cooled at only 25 percent of the events. In addition, at 50 percent of those functions using chafing dish burners and ice baths for cold holding on buffets, the chafing dish burners were not operating properly throughout the entire function and the ice baths were not refilled as the ice melted.

Language version	Mean (%)	Standard deviation (%)	Number of respondents
English	73.3	11.7	67
Spanish	62.9	11.4	14
Total	71.5	12.2	81

**Table IV.**  
Mean respondent score  
by language

Mean (SD) count Type of operation	Type of event		Total
	Off-premise	On-premise	
Corporate (%)	68.3 (14.4)	70.2 (11.3)	69.6 (12.3)
Independent (%)	78.9 (10.2)	75.0 (9.1)	78.1 (9.9)
Total (%)	72.6 (13.7)	70.6 (11.1)	71.5 (12.2)

**Table V.**  
Mean respondent scores  
by type of location and  
event

BFJ  
109,7

The observers collected additional information about the vehicles used for the off-premise functions. Only three of the 12 trucks transporting food and equipment to off-premise functions had a cooling unit. However, all trucks were observed to be clean inside and out.

570

### Occurrence of violations

As described above, at each event, violations were checked off on a worksheet and tallied at the end of the observation period. Violations were divided among the four different categories of food safety and sanitation: personal hygiene, cooking foods, holding foods, and equipment.

#### *Personal hygiene*

Most of the observed violations were categorized as personal hygiene issues. The researchers observed 160 hand washing violations during the event and almost 75 incidents of hands not being washed before the event began (Table VI). Hand washing violations occurred much more often at the off-premise functions compared to the on-premise functions. The researchers also frequently observed service staff not wearing gloves when working with ready-to-eat (RTE) foods. However, observations of this violation were slightly more prevalent at on-premise functions compared to off-premise ones.

Although employees seemed to know more about proper personal hygiene practices (as indicated by their scores on the surveys), they were very lackadaisical in performing these hygiene practices during a catering event (Table VI).

#### *Cooking*

When observing the preparation of the food for service at on- and off-premise functions, the most frequent violation was moving food to holding equipment without checking its temperature (Table VII). This violation occurred more frequently at off-premise events compared to on-premise ones. Another common violation was employees improperly tasting food while cooking it; however, this was a much bigger problem in on-premise events than off-premise. This disparity can be explained by the

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Personal hygiene violations	Premise		Grand total
	Off	On	
Hands not washed after touching body, uniform, etc.	97	63	160
Not wearing gloves when working with RTE foods	64	67	131
Hands not washed before event starts	52	22	74
Drinking out of improper containers near food	35	24	59
Eating/drinking near food preparation/service areas	28	28	56
Hands not washed after returning from break	24	11	35
Hair improperly restrained during event	25	8	33
Improper jewelry	8	20	28
Hair improperly restrained before event	20	7	27
Dirty uniform during event	8	17	25
Dirty uniform before event starts	7	3	10
Work without properly covering cuts	2	2	4

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**Table VI.**  
Personal hygiene  
violations by event type

fact that most of the food for off-premise events was prepared in an off-site kitchen at a different time than the service of the food.

*Holding*

Holding violations were the second most common area of violation after personal hygiene violations. The most common holding violation was removing food from a warmer without checking its temperature (Table VIII). This happened twice as often at on-premise functions as it did during off-premise ones. Surprisingly, another area in which on-premise events had significantly more violations was food not being covered in either warming or refrigerated units. Since food has to be transported to an off-premise event, most caterers must cover the food during transport which may be the reason off-premise events had fewer violations in this area. The most common violation at off-premise functions was leaving the food in the temperature danger zone (40°-135°F) for more than four hours. Another common violation at off-premise functions was stacking food improperly in refrigerated/cooling units (i.e. trays stacked directly on top of one another as opposed to using the slides provided).

*Equipment*

The researchers observed significantly more equipment violations at off-premise functions as compared to on-premise ones (Table IX). Since there was typically not a three-compartment sink or sanitizing solution available (as determined by the Event Observations), it was more difficult for the service staff at these functions to properly clean/sanitize their equipment.

Cooking violations	Premise		Grand total
	Off	On	
Move food to holding or serve it without checking temperature	24	18	42
Improperly tasting food while cooking it	3	13	16
Move food to holding or serve it when know it's at wrong temperature	2	12	14
Use wrong cooking equipment when preparing food	0	0	0

**Table VII.**  
Cooking violations by  
event type

Holding violations	Premise		Grand total
	Off	On	
Food removed from warmer without checking temperature	33	69	102
Food left in the temperature danger zone too long	41	33	74
Food not properly covered in warmer	9	50	59
Food not properly covered in refrigerator	10	49	59
Food stacked improperly in refrigerator	40	14	54
Food stored directly on the floor	28	13	41
Improperly mix old and new food in warmer/refrigerator	35	1	36
Food stacked improperly in warmer	1	34	35
Food stored in wrong order in refrigerator	4	27	31
Food removed from refrigerator without checking temperature	25	2	27
Food stored in wrong order in warmer	0	13	13

**Table VIII.**  
Holding violations by  
event type

*Miscellaneous violations*

The violation worksheet had a separate section for miscellaneous violations. One of the largest, and most disconcerting, violations observed was the number of incidents of cross-contamination (Table X). This was surprisingly higher during the on-premise functions compared to the off-premise ones. At both types of events there were an equal number of observations of service staff ignoring food and drink that had been spilled. On occasion a guest would have to find service staff and tell them of the spill.

**Discussion and conclusions**

The most significant finding was that the performance of employees, regardless of their food safety and sanitation knowledge (based on the survey results), was less than stellar. Many employees knew what proper procedures were but failed to follow them during the execution of an event, either in the kitchen or in the dining room and regardless of whether the function was on-premise or off-premise. This lack of employee performance was also evident regardless of whether they were working at corporate or independently catered events and whether the worker was a part-time or full-time employee of the caterer. These findings were similar to that of Howes *et al.* (1996) who also observed that employees' food safety knowledge does not always translate into good food safety practices. Many researchers (Clayton and Griffith, 2004; Clayton *et al.*, 2003; Green and Selman, 2005; Manning and Snider, 1993) also found that food safety education was not enough to encourage employees to perform proper food safety and sanitation procedures.

One reason for not performing the proper food safety practices may be that the employees were so busy trying to complete basic preparation and provide service for the event that they chose, either consciously or subconsciously, not to follow proper food safety and sanitation practices. Green and Selman (2005) also found that there were a number of factors that impacted foodservice employees' ability to prepare food safely, including time pressure; equipment and resource availability; food safety emphasis by management and coworkers; and food safety education and training.

**Table IX.**  
Equipment violations by event type

Equipment violations	Premise		Grand total
	Off	On	
Service utensils not cleaned/sanitized after use	39	9	48
Knives/kitchen utensils not cleaned/sanitized after use	14	10	24
Cutting boards not cleaned/sanitized after use	11	6	17
Other kitchen equipment not cleaned/sanitized after use	4	4	8

**Table X.**  
Miscellaneous violations by event type

Miscellaneous violations	Premise		Grand total
	Off	On	
Other incidents of cross-contamination	58	73	131
Ignore spillage of food and drink	22	22	44
Manager correcting employees on sanitation issues	6	5	11

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In addition, there appeared to be a lack of supervision by the catering managers during the event. It is possible that if managers had circulated more during the events, the employees would have been more likely to follow the proper food safety and sanitation procedures knowing they would be reprimanded for improper procedures. Other researchers (Food and Drug Administration (FDA), 2001; Green and Selman, 2005) have also found that management plays a significant role in the extent to which food workers engage in safe food preparation practices. Unfortunately, even knowing that the researchers were observing them for proper food safety and sanitation practices, the employees did not attempt to follow these practices.

The researchers found the most significant error made by catering employees was the lack of personal hygiene practices; more specifically, the lack of proper hand washing. This is disturbing as many researchers (Clayton and Griffith, 2004; Guzewich and Ross, 1999 (as cited in Clayton and Griffith, 2004); Harrington, 1992; Paulson, 2000) found that proper handwashing was the single most important means of preventing the spread of foodborne illness.

Also of concern was the fact that when moving food to or from warming or refrigerated equipment, employees did not check the food temperature. When food is not served at the proper temperature, it can harbor micro-organisms which multiply exponentially the longer the food is in the temperature danger zone (40°-135°F). These micro-organisms can cause foodborne illnesses to be contracted by guests at a catered event.

### **Limitations**

There are a number of limitations to this research study. The biggest limitation was the lack of participation and support that the researchers received from the catering managers and owners. The study used convenience and snowball sampling rather than random sampling as the researchers had originally intended. This resulted in a possibly biased sample as those caterers willing to participate may have had more interest in food safety or may have believed that their practices were in compliance with established standards. In addition, a larger and more diverse sample could have provided more generalizable data.

Another limitation of the study is the effect that observers have on the people they are observing while they are performing their duties – the Hawthorne Effect. Although the researchers tried to minimize this effect by wearing uniforms similar to the people they were observing, it is likely that the presence of observers still had some effect on the employees' performance.

In addition, the researchers chose to use a traditional checklist approach for determining the performance of catering employees during the functions and generally only one researcher (or assistant) was observing each employee at a given function. This meant that the Hawthorne effect could have influenced some of the employees' behaviors and actions during the observation period. If video cameras could have been used, the number of food safety violations could have been recorded more consistently. Video cameras also would have allowed the researchers to amass more data over longer periods of time without the physical presence of observers in the kitchen and dining room distracting the catering employees.

A final limitation is that the researchers did not question employees about their previous food safety training or knowledge or their tenure in the food service industry.

It would have been useful to compare employees who considered themselves knowledgeable about food safety and sanitation practices with those who had little or no knowledge or training in this area.

### **Development of training materials**

To reduce the incidence of foodborne illness, it is important to improve foodservice employees' food preparation practices and knowledge (Green and Selman, 2005). The number of food safety violations in each of the four categories of this study and the low scores on the food safety surveys indicated a strong need for food safety training for catering employees. To that end, the researchers developed a short training booklet addressing the most important food safety issues as determined by the study. The booklet included the following topics:

- (1) *Personal cleanliness:*
  - Hand washing requirements and procedures;
  - Glove usage; and
  - Not eating and drinking in food preparation and service areas.
- (2) *Cooking, holding, and serving procedures:*
  - Hot and cold food holding temperatures;
  - Proper food storage procedures; and
  - Minimum internal cooking temperatures.
- (3) *Equipment and other contamination:*
  - Definitions of and procedures for cleaning and sanitizing;
  - Special equipment and procedures needed for off-premise catering; and
  - Special equipment and procedures needed for buffets.

The training pamphlet was produced in both English and Spanish and in print and electronic versions. It was distributed to all caterers who participated in the study and in the proceedings of the Catersource Conference held in Las Vegas in January 2006, which was attended by over 3,000 people.

Once employees are given the opportunity to read and understand the information provided in the booklet, it is imperative that they are then surveyed to determine if the information was processed. Then researchers could observe these "newly educated" employees during additional catering events to determine if they were putting the knowledge from the booklets to use. The survey results and observations from the "newly educated" employees could then be compared to the results and observations from this study to determine if the booklet increased the knowledge and/or practices of this type of employee.

### **Future research**

It is important to understand that the research conducted and reported herein is only a sample based on 23 catering events in the Las Vegas area. More extensive studies over a wider geographical area and consisting of a greater number of events needs to be conducted in order to apply the results to the larger population of caterers. The discrepancies between the knowledge of the catering employees and their actions

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during an event also need to be explored to determine the reasons why they occurred. Different observation techniques could also be incorporated to decrease the invasiveness of the observers and to determine the number of violations that could have been prevented. It is important to note that further research is needed to determine how catering employees can improve their food safety and sanitation knowledge and practices. In addition, management techniques and knowledge of these issues should be studied to determine their motivation to monitor and discipline their employees with respect to food safety.

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