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Effect of Placard Grading on Food Safety in Retail Food Facilities

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This is to certify that the doctoral dissertation by

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Abstract

Most people have had an episode of foodborne illness at one time or another; however, the majority of those stricken with foodborne illness fails to associate ill health with something consumed within the past 72 hours. The World Health Organization (WHO) estimates that foodborne diseases affect 30% of the population in developed countries, and that in developing countries, about 2 million people die yearly due to foodborne illness. Previous researchers have indicated that food handlers with poor personal hygiene are potential sources of infection. Although public health agencies in many countries already regularly inspect food facilities to control potential foodborne illnesses to some extent, the question of the most appropriate and effective means of achieving the goal of food safety remains unanswered. Therefore, the purpose of this study was to determine whether a color-coded placard grading system is an effective tool for achieving this goal while simultaneously educating the public about food safety. This study involved 1,410 randomly selected food service establishments, consisting of traditional restaurants, take-out restaurants, grocery stores, public school cafeterias, and institutional food facilities located in Alameda County, California. Inspection data were analyzed for the first 12 months of placard grading and compared to the following 12 months during the placard grading period. Statistical analysis results did not show significant differences in the CDC major violations and in confirmed foodborne illnesses between the 2 years. However, it is expected that the new program will provide improved food handling practices in the future. Improvement in food handling practices will contribute to social change by reducing the number of foodborne illnesses, promoting better health for the community, and educating the public about food safety.

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Dedication

This dissertation is dedicated to my two late brothers, Prof. John U. Ogbu and Mr. Jacob A. Ogbu. The two of you gave me the opportunity to learn how to read and write—I wish you were here today.

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Chapter 1: Introduction to the Study

Preface

A food inspector conducting an inspection in a restaurant facility was once confronted by a patron who was eating her purchased meal. While the inspector was busy doing his duties—inserting a probe thermometer into prepared foods on the counter, shining a flashlight under cooking-line equipment, and questioning the person in charge to determine which cutting boards were designated for raw or ready-to-eat foods—a patron suddenly interrupted her meal for a moment, turned around, and asked the inspector, "What are you doing?" The inspector cordially answered, "I am conducting an inspection of the restaurant." The lady quipped, "Well, my parents and I have been eating here since I was a teenager. I am now 60. I'm still here. Nothing has happened to me."

This short scene provides a brief overview of the restaurant environment, and the relationship between a food facility operator and a health inspector. At the same time, the scene reveals some of the public perceptions of a food inspector's duties. Although a certain percentage of the population is unaware of the importance of a public health food protection program, the services of the inspectors in protecting public health are vital to society. Despite some misconceptions, environmental health agencies continue to search for new ideas or innovations to protect the general public by enforcing food safety guidelines, even when the effort is not always appreciated. On the other hand, the majority of the population is generally aware of the importance of food safety and does support efforts to prevent possible foodborne diseases in the community. The scene related above also provides health agencies with another reason to continue to educate

not only food facility operators and their food handlers, but also the uninformed members of the general public who ignore the importance of food protection program.

Introduction

Food safety is a concern, whether in the home or an established food facility. Ground beef is often linked to outbreaks of pathogenic bacteria, such as *Escherichia coli 0157:H7* and *Salmonella*, which consumers may be exposed to through unsafe preparation and handling. Beef and chicken are among the potentially hazardous foods (PHF) that form integral parts of the diets consumed in most American homes on a daily basis. U.S. Department of Agriculture (USDA) and Food and Drug Administration (FDA) guidelines recommend cooking ground beef patties to an internal temperature of 155 ºF. However, a significant number of people in the American population do not adhere to this requirement.

A group of University of California researchers conducted a study to determine how consumers may be exposed to foodborne illness through unsafe preparation of ground beef. The researchers noted that 22% of the participants declared their burgers ready to eat when the temperature was below 155 ºF. Among the participants, only 7% observed the 20-second hand-washing guideline. It was also noted in the study that potential cross-contamination was common with dirty hands, which are often the major vehicle for food contamination. Based on the information from this study, the researchers concluded that consumers with and without food safety knowledge exposed themselves to potential foodborne illness. A further test given to the participants showed that only

13% knew the recommended internal temperature for ready-to-eat beef (Pham, Jones, Sargeant, Marshall, & Dewey, 2012).

Food handling habits are an issue that must be addressed at any level where food is involved, including special events and family picnics, as well as in food facilities. Foodborne illnesses pose special problems to the very young, the infirm, and the aged. In addition, ethnic minorities in the United States are disproportionally affected by foodborne illness, according to Henley, Stein, and Quinlan (2012). The authors noted that racial minority groups (African Americans, Hispanics, and Asians) are significantly affected by *Salmonella* and *Campylobacter* illnesses due to limited knowledge, poor food handling habits, certain cultural practices, and their perception of foodborne illness. In three sets of focus group data, it was observed that ethnic minority groups failed to follow the required rules for handling potentially unsafe foods. The failures included an extended time period for transporting foods from food facilities to homes, failure to wash raw poultry or use hot water for utensil washing, and mishandling potentially hazardous foods.

Background

In an effort to educate both food facility operators and the public about food safety conditions inside food facilities, several health agencies across the nation have begun applying various innovative enforcement tactics, including behavioral modification. The tactics employed by major health agencies include (a) suspending permit to operate, (b) levying fines for repeat violations, (c) posting food facility inspection reports on facility windows and on the Internet for the public to view and use

to make individual choices about where to eat or not eat. For example, some local health agencies employ the following:

- Letter grading (New York Health Department)
- Color-coded grading (Sacramento County Health Department, Alameda County Health Department, and San Diego County Health Department)
- Percentage grading only (Los Angeles County Health Department)
- Score-point grading only (San Francisco County Health Department).

The intent of posting inspection results on windows and on the Internet is to alert the public as well as motivate and encourage food facility operators to make the necessary efforts to improve sanitation through food safety awareness during operations. The different methods of posting inspection results are also intended to influence the behavioral patterns of food handlers by requiring that food facility workers pay close attention to food safety during meal preparation. Additionally, public posting of inspection results gives the general public an opportunity to make informed decisions about where to eat or not eat (Enriquez, Ruiz, & Talusik, 2009). Placard grading and posting are among the inspection tools introduced by the FDA in 2003 as part of food facility evaluations.

The different types of grading include letter grading, color-coded grading, score-point grading, and percentage grading. Alameda County adopted color-coded grading and posting for the following reasons:

1. Color communication is easier to understand than letter grading in food safety and other precautionary matters. The choice of color-coded grading was

pretested by the Alameda County Environmental Health Department (ACEHD) food inspectors prior to the implementation of the placard grading program.

2. Color portrays a universal language, whereas the letters A, B, and C communicate to English- and semi-English-language-speaking groups only.
3. Quoting the National Restaurant Association (NRA, 2006), Yiannas (2010, p. 3) indicated that one out of every four food establishment workers in the United States does not speak English at home. It therefore becomes justifiable to use a communication medium other than English language symbols.
4. In food establishments, inspectors use the colors green, yellow, and red to convey to the public levels of food safety or possible danger in a restaurant at the time and date of facility inspection.

Given the large number of non-English-speaking food workers in Alameda County, it becomes necessary to use a communication medium that all food handlers can understand. Therefore, color-coded placarding is an appropriate choice.

Health inspectors are professionally trained to watch and monitor the behaviors and actions of food handlers during food preparation. In one study, it was observed that food handlers in the kitchen paid little or no attention to food safety practices during busy lunch or dinner hours (Chapman, MacLaurin, & Powell, 2011). In a similar study, it was noted that lack of intensive foodborne disease surveillance hampered proper food safety monitoring in developing countries (Lee, Kim, & Park, 2009). Local health agencies are often impeded by insufficient funds, which result in an inadequate number of inspectors

assigned to conduct routine inspections of food facilities. Kufel et al. (2011) showed that counties with a higher food safety budget and a higher number of health inspectors had a lower number of foodborne illness cases and outbreaks, compared to counties with a lower budget and fewer health inspectors. In another investigative study to determine the effect of training on food safety, the results showed that inadequately trained young adults in food facilities could be contributing to the present increase in the number of foodborne diseases in the country (Abbot, Byrd-Bredbenner, Schaffner, Bruhn, & Blalock, 2009). Although experts agree that training and education are critical to food safety at the retail and food service levels, it was shown that even restaurants with trained food handlers were occasionally closed due to serious health violations (Nummer, Fraser, Marcy, & Klein, 2010). In consideration of critical issues involved in maintaining food safety, an online survey of food facility inspectors in Canada showed that all of the 239 respondents rated time-temperature abuse, inadequate hand washing, and cross-contamination as important food safety issues that frequently lead to foodborne illness in food facilities (Jones, Sargeant, Marshall, & Dewey, 2012).

Statement of the Problem

Foodborne illness is a major public health concern in any civilized society. Bacteria, viruses, and microbes in foods are responsible for foodborne illnesses. Foodborne illness occurs when a living, disease-causing microorganism is eaten along with foods (McSwane, Rue, & Linton, 2005). There are different classes of foodborne illnesses with various symptoms and effects on the body, depending on the type of organism or contaminant. The three main classes of foodborne diseases through which

harmful organisms enter the body are biological, chemical, and physical contact. Among the three groups, biological hazards, which include bacteria, viruses, parasites, and fungi, cause most of the foodborne illnesses (McSwane et al., 2005, p. 29). Chemical toxic substances enter the body as contaminants, either naturally or through agricultural food additives, including pesticides and fertilizers. Physical hazards—including glass, metal, jewelry fragments, bandages, and human hairs—enter the body as foreign particles in foods. Any of the foodborne agents may enter the body due to unhygienic food handling processes, deterioration and food spoilage, a dirty environment, or cross-contamination. The Centers for Disease Control and Prevention (CDC) indicate that there are eight pathogens causing most foodborne illnesses, hospitalizations, and deaths in the United States. The known pathogens include *Norovirus*, *Salmonella*, *Clostridium perfringens*, *Campylobacter* species, *Staphylococcus aureus*, *E. coli 0157*, and *Listeria monocytogenes*. Some pathogens are more deadly than others; for example, *Salmonella, Toxoplasma, Listeria, Norovirus,* and *Campylobacter* contribute to domestically acquired foodborne illnesses resulting in death (CDC, 2012b). Young children and older adults are more likely to experience severe complications and die from foodborne illnesses than other groups in the population.

In Alameda County, about 250 alleged foodborne illnesses are reported annually, with 18 to 20 confirmed cases of *Norovirus, Salmonella, E. coli,* and *Staphylococcus aureus* (ACEHD, 2011). The CDC indicates that each year, about 1 in 6 Americans, or 48 million people, become ill, 128,000 are hospitalized, and 3,000 die of foodborne diseases. These foodborne diseases occur despite the fact that the food supply in the United States

is one of the safest in the world (CDC, 2011a). Most foodborne illnesses are traced to improper food handling practices in retail food facilities due to noncompliance with food safety requirements (Chapman et al., 2011; Griffith, Livesey, & Clayton, 2010). A *retail food facility* is defined as an operation that stores, prepares, packages, serves, vends, or otherwise provides foods for human consumption at the retail level. Permanent or nonpermanent food facilities include, but are not limited to, restaurants, public school cafeterias, restricted food service facilities, licensed healthcare facilities, commissaries, mobile food facilities, mobile support units, temporary food facilities, vending machines, and certified farmers' markets (Cal Code 2013, p. 16). Each food establishment and its operation is unique; however, the common factor linking most retail food facilities is that food items prepared and served for human consumption generally pass through several food workers: from the farm, through the delivery worker, to the food storage facility, from the preparation line through the food server, and finally to the customer (consumer).

The number of food facilities has been on the increase in recent years due to an increase in the number of individuals and families who are choosing to eat out more frequently; and at the same time, the media and general public demand to know more about food safety and sanitation in retail food facilities (Lee, Almanza, Nelson, & Ghiselli, 2009). In the state of California, local health agencies are mandated to develop and implement food safety programs in conjunction with state guidelines in an effort to reduce incidence of foodborne illness. Any reduction or prevention of foodborne illness is in the interest of both retail food establishments and consumers (Enriquez et al., 2009). In addition to food handling violations regularly observed and documented by health

inspectors during routine inspections, effective planning, adequate funding, and sufficient health inspectors also play crucial roles in preventing possible foodborne diseases in food service facilities. In two separate studies (CDC, 2011a; Zablotsky, Resnick, Fox, McGready, & Yager, 2011), the researchers point out that lack of an adequate number of health inspectors resulting from insufficient funding to employ full-time health professionals contributes to possible foodborne illness in food establishments. Observations made during food facility inspections and evaluations indicate that food handlers, as well as food establishment operators, need constant r*e*minders of food safety regulations. The need for constantly reminding food operators of the importance of food safety therefore requires more food inspectors to perform frequent facility evaluations and inspections.

Purpose of the Study

The purpose of this study was to determine whether using a color-coded placard grading system as a health inspection tool affects food handling practices and reduces foodborne illness in retail food facilities in Alameda County, California. One of the factors in reducing the number of foodborne diseases in a population is the ability of the local health agencies and their inspectors to educate and convince food handlers to adopt established food safety guidelines (Chapman et al., 2011). Despite the ongoing food safety education built into food facility evaluation as part of the health agencies' inspection program, the persistent problem is the unwillingness of food handlers to comply with established rules and regulations. Another reason for unsatisfactory compliance with food safety regulations among food service operators and workers

relates to differences in individuals' planned behaviors. Pilling, Brannon, Shanklin, Howells, and Roberts (2008) theorized that three planned behaviors (TpB) and personal beliefs interfere with improving food safety practices in food service operations. The authors named three behaviors—failure to wash hands, not using thermometers, and improper handling of food contact surfaces—as major causes of food contamination that substantially affect public health. Using a cross-sectional study, the authors surveyed 190 food service employees across three Midwestern states. The survey showed that employees' attitudes were the one consistent predictor of intentions for performing all of the three behaviors. The researchers concluded that training interventions intended to improve employees' behavioral intentions and attitudes for food safety should focus on TpB components, aligning the new trainees to conform to the beliefs of the other employees who already intend to properly comply and perform food safety behaviors.

Inspection Process

Local health departments have one main objective when inspecting food facilities: to protect public health by monitoring food handling processes in an effort to prevent possible food contamination that could lead to foodborne illness. In the late 1990s, the Food and Drug Administration (FDA, 2006) introduced the food code with the same purpose in mind. In early 2000, the CDC first published foodborne illness risk factors to reinforce the food codes (CDC, 2011b). The food codes and the CDC Food Safety Risk Factors provided state and local health departments with a strong baseline for and clear understanding of food protection and the tools for food inspections at all levels, including retail food facilities. While various state and local health jurisdictions adopted several

variations of the CDC Food Safety Risk Factors for food protection, the County of Alameda Environmental Health Department embraced the placard grading system using the same CDC Food Safety Risk Factors.

At the start of each inspection process, a 100-point score is assigned to each food facility. Focusing on the CDC Risk Factors, the health inspector deducts and records corresponding point values from the 100 points, based on the type and seriousness of the violation observed. The point values deducted are also based on the level of food safety risk in the food establishment. The resulting score reflects the overall food safety risk in the food facility (Alameda County Environmental Health, Food Protection Division, 2012a). The official inspection report (OIR) contains the following issues that are directly or indirectly related to the CDC risk factors:

1. Compliance with communicable disease prevention.
2. Proper hand washing before handling ready-to-eat foods.
3. Adhering to temperature requirements.
4. Food in good condition, safe, and unadulterated.
5. Food contact surfaces clean and sanitized.
6. Food obtained from approved sources, including shellfish and oyster regulations.
7. Compliance with variance, specialized process, and Hazard Analysis Critical Control Point (HACCP) plan.
8. Licensed health care facilities' and schools' safe food requirements: not offering prohibited foods to highly susceptible populations.

9. Availability of hot and cold running water in the food facility.
10. Sewage and waste water properly controlled and discharged.
11. No rodents, insects, birds, or animals in the food facility.

Before a food facility inspection, the facility manager or person in charge is informed that the inspection involves placard grading, with the result of the inspection indicated on the placard to be posted. The overall result of inspection and the type of placard a food facility receives are generally discussed with the facility manager or other person in charge before being posted in public view at the restaurant.

The placards are awarded to each facility using the scoring criteria shown in Table 1:

Placard Grading System for Retail Food Facilities

Points	Category	Observed condition	Action taken/ results
80–100	Green placard	Approved food handling practices, good facility maintenance, and no more than one corrected major CDC risk factor violation.	Open and permitted to operate.
75–79	Yellow placard	No major CDC risk factor observed; noted violations must be corrected within 7 days.	Allowed to open, follow-up inspection required.
0–74	Red placard	Poor food safety practices and inadequate overall food establishment maintenance. The noted CDC risk factor cannot be immediately corrected.	Facility is closed due to health and safety risks. Permit is immediately suspended.

The placard grading system for retail food facilities has been developed to establish criteria for evaluating food handling practices, overall maintenance, and sanitation at food facilities in Alameda County.

In evaluating a food facility, each of the CDC Risk Factors is worth 4 points. Thus, a 4-point value is deducted for failure to comply with any of the major health risk factors that pose immediate food safety risks, such as failure to wash hands or wear disposable hand gloves before touching ready-to-eat foods or presence of rodents in the food facility. In this study, the CDC Risk Factors are considered *major*, and the related food safety violations have been termed *food handling practice.* On the other hand, violations considered *minor* health risks, and which are not directly related to the CDC Risk Factors, are defined here as *food handling behavior*; for example, improper labeling of food containers or failure to maintain regular disposal of refuse. A 1-point value is deducted for each minor violation observed during a food facility inspection.

Research Questions and Hypotheses

The following questions were designed specifically for the Alameda County Environmental Health Department in developing its grading and placarding program. The same questions were adopted and incorporated with a matching hypothesis for this research. The study was designed to compare and answer the research questions for the first 12 months (first year) of placarding compared to the next 12 months (second year) of placarding, using the same food facilities.

Research Question 1

Are there statistically significant differences in major violations in the food facilities between the first year and the second year of placard grading in Alameda County?

Null hypothesis ($H_0$1): There are no statistically significant differences in major violations in food facilities between the first and second year of placard grading.

Alternative hypothesis (H_A1): There are statistically significant differences in major violations in food facilities between the first and second year of placard grading.

Research Question 2

Are there statistically significant differences in minor violations in food facilities between the first year and the second year of placard grading?

Null hypothesis ($H_0$2): There are no statistically significant differences in minor violations in food facilities between the first year and the second year of placard grading.

Alternative hypothesis (H_A2): There are statistically significant differences in minor violations in food facilities between the first and the second year of placard grading.

Research Question 3

Are there statistically significant differences in the number of green placards or the number of red placards between the first year and the second year of placard grading in the food facilities?

Null hypothesis ($H_0$3): There are no statistically significant differences in the number of green placards or the number of red placards between the first year and the second year of placard grading in food facilities.

Alternative hypothesis (H_A3): There are statistically significant differences in the number of green placards or the number of red placards between the first and the second year of placard grading.

Research Question 4

Are there statistically significant differences in the number of confirmed foodborne illnesses between the first year and the second year of placard grading in food facilities in Alameda County?

Null hypothesis (H_04): There are no statistically significant differences in the number of confirmed foodborne illnesses between the first year and the second year of placard hypothesis grading in food facilities.

Alternative hypothesis (H_A4): There are significant differences in the number of confirmed foodborne illnesses between the first year and the second year of placard grading in food facilities.

Definition of Theoretical Constructs

Operant conditioning theory was used in this research to study the food handling behaviors and practices of food establishment workers. This model of behavioral change was pioneered by Ivan Pavlov, in what is known as *classic conditioning* (Institute of Medicine, 2001, p. 184). In 1905, Edward Thorndike proposed a theory known as the *law of effect*. According to Simons-Morton, McLeroy, & Wendel (2012), although B. F. Skinner is the father of operant conditioning, his work was based on Thorndike's law of effect. Skinner's theory also builds on classic conditioning but focuses on the hypothesis that the frequency of behavior is determined by its consequences (McLeod, 2007;

Simons-Morton, et al., 2012). Behavior is significantly influenced by past experiences and reinforcements that could result in either positive or negative consequences. Researchers on health behaviors support the theory that food handling practices are directly related to past behavioral experiences. Placard grading and posting serve as reinforcements in this study, with the green placard (passed—open and allowed to operate) serving as positive reinforcement and the red placard (failed—closed operation) serving as negative reinforcement. Although food handlers might have exhibited poor food handling practices in the past, it is expected that a new green placard will serve as a motivation for positive behaviors, whereas the intent of a red placard posting is to admonish the food handlers for inappropriate behaviors and allow the handlers a chance to make the necessary correctional changes by practicing better food handling behaviors. The function of operant conditioning is therefore to create self-regulation of goal-directed behaviors by the participants.

On the other hand, the health belief model (HBM) is intended to determine the public reaction to the placard posting. A group of U.S. Public Health Service social psychologists developed the health belief model in the 1950s to explain why only a few people participated in health programs designed to detect and prevent diseases (Institute of Medicine, 2001, pp. 187–188; National Cancer Institute, 2005; Simons-Morton et al., 2012, pp. 113–118). According to the authors, perception of threats posed by a health problem influences the individual's decision to act. Threats of health problems include susceptibility, severity, and the benefits of avoiding the threat. In observing a red placard conspicuously posted at the entrance to a food facility, the individual must decide

whether it is worth the risk to eat in that facility, or whether it is preferable to search for an alternative food facility, thereby avoiding the risks. The reactions of food facility consumers are expected to reflect on the facility operators, covertly forcing the operators and food handlers to change their food handling behavioral practices. A noticeable change in action will reinforce the positive behaviors.

By exposing a health inspection result for failing to meet food safety requirements, a food facility operator could lose potential customers, and consequently the business may fail. The model is also intended to change or influence the food facility operator and food handlers to take food safety more seriously. Color-coded placard grading and posting may have a positive effect by improving food handling behaviors and practices in food facilities, leading to better personal hygiene, more attention paid to food storage and processing, proper temperature control, and adequate food handling practices. Personal habits, behaviors, and group cultures play significant roles in cross-contamination of foods and consequently in foodborne illness outbreaks. Foodborne illness does not occur by accident but due to the negligence of the person in charge in not following the proper food safety procedures. Poor personal hygiene and habits are serious hazards in food establishments; for example, a food handler's fingers may be contaminated with saliva during eating or smoking. According to McSwane, Rue, and Linton (2004, p. 96), the presence of bodily fluids, in addition to poor hand-washing habits, can be a harmful source of contamination in foods. It should also be noted that untrimmed fingernails may harbor various bacteria, including *Staphylococcus*.

Definition of Terms

The following definitions are adapted from the California Department of Health Services (Cal Code 2013), the Alameda County Environmental Health Department (ACEHD, 2012a), and the Los Angeles County Public Health Department (LAPHD, 2011).

Alameda County Environmental Health Department (ACEHD): Located in Northern California, Alameda County is a part of the metropolitan landmark that joins other adjacent counties to form the popular Bay Area. There are 14 incorporated and four unincorporated cities in the county, with a total population of about 2.5 million people.

Approved source: A producer, manufacturer, distributor, or food facility that is acceptable to the local health enforcement agency based on a determination of conformity with applicable laws, or in the absence of applicable laws, with current public health principles and practices, and generally recognized industry standards that protect public health (ACEHD, 2012a; LAPHD, 2011).

Cross-contamination: The transfer of harmful microorganisms, such as bacteria and viruses, from one food to another by means of nonfood surface contacts (equipment, utensils, human hands), or from storing or thawing raw meat and poultry adjacent to or above ready-to-eat foods (LAPHD, 2010, p. 9).

Environmental Health Specialist (EHS): Also known as *health inspector*; someone who has completed college-level studies in biology, chemistry, physics, or microbiology, possesses a bachelor's degree or higher, and has passed or is in the process

of taking the California State Environmental Health Specialist registration examination. (LAPHD, 2010; ACEHD 2012a).

Food facility: An operation that stores, prepares, packages, serves, vends, or otherwise provides food for human consumption at the retail level. Permanent or nonpermanent food facilities include, but are not limited to, restaurants, public school cafeterias, take-out (fast food) providers, restricted food service facilities, institutional food facilities (hospitals, nursing homes, prisons), grocery stores, commissaries, mobile food facilities, temporary food facilities, vending machines, and certified farmers' markets (ACEHD, 2012a; LAPHD, 2010).

Foodborne illness: An infection or intoxication caused by bacteria, viruses, or parasites transmitted by food (ACEHD, 2012a).

Food handling culture: Group cultural behaviors that food facility operators and their staff follow to produce and provide foods to their customers; the tendency to do what has always been conveniently done, regardless of outside influences (Yiannas, 2010, p. 11).

Food service employee (food handler, food worker): Someone who transports, stores, cooks, handles, serves, or assists in the preparation or service of food in any form in a food facility (ACEHD, 2012a).

Hazard Analysis Critical Control Point (HACCP): A system designed to follow the flow of food through the food establishment and identify each step in the process where contamination might cause the food to become unsafe (ACEHD, 2012a).

Imminent health hazard: A significant threat or danger to health that is considered to exist when there is sufficient evidence to show that a product, practice, circumstance, or event creates a situation that can cause food infection, food intoxication, disease transmission, vermin infestation, or a hazardous condition that requires immediate correction or cessation of operation to prevent injury, illness, or death (ACEHD, 2012a).

Intervention: Action taken to reduce or prevent the risk of potential foodborne illness (LAPHD, 2011, p. 9).

Local enforcement agency (LEA): The department or local health agency having jurisdiction over the food facility (ACEHD, 2012a; LAPHD, 2011, p. 9).

Major violation (CDC Risk Factors): A violation that poses an imminent health hazard, warranting immediate correction and possible closure of the food facility (ACEHD, 2012a; LAPHD, 2011, p. 10; Cal Code, 2013, p. 22).

Minor violation (Approved Retail Practices): A violation of an approved practice that does not pose an imminent health hazard but does warrant correction (ACEHD, 2012a; LAPHD, 2011, p. 10; Cal Code, 2013, p.22).

Person in charge (PIC): The individual present (operator, manager, or designated person) at a food facility who is responsible for operation of the facility at the time (ACEHD, 2012a; LAPHD, 2011, p. 10).

Placard system: A system involving the use of color-coded posters to display current food safety conditions inside a food establishment after official inspection and scoring, to inform the public of the level of risk observed in the food facility. The type of placard posted (green, yellow, or red) depends on the total score recorded or level of

imminent health danger observed after the inspection and evaluation of each food facility (ACEHD, 2012a).

Potentially hazardous food (PHF): A food that requires time and temperature controls to limit pathogenic microorganism growth or toxin formation. PHF includes a food of animal origin that is raw or heat-treated; a food of plant origin that is heat-treated or consists of raw seed sprouts, cut melons, cut tomatoes, or mixtures of cut tomatoes that are not modified to render them unable to support pathogenic microorganism growth or toxin formation; and garlic-in-oil mixtures that are not acidified or otherwise modified. Potentially hazardous food (PHF) has high protein or carbohydrate content, a pH value above 4.0, and water activity above 0.85 (LAPHD, 2011, p. 10; McSwane et al., 2005, p. 39; Cal Code, 2013, p. 25).

Restrict: To limit the activities of a food service employee so that there is no risk of transmitting a foodborne disease and the employee does not work with exposed food, clean equipment, utensils, linens, and unwrapped single-use articles (LAPHD, 2011, p. 10; Cal Code, 2013, p. 29).

Revocation: An action taken by the environmental health food protection division to permanently order a food facility closed under the existing public health permit (LAPHD, 2011, p. 10).

Suspension: An action taken by the environmental health food protection division to temporarily order a food facility closed until necessary corrections are made (Cal Code, 2013, p. 149; LAPHD, 2011, p. 10).

Water activity: Water activity is a measure of free moisture sufficient to support bacterial growth in potentially hazardous food. Pure water has water activity of 1.0 (McSwane et al., 2005, p. 39).

Limitations

In addition to the foodborne illnesses reported in retail food facilities, farms, industrial storage, food processing and packaging plants, and transportation systems occasionally contribute to cross-contamination of foods. The FDA, states, and local health agencies are aware of the possibilities of food contamination by bacteria, viruses, chemicals, physical objects, animals, insects, and rodents at any point between farms and ready-to-eat status. This study was only concerned with food handling practices and the potential for foodborne illnesses in retail food facilities, and it did not involve foods in farms, processing plants, warehouse storage, transportation, and distribution facilities. The study also did not involve foods served in homes, catering at private events, or foods served at temporary events. Although the above-listed food facilities have the potential to cause foodborne diseases and are regulated by the FDA and local health agencies to some extent, the inclusion of every food facility category in this research was beyond the scope of this study. The main focus of this study was therefore foods prepared in the selected food facility categories and served to the public in Alameda County, California.

Significance

Preventing foodborne illness in food establishments requires structured education designed specifically for food handlers. In every food establishment, food handlers have the closest contacts with foods stored, prepared, and served to the consumers. Due to

direct contact between food handlers and the foods served in food establishments, it becomes obvious that the food handlers could be held responsible for food safety in food facilities. The facility operators and food handlers should be held accountable and are expected to assimilate, cooperate, and comply with the established rules and regulations on food safety requirements. On the other hand, it is the responsibility of various health agencies and departments to invest a reasonable amount of time and resources in educating food establishment managers and food handlers in an effort to prevent food contamination and possible foodborne illness. Although education and assimilation of food safety rules may be achieved, it was shown in past studies that food handlers still made a series of mistakes in food handling practices, despite the amount of time devoted to training (Knowls, Heinemann, House, & Hill, 2002; Nummer et al., 2010). There are over 6,000 food establishments in Alameda County, and on average, each facility serves more than 100 customers daily. A major outbreak of foodborne illness in any of the food facilities could have serious impacts on the individuals involved, the food facility, and the community, leading to possible public health and financial burdens on society. Scharff, McDowell, and Medeiros (2009) conducted a study in the state of Ohio to determine the economic burden of foodborne illness in the community. The researchers estimated that the state spent about $7.1 billion (or $624 per Ohio resident) annually due to foodborne diseases. In an earlier study, it was estimated that the United States spent up to $152 billion a year on foodborne illness. However, this figure was later revised in 2012, when the CDC record estimated that the annual burden of foodborne illness in the United States was $77.7 billion, with 3,000 deaths (Scharff, 2012). As noted in the CDC report, the

revised estimate was only based on medical costs, productivity losses, and deaths. The estimates did not include costs to the food industry, expenses to public health agencies, or costs due to long-term effects on the victims in the United States. WHO (2007) records indicated that the global incidence of foodborne illness was difficult to estimate but that in 2005, 1.8 million people died from diarrheal diseases as a result of food and water contamination.

It is almost impossible to estimate the number of persons affected by foodborne illness on an annual basis, particularly in developing countries. Ethnicity and cultural beliefs play significant roles in the occurrence and perception of foodborne illness in developing countries. Quite frequently, foodborne illness is attributed to poison introduced into the food by an enemy or a jealous relative, friend, or neighbor. Furthermore, if the ill person dies, the death is generally blamed on the dead person's destiny. Developed nations, including the United States, are no exception in the underreporting of foodborne illnesses. In the United States, various ethnic groups rarely report foodborne illnesses contracted from foods purchased from or eaten in food facilities owned and operated by members of their own racial or ethnic group. Consequently, unreported foodborne diseases are more prevalent among members of minority ethnic groups than in the general public. Although all incidents of foodborne illnesses reported to the health agency are strictly anonymous and confidential, members of minority groups often consider the report of a foodborne illness acquired from establishments owned and operated by a member of their community to a government agency as being unethical and a betrayal of one another. The underreporting of foodborne

illness due to cultural and social ties will continue to affect the number of recorded foodborne illnesses in many countries, including the United States.

This study on the effect of placard grading on food safety in food facilities may contribute to a better understanding of the relationship between food handlers and food safety in food facilities by making operators aware of sources of cross-contamination, while motivating food handlers to take precautionary measures to prevent possible foodborne illness. The placard grading system is designed to warn food facility patrons to avoid becoming victims of foodborne diseases. The display, while serving as a public health education symbol, also serves as a warning to the general public to avoid eating in food facilities with serious health violations. Placard grading is used as a behavioral deterrent to control poor food handling practices. In practice, food handlers rarely admit they did something wrong during food preparation.

Food processing and preparation are conducted in several stages and steps. The exact time and stage of cross-contamination of food are not easily detectable. The introduction and revision of HACCP in 2007 and in 2009 were meant to resolve the problem of where, when, how, and at what stage cross-contamination occurs in the food handling process. While the HACCP is suitable and practical in an industrial food setting, it is hardly suitable or convenient in many small- to medium-sized retail food facilities. Consequently, HACCP is rarely practiced in retail food establishments. Due to lack of resources and time to implement HACCP in retail food facilities, most of the responsibilities for food protection fall on the food handlers, who are quite often not trained in HACCP practices. It could be appropriate to state that a substantial majority of

food handlers in retail food facilities do not know the meaning or purpose of HACCP. Although knowledge of HACCP is not a prerequisite for personal hygiene and good food handling practices, it is an essential part of food protection and an important food safety tool.

The occurrence of foodborne illness in a food facility is hardly accidental, as it can be prevented. It has been shown in past studies that food properly controlled in the appropriate environment rarely spoils by growing microorganisms within a given period, thus causing foodborne illness. However, when foods are left unattended in an improper environment, stored or processed on unsuitable surfaces, exposed to cross-contamination through human contacts, temperature abused, or adulterated, the likelihood of causing foodborne illness is increased exponentially. In other words, food contamination and foodborne illness occur as consequences of mishandling. Efforts to control food safety should therefore focus primarily on human behaviors.

Behaviors can be learned and unlearned, as evidenced by Skinner in his development of operant conditioning theory (Yiannas, 2010). The use of green, yellow, and red placards represents an effort to control food handlers' behaviors. The placard colors represent reward and punishment for acceptable and unacceptable food handling behaviors in food facilities. Taking into consideration the number of lives and amount of money lost, compromised individual as well as community health, and societal and individual productive disruptions due to foodborne illness resulting from improper food handling behaviors in the United States, effective placard grading in food facilities would

greatly alleviate human suffering by improving community public health through food safety.

The goal of this placard grading study was to educate and to motivate not only food facility operators, but also food workers to become more proactive in food handling practices, and at the same time to educate and protect individual consumers and public health. Practicing food safety can prevent foodborne illness in food facilities, and this positive achievement would result in social change.

Social Change Implications

The social change goals of this study were to inspire and motivate food facility operators and food handlers to practice food safety and prevent possible foodborne illnesses. The study involved using placard grading as a motivating factor to improve food safety conditions inside food facilities. When sanitation conditions improve in food facilities, fewer people become ill from foodborne diseases. On the other hand, when individuals or families become ill after dining in a restaurant, many people are affected; including the facility owner, the food handlers, the foodborne illness victim(s), and the local health inspectors, who spend several hours attempting to find the source or cause of the illness. In some cases, the affected group may file a lawsuit against the food facility owner(s), claiming compensation for hospital expenses and other damages. If death occurs, the consequences may result in closure of the restaurant and the dismissal of the food facility employees. Closing a food facility has many negative implications for its community. The objective of this study was therefore to evaluate the use of placard grading.

When placard grading is determined to be effective, it will then be applied as a health inspection tool to improve food safety in facilities and motivate the operators, as well as the food handling employees, to become more proactive in food handling practices. Placard grading will also be used to educate consumers about and protect them from possible foodborne illness infections. Preventing foodborne illnesses will in turn avoid closures of food service facilities, and give food workers job security—not only in one facility, but also in other food facilities within Alameda County. Improvement in food safety will have a positive impact on social change.

Summary

Food safety is everyone's responsibility, whether the food is prepared and served at home or in a food facility. This study focused on how food is handled in retail food establishments in Alameda County, California. The CDC (2011a) has indicated that a significant number of people in the population become ill, many are admitted to hospital settings, and others die each year as a result of foodborne illnesses. Although food facilities are routinely inspected by local health agencies, the question remains: "What is the most effective way to prevent foodborne disease?" Past studies have shown that improper food handling and poor personal hygiene are the major causes of foodborne illness. This study was designed to determine the effect of placard grading on food handling practices in food facilities. Literature review and analysis are addressed in Chapter 2, in an effort to show possible links between poor food handling practices and foodborne diseases. Chapter 3 contains a description of the study's methodology,

including data collection and analysis. Chapter 4 presents the results of the analysis, and Chapter 5 contains a discussion of the study's conclusions.

Chapter 2: Review of Literature:

Introduction

Studies in food safety are ongoing events conducted in an effort to prevent possible foodborne diseases. Several research studies have been performed at different levels—by individuals, institutions, local health agencies, states, and national agencies—to determine why and how foods become contaminated with microorganisms, and at what points the food handlers in food establishments fail to properly protect foods. Fein, Lando, Levy, Teisl, and Noblet (2011) noted that determining food handling risk to consumers has not been practicable in the past several years due to differences in the designs of published studies. There are differences not only in type, size, circumstance, and variety of foods, but also in individuals' perceptions of foodborne illness risk factors. There is no uniformity observed in the past literature, and causes of foodborne illness differ. One of the major reasons for a lack of dramatic improvement in food handling is food handling culture. *Culture* is defined as patterned ways of thought and behavior that characterize a social group (Yiannas, 2010, p. 11). Quoting from Coriel, Bryant, and Henderson (2001), Yiannas (2010) observed that food culture can be learned through socialization processes and that group culture persists through time. Based on the culture of a defined group in a food establishment, food handling habits will continue to influence the ways in which individuals and groups conduct food handling practices, despite ongoing educational training and lessons in food safety. In addition to group culture among food handlers, ethnic food handling culture and foodborne illness perception directly and indirectly affect food safety in food establishments. A survey of

food safety professionals between 1990 and 2003 showed that ethnic foods caused 135 outbreaks with 2,593 cases of foodborne illnesses (Mauer et al., 2006). The issues cited in this study (Mauer et al., 2006) included foods from unsafe sources, inadequate cooking, improper holding temperatures, contaminated equipment, and poor personal hygiene. As the United States embraces many different cultures, ethnic foods become increasingly important and available in food establishments across the country.

Purpose of the Study

The purpose of this study was to determine the effect of color-coded placard grading on food safety in food facilities. Human hands are the primary contact in food contamination, and most foods must pass through several hands—from farms to dining tables—before being consumed. In concept, placard grading and posting in food facilities is an attempt to change behavioral patterns of food service workers. The habits and preferences of consumers also play important roles in the selection of foods to eat, whether in grocery stores or in ready-to-eat food facilities. Koc and Ceylan (2009) conducted a case study in Eastern Turkey on consumer awareness and information sources on food safety. Among the 300 participants, 85% of those with a university-level education and 56% of those with a lower level of education changed their food purchasing habits after watching a syndicated food safety information program on television. The results of the study also showed that the majority of the consumers started paying attention to the quality and nutritional value of the foods they purchased. In another study of personal behaviors concerning food safety, Gauci and Gauci (2005) indicated that in general, consumers were aware of the recommended food safety

precautions; however, many still adopted high-risk behaviors. It is a matter of general knowledge for environmental health specialists that foodborne diseases are underreported, particularly in home-prepared meals, group picnics, and family parties, due to poor food handling practices and consumers' lack of awareness. In such cases, reports of foodborne illness to health agencies are rare, unless the individual(s) had been previously exposed to salmonellosis, had a dependent who had been exposed, or had developed a higher level of food safety knowledge and awareness (Gauci & Gauci, 2005). In his book *Food Safety Culture*, Yiannas (2010) stated that, "Behavioral theory is largely based on B. F. Skinner's 1953 work on operant conditioning. According to this theory, repeated pairing of the desired response with a positive or negative reinforcement can either increase or decrease the behavior", (p. 23). In other words, the regular posting of placards on the facility window is expected to decrease or increase poor food handling behaviors among facility food handlers. If a decrease in poor food handling is observed, it could be attributed to a change in food handling culture, and consequently a positive outcome in food safety awareness.

Food Safety

Food safety represents exactly what the term indicates: safe food for human consumption. Complete food safety has not yet been achieved anywhere in the world, including the United States, as reported by Bryan (2002). Evidence of inadequate food safety is indicated by the number of reported foodborne disease outbreaks, laboratory-confirmed cases of diseases that can be attributed to foodborne diseases, estimates of foodborne illnesses based on surveillance data, and out-of-compliance risk factors

regularly observed and documented by health inspectors in food establishments. Food safety specialists are aware that lack of food safety practice does not always involve ignorance of safe food requirements. Abbot et al. (2009) conducted a comparison of food safety cognition and self-reported food handling behaviors of young adults. The authors found that although the students scored high on a pretest on food safety, the majority of the group still engaged in unsafe food handling practices. In a similar study, Morrone and Rathbun (2003) added that male college students exposed themselves to possible foodborne diseases through consumption of rare hamburgers more often than their female counterparts. The researchers concluded that possession of food safety knowledge does not necessarily translate into safe food handling practices. Using a broader definition, Knechtges (2012, p. 36) stated that food safety is the state of acceptable and tolerable risks of illness, disease, or injury from the consumption of food. The author added that food safety is achieved through policies, regulations, standards, research, engineering design and technology, surveillance and monitoring, and other applicable measures to reduce the risks or control hazards in the food chain.

As more American families become engaged in the workforce outside the home, more people—especially households of working couples—depend on ready-to-eat foods known as *home meal replacement* (HMR). Due to lack of time to prepare home-cooked meals, it becomes more appropriate and convenient to either eat in a sit-down food facility or purchase ready-cooked meals. It was estimated that in the year 2003, Americans spent more than $170 billion on meals prepared outside the home but consumed at home (Binkley & Ghiselli, 2005). Food safety becomes a concern in this

type of meal service due to the volume of food sales, high turnover of food handlers, level of food safety knowledge of the food handling employees, temperature of the purchased meal while in transit, and time lapse before the meal is consumed. Environmental health specialists who are involved in food safety training are aware of the needs and difficulties of more than 1 million food establishments serving about 70 billion meals a year in the United States. In a survey of environmental health specialists providing food safety training to food facility employees, Nummer et al. (2010) indicated that the ultimate safety of foods in food establishments lies with the restaurants' management and employees. Health professionals have documented evidence to support their beliefs that food contamination and foodborne illness outbreaks occur primarily due to lack of personal hygiene, employees' wrong behavioral practices, and inefficiency of operational management. Based on this theory, a group of researchers decided to examine the most likely behaviors that often lead to food contamination, and consequently to foodborne illness. Medeiros, Kendall, Hillers, Chen, and DiMascola (2001) selected a group of experts in epidemiology, microbiology, and food safety education, as well as food safety policymakers, to identify the key behaviors associated with causes of foodborne illnesses. The purpose was to tap the knowledge and experiences of the experts and use the information to plan future food safety educational programs. Based on the analysis provided by the experts, a total of 29 key food handling behaviors were identified, including lack of hand washing, failure of an ill person to self-report, uncovered open wounds, wrong cooking temperatures, failure to use thermometers, and failure to reheat foods to adequate temperatures. In summary, the health experts listed the

following as the major behaviors associated with foodborne illnesses: poor personal hygiene, inadequate cooking, cross-contamination, failure to keep foods at the required holding temperatures, and obtaining foods from unsafe sources (Medeiros et al., 2001).

Food Handling Practices

Food handling has always been a problem, whether at home or in a defined food facility. There are various reasons why food safety will continue to be a challenge in every society. For example, there are individual differences not only in food handling practices, but also in how each food facility is operated, how each person perceives foodborne illness risks, and most importantly, the style or culture of the food facility management. A food facility requires structured management similar to that of a well-functioning organization in which orders come from the top. Success or failure of the organization often depends on the decisions made at the top level. The WHO estimates that foodborne diseases affect about 30% of the world's population in developed countries, and in developing countries, more than 2 million people die each year due to foodborne diseases. Food handlers with poor personal hygiene who work in food facilities are potential sources of infection by many helminths, protozoa, and entero-pathogenic bacteria (Dagnew, Tiruneh, Moges, & Tekeste, 2012). In a cross-sectional study involving 200 food workers conducted by Zaglool, Khodari, Othman, and Farooq (2011), the food workers' fingernails tested negative for bacteria, but *Staphylococcus aureus* was isolated in most of the food handlers. Forty-six percent of the food handlers tested positive for intestinal parasites, with *Giardia lamblia* the most prevalent, followed by *Entamoeba histolytica*. In another study of prevalent foodborne diseases, Appleton

(2000) found that the two main causes of foodborne infections were viral gastroenteritis caused by round viruses of the *Norwalk* group, and hepatitis A. Although both infections normally are transmitted from person to person, they may occasionally become foodborne or waterborne viruses.

Okojie, Wagbatsoma, and Ighoroge (2005) conducted a cross-sectional study of 102 food workers in a Nigerian institution to determine food handling practices. The results showed the majority of the food handlers had poor knowledge of personal hygiene and low and infrequent hand-washing habits, and that only about 30% had undergone preemployment medical examinations. The findings of this study are not surprising, considering that most food establishment workers and street food vendors in developing countries operate without permits or regulations. Food safety has additional implications in developing countries. Members of the public rarely question the safe condition of the food purchased, the temperature, equipment, or utensils used, the source of the food, or the environmental condition in which the food is displayed. Significant numbers of the public do become ill after consumption of contaminated foods; however, they seldom associate their ill health with food recently consumed, and in some cases may attribute their illnesses to a natural phenomenon. Poor sanitation, few or no regulations, as well as cultural and religious beliefs, affect food handling practices in developing countries. A study of street food vendors in Malaysia showed that many of the illegal food vendors were willing to learn and practice food safety measures, but often the printed public health guidelines and information were kept secret by the authorities, leaving the food operators ignorant of food safety regulations (Pang & Toh, 2008).

The United States has a growing population of people older than 60 who live alone. A recent study of the elderly population showed poor food handling practices, particularly amongst members of poor and minority groups. Most individuals in the group, who were already immunocompromised, had poor perceptions of foodborne illness, and in several instances kept their potentially hazardous meals at the danger zones longer than is optimal (Roseman, 2007). Although the American food supply is considered safe, mishandling of foods, especially potentially hazardous foods, provides venues for contamination by disease-causing bacteria or pathogens. Most of the disease-causing bacteria are found on the outside of foods such as meat, poultry, or seafood. However, if the same food products are cut open, sliced, or ground, the pathogens have additional surface area on which to grow, according to Mancini, Murray, Chapman, and Powell (2012). With the exposed parts of food products containing most of the bacteria, frequent hand washing becomes important in the food handling process in an effort to prevent cross-contamination between different foods, kitchen utensils, and food equipment. The investigation of an outbreak of *Norwalk*-like viral gastroenteritis in the state of Ohio in 1999 showed that food facilities with frequent food safety violations and inadequately trained food handlers were more likely to have foodborne disease outbreaks than facilities in compliance with food safety regulations. Kassa (2001) conducted a case-control study to determine the cause of the *Norwalk*-like outbreak and found that 93 of 137 attendees became ill after consuming foods at an event. The author also noted that a total of 57 health violations were found during postoutbreak inspection of the food facility involved, including poor sanitation of food contact surfaces, improper food

temperatures, and poor employee hygiene. The same food facility had often been cited in the past for poor food handling practices. The author concluded that food facilities with poor inspection results are more likely to cause foodborne outbreaks than facilities with good food handling inspection results.

Many health professionals often ponder the efficacy of education and training given to food workers—if the training is effective, how long the retention period would last, and how long the recipients would continue to put the education into practice. In a study by Malhotra, Lal, Prakash, Daga, and Kishore (2008), 136 food handlers were provided with health education training, using posters and interactive flipchart sessions. The same group was retested after 3 months to determine food safety retention and practice. The researchers noted that the majority of the participants remembered the diseases associated with foodborne illness, and the measures to prevent contamination through personal hygiene and frequent hand washing. In the same study, the group also demonstrated that learning through memorization is easier than practicing what has been learned. In a similar study, the participants showed better performance in the posttests than the pretests (Yarrow, Remig, & Higgins, 2009). For example, a group of college students was tested on food safety attitudes, beliefs, knowledge, and self-reported practices after educational training on food safety. Results showed better performance in posttests than in pretests (Yarrow, Remig, & Higgins, 2009). In another study involving educational intervention, the participants had shown improvement in food safety, but the knowledge gained did not translate into actual food safety practices; in other words,

although the participants acquired food safety knowledge, they could not put the experience into practice (Redmond & Griffith, 2003).

Food establishment managers play important roles in safe food handling practices. Management is responsible for overseeing identifiable major factors that could lead to possible foodborne illnesses: for example, improper food holding or storage temperatures, and poor personal hygiene among food service employees. A study of a group of managers showed that food establishment managers with health agency training, plus years of experience, performed the best among the 231 surveyed. It was also shown that facility managers who received only food industry training did not perform well, whereas those who did not receive any training performed the worst (Lynch, Elledge, Griffith, & Boatright, 2003; Nummer et al., 2010). The food facility managers who received only food industry training perhaps lacked health agency training, which covers a wider perspective and more detailed food safety information. The majority of food industry trainings focus specifically on their particular industrial products.

Environment and Food Equipment

Other aspects of food safety often overlooked in studies are the conditions of food storage equipment and the processing environment. Food processing environment and equipment design are as important as the behaviors of food handling employees. Without sufficient clean and ventilated space, appropriate equipment, proper lighting, and availability of a clean and potable water supply, food handlers are indirectly handicapped in performing their delegated duties. Food safety experts agree that to ensure safe food and adequate sanitation, the food facility and surrounding processing environment must

be designed and constructed with sanitary principles in mind (Schmidt & Erickson, 2005). In a poorly designed and constructed food facility, food handlers may not be capable or knowledgeable enough to control harborage and infestation by rodents and other vermin. In addition, the presence of mold, mildew, chemical or other pollutant contamination could become overwhelming and threaten food safety. Food storage and processing equipment play crucial roles in food safety. Equipment designers and food operators know that poorly designed equipment is more likely to expose foods to possible microbial contamination. Faulty equipment breaks down easily, causing loss of foods, time, and finances, as well as creating possible sources of foodborne illness. Food equipment should therefore be hygienically designed and must not contain toxins or microbial organisms, or residues of cleaning and disinfecting chemicals.

Cleaning is a critical component of food safety in a food facility. Both the food processing environment and the equipment require scheduled detailed cleaning procedures to remove microorganisms from surfaces and prevent possible contamination of foods. The purpose of cleaning and sanitizing food contact surfaces is to remove foods or nutrients that bacteria need for growth, and to kill bacteria present on the surfaces. It is important therefore that all food safety programs should include sufficient time devoted specifically to cleaning and sanitizing, using safe and effective methods.

The Food Industry

The food industry and food facility management have important roles to play in food safety and in preventing foodborne illness. While public health department guidelines emphasize food safety and the reduction of microbiological contamination of

food products, food industry operators must also continue to make concerted efforts to reduce the risk of food contamination by regular training, and require employees to maintain good personal hygiene and safe food handling practices. In a preemployment screening study involving 120,000 food handlers conducted by occupational health physicians in Britain, skin and gastrointestinal disorders received the highest priority for exclusion of workers from food handling employment (Harker, 2001). McCollum et al. (2012) conducted a study of a multistate outbreak of *Escherichia coli 0157:H7* infections associated with in-store sampling of an aged raw-milk Gouda cheese in 2010. The investigation showed that 41 people became ill with *E. coli 0157:H7* after consuming samples of the aged raw-milk Gouda cheese. The source of infection was traced to sanitation deficiencies and poor food handling practices at the cheese manufacturing company and in the retail food stores.

Human noroviruses (HNoV) have often been implicated in gastrointestinal outbreaks associated with fresh produce, juices, and ready-to-eat foods. Horm, Davidson, Harte, and D'Souza (2012) conducted a study to determine the risk of HNoV transmission by contaminated blueberry juice, and the survival rate of HNoV surrogates. Results showed that virus surrogate survival in blueberry juice at 4ºC correlates with ease of HNoV transmission via juices. On the other hand, there was a significant reduction in HNoV after homogenization. In another study by Park et al. (2012), the team reviewed 68 studies to determine the origin and source of produce contamination, from farm to food facility. The three targeted contaminants were *Listeria*, *Salmonella*, and *E. coli 0157:H7*. The conclusion was that animal-related contacts produced more serious contamination

and were more frequent than other sources. Animal-related contacts included urine and feces. Other sources of contamination were soil, non-pH-stabilized manure, and use of spray irrigation with contaminated water. The researchers suggested that reducing microbial contamination of irrigation water and soil are the most effective means of preventing and controlling produce contamination. In many developing countries, microbial food contamination remains a major economic and public health burden. Foodborne pathogens commonly isolated include *Brucella*, *Clostridium botulinum*, fecal coliforms, *Escherichia coli 0157:H7*, *Listeria monocytogenes*, *Salmonella*, and *Staphylococcus aureus*. In a review conducted by Kamleh, Jurdi, and Annous (2012), the group found that the named microorganisms are frequent causes of major reported foodborne illness outbreaks in Arab and other developing countries.

Regulatory Issues

Local environmental health departments, public health agencies, and state health agencies are responsible for inspection and enforcement of food safety requirements. The health agencies follow food safety standards and guidelines set by the FDA. All foods must comply with the FDA food safety regulations to protect the public's health by preventing food adulteration and misbranding (McSwane et al., 2004, p. 363). In the process of searching for better and more effective ways to enhance food safety, the FDA developed the HACCP system. The system is designed to follow the flow of food through the food establishment, identify each step in the food handling process, and determine at what point contamination might cause the food to become unsafe. In the process, when a problem step is identified, action is taken to make the food product safe, or if an

immediate correction is not feasible, the food is discarded (McSwane et al., 2004, p. 11). Public health authorities have always debated the most effective method of conducting retail food facility routine inspections. In the past, routine food facility inspections had focused primarily on monitoring and enforcing compliance with applicable laws. However, many health authorities have begun to question the effectiveness of such inspections versus other strategies, such as food handler education and public disclosure inspections, including grading and posting of inspection results (Newbold, McKeary, Hart, & Hall, 2008). The debate resulted in different methods of conducting food facility inspections and evaluations. In many local and statewide health agencies, the traditional food establishment inspection involves pointing out and demonstrating to the operators either the wrong or the right ways to handle foods. However, the introduction of HACCP prompted a new direction in food facility inspections by introducing grading and placard methods. The latest research comparing the old method of inspection with the grading system was conducted in Norway. Rossvoll et al. (2012) analyzed 2,008 self-reported surveys comparing a risk-based grading system with the traditional "right" and "wrong" methods. Most of the survey participants responded that the use of risk-based grading gave a more realistic picture of risks associated with food handling practices. The authors concluded that the surveys built upon the HACCP-based approach using risk-based grading contributed to a better understanding of food handling practices, both domestically and in commercial food establishments. Availability of resources also plays an important role in food safety. When regulatory agencies cut back spending, it reduces their workforce and affects food safety monitoring programs, such as pesticide detection

and food inspections, and eliminates some other food safety programs, according to a study by Brackett (2006), who heads the FDA's Center for Food Safety and Applied Nutrition (CFSAN).

Despite millions of routine restaurant inspections performed in the United States each year, the CDC data indicate that the majority of foodborne illness outbreaks occur in restaurant settings, with a certain percentage occurring in institutional food facilities. Another setback to food safety occurs when foodborne illness outbreaks are not expeditiously handled, due to barriers to investigating foodborne or enteric outbreaks, according to a study by Boulton and Rosenberg (2011). The authors conducted a web-based questionnaire to collect information about national food safety from the Council of State and Territorial Epidemiologists (CSTE). All 50 states reported barriers to the investigation of foodborne diseases, including delayed notification of outbreaks, lack of sufficient food safety staff members, lower prioritization of investigations, lack of ability to pay overtime costs, lack of adequate epidemiology expertise, difficult working with in-state agencies, constraints related to administrative support, and difficulties working with other state or federal agencies. The result of the epidemiological assessment indicated that the states need 304 or more full-time employees working in food safety surveillance, investigation, and educational training to reach the required full program capacity. Public health agencies and local environmental health specialists are constantly in search of ways to minimize potential foodborne illness outbreaks. On this basis, routine food facility inspections are reinforced with food safety training aimed at food facility managers and employees. In a survey of the activities of health agencies, Nummer et al.

(2010) noted that many environmental health specialists conducted food safety training monthly or quarterly to meet the needs of their jurisdictions. Studies have also been conducted to determine if the frequency of food facility inspections has any effect on sanitation, and consequently on foodborne illness prevention. The researchers obtained a mixed result, according to Newbold et al. (2008). In this study, sanitation improved when inspection of premises increased from 2 to 4 times annually; however, a similar study by a different group showed either no significant difference or a decrease in sanitation as the inspection frequency rate increased. The authors concluded that there is little scientific evidence to support the impact of increased routine inspections on compliance rates. Food facility adherence to or noncompliance with regulations often has differing results. Petran, White, and Hedberg (2012) conducted a study that showed that food facilities with more health violations are likely to have more foodborne illness outbreaks. The researchers noted that about 11 more health violations were recorded at restaurants that had outbreaks, than in restaurants that did not have outbreaks. The study also showed that the majority of the violations related to food contamination occurred during food processing, in the preparation environment, and due to food handling procedures. The three major causes of foodborne illness outbreaks were *Norovirus*, *Clostridium perfringens,* and *Salmonella* infections. The results of this study may serve as a predictor of potential foodborne illness outbreaks in poorly managed food establishments.

In the present age of the Internet, it is expected that essential information such as food safety should be made available to a large audience in many countries around the world. Although many developed countries have made efforts in this direction, food

safety information on the web is still lacking in most countries around the world, particularly in developing countries. A study by Namkung and Almanza (2006) showed that out of 192 WHO-member countries, only 11 nations operated food safety web sites. Most of the existing food safety web sites are located in Europe and North America, whereas countries in Africa, Asia, and South America do not have access to web-based food safety information. With growing dependence on the Internet as a public information source, it is expected that each country should make a concerted effort and take advantage of the worldwide web by providing free food safety information to its citizens.

Summary

Several studies exist on food safety and foodborne diseases. However, while the literature review addressed many aspects of poor food handling practices and the consequent results of foodborne illnesses, there is a lack of uniformity in research methodologies due to the differences in and uniqueness of each study (Fein et al., 2011). Food safety researchers generally agree that foodborne illnesses occur due to improper food handling practices. For example, Dagnew et al. (2012) indicated that food handlers with poor personal hygiene who work in food establishments could be potential sources of many foodborne illness infections. There are also existing textbooks and other informative health materials on food safety for educational purposes, and guidelines on food handling in food establishments. Although adequate training resources may be available, Almanza and Nesmith (2004) reported that the tremendous growth of the food service industry in recent years created labor shortages in food establishments and the

hiring of employees with literacy barriers. These factors have resulted in food handlers who receive quick but inadequate training in sanitation procedures.

Chapter 3: Research Method

Introduction

This chapter consists of the research methodology, research design, instrumentation, data collection and analysis, and ethical considerations of the study. The chapter also addresses the rationale for choosing the research design, including the sample size and characteristics of data collected.

Purpose of the Study

The purpose of this study was to determine whether using a placard grading system as a health inspection tool would improve poor food handling practices and reduce foodborne illnesses in retail food facilities in Alameda County, California. One of the factors in reducing foodborne diseases in a population is the ability of local health agencies and their inspectors to convince food handlers to adopt established food safety requirements (Chapman et al., 2011). Past studies have shown that food handlers with poor personal hygiene who work in these facilities are potential sources of infections due to many intestinal helminths, protozoa, and entero-pathogenic bacteria. The WHO estimates that foodborne diseases affect 30% of the population in developed countries. Furthermore, in developing countries, about 2 million people die yearly due to foodborne illness, according to Dagnew et al. (2012). In most cases, humans serve as the cross-contamination medium between bacteria and foods.

The placard grading system uses color-coded cards—green (pass), yellow (conditional pass), and red (closed)—to inform the public of the safety status within the food facility at the time and date of the inspection. There are over 6,000 food

establishments in Alameda County, but the sample size of this study was limited to 1,410 food facilities.

Research Design and Approach

This study employed a quasi-experimental design, with pre and post testing from Year 1 to Year 2, using one-sample *z* tests. The one-sample *z* test was the most appropriate means of finding a significant difference between the mean percentages of those food establishments with violations over the 2-year period. Data for this study were supplied by the Alameda County Environmental Health Department. A random sampling technique was used to select the food facilities that fell within each placard grading category. The use of a random sampling technique ensures that each food facility has an equal chance of being selected (Creswell, 2009). Sampling using this technique ensures that each subcategory of food establishment is represented. Trochim and Donnelly (2007) stated that one of the advantages of random sampling is that it gives each subject an equal chance to be selected, thereby providing an unbiased selection of data for the study. The data were stored in an Excel file format and analyzed with SPSS software version 22. The SPSS data output was used to make a determination on the following research questions:

RQ_1: Are there statistically significant differences in the number of major violations in food facilities between the first year and the second year of placard grading?

H_01: There are no statistically significant differences in major violations in food facilities between the first and second year of placard grading.

H_A1: There are statistically significant differences in major violations in food facilities between the first and second year of placard grading.

RQ_2: Are there any statistically significant differences in the percentage of food facilities with minor violations between the first year and the second year of placard grading?

H_02: There are no statistically significant differences in minor violations in food facilities between the first year and the second year of placard grading.

H_A2: There are statistically significant differences in minor violations in food facilities between the first and the second year of placard grading.

RQ_3: Are there any statistically significant differences in the number of facilities with green and red placards between the first year and the second year of placard grading?

H_03: There are no statistically significant differences in the number of green and red placards between the first year and the second year of placard grading in food facilities.

H_A3: There are statistically significant differences in the number of green and red placards between the first year and the second year of placard grading.

RQ_4: Are there any statistically significant differences in the number of confirmed foodborne illnesses between the first year and the second year of placard grading in food facilities in Alameda County?

$H_0$4: There are no statistically significant differences in the number of confirmed foodborne illnesses between the first year and the second year of placard grading in food facilities.

H_A4: There are significant differences in the number of confirmed foodborne illnesses between the first year and the second year of placard grading in food facilities.

Setting and Sample

The 6,000 food facilities in Alameda County include traditional restaurants, take-out restaurants (fast foods), public school cafeterias, food markets/grocery stores, institutional food facilities, farmers' markets, mobile food trucks, and temporary food facilities. Although chances for mishandling food exist in every food facility, the selected groups of food establishment categories had greater risks for foodborne diseases due to the type of foods served, the number of people served, and the health conditions of the group of people served on a daily basis. Other food facility categories not selected for this study were catering facilities, mobile food facilities, and temporary event facilities, including farmers' markets. Control of food handling activities was also taken into consideration during the food facility category selection process. For instance, it is not quite feasible to control food handling processes at temporary events. The food categories in this study were fixed facilities:

- 333—Restaurants with over 75 seats
- 282—Restaurants with 51–75 seats
- 263—Take-out restaurants with three or more food handlers

- 260—Take-out restaurants with two or fewer food handlers
- 192—Public school cafeterias
- 67—Food markets over 10,000 sq. ft.
- 13—Institutional food facilities

Facility Selection Process

In each of these food categories, 1 food facility was randomly selected for every 3 food facilities. If the selected food facility did not meet the criteria, then the next facility was chosen. For example, 192 school cafeterias were randomly selected from 610 cafeterias in the group.

Tables 2 to 5 show samples of raw data collected from the various categories of food facilities in the study for the first and second years of placarding.

Table 2

Food Facility Grading Results: Number of Green, Yellow, & Red Placards Issued by Type of Food Facility

Type of food facility	Sample size	First year of placarding 7/01/2012–6/30/2013	Second year of placarding 7/01/2013–6/30/2014	Difference
Traditional restaurants (over 75 seats)	333	G: 265 Y: 59 R: 9	G: 271 Y: 55 R: 7	+6 -4 -2
Traditional restaurants (51 to 75 seats)	282	G: 223 Y: 46 R: 13	G: 240 Y: 40 R: 2	+17 -6 -11
Take-out restaurants (3 or more food handlers)	263	G: 237 Y: 25 R: 1	G: 228 Y: 32 R: 3	-9 +7 +2
Take-out restaurants (2 or fewer food handlers)	260	G: 226 Y: 30 R: 4	G: 220 Y: 36 R: 4	-6 +6 0
Food markets/ grocery stores (Over 10,000 sq. ft.)	67	G: 65 Y: 2 R: 0	G: 64 Y: 3 R: 0	-1 +1 0
Public school cafeterias	192	G: 182 Y: 10 R: 0	G: 188 Y: 4 R: 0	+6 -6 0
Institutional food facilities (nursing homes, assisted living, hospitals, and prisons)	13	G: 13 Y: 0 R: 0	G: 12 Y: 1 R: 0	-1 +1 0

Note. Key to placarding: G = green; Y = yellow; R = red.

Table 3

CDC Risk Factors—Number of Major Violations by Type of Food Facility

Sample size	Type of food facility	First year of placarding: 7/01/2012–6/30/2013	Second year of placarding: 7/01/2013–6/30/2014	Difference
333	Traditional restaurants (over 75 seats)	279	295	+16
282	Traditional restaurants (51–75 seats)	247	243	-4
263	Take-out facilities (3 or more food handlers)	205	196	-9
260	Take-out facilities (2 or fewer food handlers)	207	219	+12
192	Public school cafeterias	117	114	-3
67	Food markets (Over 10,000 sq. ft.)	45	40	-5
13	Institutions: hospitals, assisted living, prisons, & nursing homes	8	12	+4

Table 4

Non-CDC Risk Factors—Number of Minor Violations by Type of Food Facility

Sample size	Type of food facility	First year of placarding: 7/01/2012–6/30/2013	Second year of placarding: 7/01/2013–6/30/2014	Difference
333	Traditional restaurants (over 75 seats)	73	62	-11
282	Traditional restaurants (51–75 seats)	45	48	+3
263	Take-out facilities (3 or more food handlers)	70	72	-2
260	Take-out facilities (2 or fewer food handlers)	66	50	-16
192	Public school cafeterias	77	86	+9
67	Food markets (Over 10,000 sq. ft.)	30	36	+6
13	Institutions: hospitals, assisted living, prisons, & nursing homes	7	4	-3

Table 5

Confirmed Foodborne Illnesses by Type of Food Facility

Sample size	Type of food facility	First year of placarding: 7/01/2012–6/30/2013	Second year of placarding: 7/01/2013–6/30/2014	Difference
333	Traditional restaurants (over 75 seats)	20	18	-2
282	Traditional restaurants (51–75 seats)	7	9	+2
263	Take-out facilities (3 or more food handlers)	1	5	+4
260	Take-out facilities (2 or fewer food handlers)	4	7	+3
192	Public school cafeterias	0	0	0
67	Food markets (Over 10,000 sq. ft.)	0	0	0
13	Institutions: hospitals, assisted living, prisons, & nursing homes	1	4	+3

Traditional restaurants (*n* = 615). Traditional restaurants prepare and serve a variety of foods and meals. Their menu options are prepared mostly from scratch by combining and mixing different food items together. The major concerns are potentially hazardous foods such as beef, poultry, pork, beans, eggs, seafood, milk, milk products, and cooked vegetables.

Take-out restaurants (fast foods) (*n* = 523). In addition to serving PHFs, fast-food restaurants attract more customers than other types of food facilities. Quick preparation and service times allow for the volume of food sales and the number of

people served by these facilities to surpass those of other food establishments on any given day. Although the workers at fast-food facilities are trained in handling these types of food menu options, opportunities for making mistakes resulting in cross-contamination of foods still exist and can be more prevalent.

Public school cafeterias (*n* = 192). Foods served in public school cafeterias are limited in variety. There are fewer PHFs served; also the portion sizes can be smaller than in comparison to those in a traditional restaurant. Moreover, public schools that serve food in their cafeterias often may have a dietitian on staff who has food safety training, along with the staff. However, the potential for foodborne illness still exists due to the variety and demographic of the students being served.

Grocery stores (food markets; *n* = 67). The majority of food markets sell prepackaged dry goods, fresh and prepackaged meat and seafood, fresh produce, refrigerated, and frozen food items. Also, some of these grocery stores sell ready-to-eat foods, just like cafeterias or a deli. Some causes of foodborne illness can arise from inadequate store management, employees not following policies and procedures for food safety, outdated or spoiled food, poor equipment condition, or a generally filthy work environment.

Institutional food facilities (*n* = 13). This demographic of food facilities includes hospitals, prisons, assisted living facilities, and nursing homes. In this environment, PHFs constitute part of most food being served. There are many immunocompromised patients in the hospital facilities. Food handling practices in institutional food facilities are better controlled, based on the presence of a trained food safety expert—for example, a

registered dietitian/hygienist—who monitors food handling practices. The potential for foodborne disease exists due to the number of people served and the health conditions of the people being served.

Procedures and Instrumentation

The local county health agencies in California are mandated to implement the state health and food safety code through routine food facility inspections and other evaluation and control programs (Cal Code 2013). Although every county and local health agency in the state of California has the same mandate to enforce the health laws based on the health code, each local jurisdiction has the authority to add any appropriate and innovative evaluation tools to enhance its food safety program. Many different evaluation tools have been implemented and used for years to satisfy the state health mandate (Enriquez et al., 2009). In addition to the inspection and regular evaluation programs, some other food safety enforcement tools include: time and temperature controls, office hearings, citations, suspension or revocation of permits, and ultimately the food service facility could be closed, depending on the seriousness of the noted health violations.

The two newest food facility evaluation and control tools are placards and grading systems. Placard grading involves awarding a food facility a specific 8 x 11 color-coded card based on the result of the current evaluation and assessment of their food safety practices. In this format, a green card is awarded to signify satisfaction and approval, a yellow card serves as a conditional approval to allow the food facility operator to correct the noted health violations within a specified time, and a red card indicates food facility

closure (Enriquez et al., 2009). These placards are placed at the main entrance to the food facility, so that they can be seen by the public. The grading system is similar to the placard system, except that each food facility is scored on a scale from 0 to 100 points, with 100 being the highest score for no health violations. There are variations in the use of placards and grading systems—for example, Los Angeles County and New York City health agencies score each food facility from 0 to 100 points, and then assign grades of A, B, or C. Other environmental health agencies score food facilities numerically without assigning letter grades; for example, the City and County of San Francisco, California. The ACEHD recently adopted the placard grading system as one of its food facility control and evaluation tools. Placard grading actually is a combination of percentage scoring and placarding. Some environmental health agencies award numerical or percentage scores without placarding. For example, the City and County of San Francisco Health Department gives numerical scores only after food facility inspection, and the City of Los Angeles awards a percentage score only after food facility evaluation, without posting placards. The ACEHD posts a placard after percentage grading of the food facility (see Appendix B for grading report form and the placard). Scores ranging from 0 to 100 points are awarded, and depending on the result of the inspection, a green, yellow, or red placard corresponding to the numerical score value earned during the inspection is posted on or near the food facility's main entrance door. A facility scoring from 80 to 100 points is awarded a green placard to indicate that food handling practices, maintenance, and sanitation of the food facility are adequate; a yellow placard for a score of 75 to 79 points indicating that food handling in the facility and the overall food

handling practices, maintenance, and sanitation meet minimally acceptable standards; and finally a red placard is issued for a score of 0 to 74 points indicating immediate closure of the food facility due to poor food handling practices and imminent health hazards. Placards are conspicuously displayed for public view at or near the main entrance to the food facility. Color-coded placards are used by the Alameda County Health Department because color represents an international language that anyone can read and interpret, rather than the letters A, B, or C, which are for English and semi-English language readers only (ACEHD, 2012a). In addition to the placard being posted on the windows, the results of the facility inspections are also published on the county's website.

Alameda County uses a combination of two methods to evaluate each food facility. First, each facility is inspected (evaluated) using the official inspection form in Appendix B. Second, the score recorded during an inspection is used to determine the type of placard to be issued, also shown in Appendix B:

0–74 pts	Red placard
75–79 pts	Yellow placard
80–100 pts	Green placard

The CDC risk factors are used in determining the score. All food facilities in the red placard category are closed for major health violations.

Data Analysis

Data were entered into SPSS 22.0 for Windows for analysis. Descriptive statistics were used to describe the sample. Frequencies and percentages present the categorical

variables of interest, such as food facilities; means and standard deviations present continuous variables of interest, such as facility scoring.

Research Question 1

Are there statistically significant differences in the number of major violations in the food facilities between the first year and the second year of placard grading?

$H_0$1: There are no statistically significant differences in major violations in food facilities between the first and second year of placard grading.

H_A1: There are statistically significant differences in major violations in food facilities between the first and second year of placard grading.

To assess Research Question 1, and determine if there were statistically significant differences in the proportions of major violations in food handling practices between the first year and the second year of placard grading, a one-sample *z* test was conducted. The continuous dependent variable in the analysis was facility scores regarding food handling practices. Scores ranged from 0 to 100 and were measured at two time periods. Data were treated as continuous. An alpha significance level of .05 was used. Prior to analysis, the assumption of normality was assessed with a Kolmogorov-Smirnov (KS) test.

Research Question 2

Are there any statistically significant differences in the percentage of facilities with minor violations between the first year and the second year of placard grading?

$H_0$2: There are no statistically significant differences in minor violations in food facilities between the first year and the second year of placard grading.

H_A2: There are statistically significant differences in minor violations in food facilities between the first year and the second year of placard grading.

To assess Research Question 2 and determine if there were statistically significant differences in the proportions of minor violations in food handling practices between the first year and the second year of placard grading, a one-sample *z* test was conducted. The continuous dependent variable in the analysis was facility scores regarding food handling practices. Scores ranged from 0 to 100 and were measured at two time periods. Data were treated as continuous. An alpha significance level of .05 was used. Prior to analysis, the assumption of normality was assessed with a Kolmogorov-Smirnov (KS) test.

Research Question 3

Are there any statistically significant differences in the number of facilities with green and red placards between the first year and the second year of placard grading?

$H_0$3: There are no statistically significant differences in the number of green and red placards between the first year and the second year of placard grading in food facilities.

H_A3: There are statistically significant differences in the number of green and red placards between the first year and the second year of placard grading.

To assess Research Question 3 and determine if there were statistically significant differences in the number of green and red placards between the first year and the second year of placard grading, a one-sample *z* test was conducted. The continuous dependent variable in the analysis was the number of facilities with regard to food handling practices. The number of facilities with green and red placards was measured at 2 time periods in the study, at the end of Year 1 and the end of Year 2. Data were treated as continuous. An alpha significance level of .05 was used. Prior to analysis, the assumption of normality was assessed with a Kolmogorov-Smirnov (KS) test.

Research Question 4

Are there any statistically significant differences in the number of confirmed foodborne illnesses between the first year and the second year of placard grading in food facilities in Alameda County?

$H_0$4: There are no statistically significant differences in the number of confirmed foodborne illnesses between the first year and the second year of placard grading in food facilities.

H_A4: There are significant differences in the number of confirmed foodborne illnesses between the first year and the second year of placard grading in food facilities.

To assess Research Question 4 and determine if there were significant differences in the numbers of confirmed foodborne illness between the first year and the second year of placard grading in Alameda County, a one-sample *z* test was conducted. The continuous dependent variable in the analysis was the number of facilities that have had a

confirmed foodborne illness. The number of facilities with confirmed foodborne illnesses was measured at two time periods in the study, at the end of Year 1 and the end of Year 2. Data were treated as continuous. An alpha significance level of .05 was used. Prior to analysis, the assumption of normality was assessed with a Kolmogorov-Smirnov (KS) test.

One Sample *z* Test

For this research study, a one-sample *z* test was considered appropriate. When given a large enough sample size and the population mean and variance are known, the *z* test provides significant results. In this research study the population parameters were known and the comparisons were made at two different time periods against the population parameters.

Sample Size

To assess the four research questions, two dependent sample *t* tests and descriptive statistics were proposed. The dependent sample *t* tests require a more stringent sample size. G*Power was used to calculate the appropriate sample size. For a two-tailed dependent sample *t* test, using a medium effect size ($d = .50$), an alpha of .05, and a generally accepted power of .80 (Howell, 2010), the minimum required sample size to achieve empirical validity was calculated to be 35.

Test-Retest Reliability

The test of reliability is based on repeated inspection and evaluation of the same samples of food facilities. If these facilities continue to properly operate within the specified food safety and cleanliness guidelines as required by the health code, then the

instrument of measurement will be considered reliable and can be expanded to other local health agencies across the country.

Ethical Considerations

This study involved analyzing and comparing data already collected by the health inspectors who regularly inspect food facilities during routine evaluations in Alameda County, California. Preliminary data collected by the food service inspectors during Year 1 were analyzed, then the secondary data from Year 2 were also collected and formed the basis of this research study. Rudestam and Newton (2007, p. 276) indicated that methodologies involving secondary analysis of data do not require informed consent, and therefore can be classified as archival because they were previously collected and recorded in a computer system. However, due to the importance and requirements of the Institutional Review Board (IRB), and to ascertain that no rule of the dissertation study was violated, the advice and approval of the IRB at Walden University was sought and then authorization received. Official request was made to the IRB to obtain permission to use food facilities data for this study, despite the fact that the data are secondary. The IRB approved the contents of this study for compliance with ethical issues before data collection was started, issuing IRB number 07-21-14-0091963.

Summary

This chapter has focused on the study samples, data collection, and the use and function of placard grading as a food facility inspection tool. The participating samples were selected from the following categories of food establishments: traditional restaurants, take-out food facilities, grocery stores, school cafeterias, and institutional

food facilities. Random sampling was used to select the sample size of 1,410 food facilities from about 6,000 food establishments. The data for this study consist of previously collected and recorded inspection data and information obtained by the ACEHD inspectors during routine inspections and evaluations. Details on each inspection report include: type of food facility, date of evaluation, the overall score on the CDC Health Risk Factor, and the type of placard awarded: green, yellow, or red. The type and number of placards awarded to each food facility category were analyzed and summarized in the data tables. The SPSS program was used to conduct the statistical analysis of the collected data.

Chapter 4: Results

Introduction: Descriptive Statistics

This study consisted of a sample of 1,410 restaurants examined over a 2-year period. Included within the sample were several types of food establishments: traditional restaurants, take-out facilities, public school cafeterias, food markets, and institutions. Traditional restaurants were separated into two subsets: those with occupancies ranging from 51 to 75 seats, and those with occupancies greater than 75. The total number of traditional restaurants with 75 or more seats was 333. There were 282 traditional restaurants with seats in the range of 51 to 75. For take-out restaurants, there were also two subsets recorded: those with three or more food handlers and those with two or fewer handlers. There were 260 take-out establishments with two or fewer food handlers observed, and there were 263 take-out establishments observed with three or more food handlers. Within the total sample of food establishments, there were also 67 food markets (over 10,000 sq. ft.), 192 public school cafeterias, and 13 institutional food facilities consisting of (nursing homes, assisted living facilities, hospitals, and prisons). Table 6 outlines the frequencies and percentages for each type of establishment. Table 7 displays the frequencies of placard grading for the first and second years.

Table 6

Counts and Percentages of Sample Demographics

Type of facility	*N*	%
Traditional restaurants	615	44
Over 75 seats	333	24
51 to 75 seats	282	20
Take-out facilities	523	37
3 or more handlers	263	19
2 or fewer handlers	260	18
Public school cafeterias	192	14
Food markets	67	5
Institutions	13	1
Overall	1,410	100

Table 7

Counts of Specific Placard Grading by Food Facility Type for First Year and Second Year

	First year			Second year		
Type of facility	Green	Yellow	Red	Green	Yellow	Red
Traditional restaurants	488	105	22	511	95	9
Over 75 seats	265	59	9	271	55	7
51 to 75 seats	223	46	13	240	40	2
Take-out facilities	463	55	5	448	68	7
3 or more handlers	237	25	1	228	32	3
2 or fewer handlers	226	30	4	220	36	4
Public school cafeterias	182	10	0	188	4	0
Food markets	65	2	0	64	3	0
Institutions	13	0	0	12	1	0
Overall	1,211	172	27	1,223	171	16

Hypothesis Testing

Research Question 1

Are there any statistically significant differences in the percentage of facilities with major violations between the first year and the second year of placard grading?

$H_0$1: There are no statistically significant differences in major violations in food facilities between the first year and the second year of placard grading.

H_A1: There are statistically significant differences in major violations in food facilities between the first year and the second year of placard grading.

The results of the one-sample *z* tests for Research Question 1 showed insufficient evidence at the 0.05% level of significance for a statistically significant difference in major violations for any type of food facility between the first year and the second year of placard grading. This indicates that the differences in major violations from the first year to the second year can be explained by random variation. Table 8 presents the results of the *z* tests for Research Question 1. While no food facility category was significantly different in major violations between the two years, institutions had the highest difference between the years at .31 ($z = 1.86$, $p = .06$). Traditional restaurants (over 75 seats) had a much smaller difference at .05 but had a comparable *z* score ($z = 1.80$, $p = .07$). This was due to the larger sample size, decreasing variation, and enabling the test to detect significance with a smaller difference. Traditional restaurants (51–75 seats) had the

smallest magnitude of difference of -.01 (z = .50, p = .62). The overall difference of .01 (z = .51, p = .61) clearly indicates the lack of difference in major violations between years.

Table 8

Summary of Dependent Sample z Tests for Differences in Percentages of Major Violations From First Year to Second Year for Different Food Facility Types

Type of facility	p_1	p_2	*d*	*SE*	*z*	*p*
Traditional restaurants Over 75 seats	.84	.89	0.05	0.03	1.80	.07
Traditional restaurants 51–75 seats	.88	.86	-0.01	0.03	-0.50	.62
Take-out facilities 3 or more handlers	.78	.75	-0.03	0.04	-0.92	.36
Take-out facilities 2 or fewer handlers	.80	.84	0.05	0.03	1.37	.17
Public school cafeterias	.61	.59	-0.02	0.05	-0.31	.75
Food markets	.67	.60	-0.07	0.08	-0.90	.37
Institutions	.62	.92	0.31	0.17	1.86	.06
Overall	.79	.79	0.01	0.02	0.51	.61

Note. p1 is the proportion of difference in the first year, *p2* is the proportion of difference in the second year, *d* indicates the difference between *p1* and *p2*, *SE* is the standard error of the difference, *z* is the *z* statistic, and *p* is the *p* value.

Research Question 2

Are there any statistically significant differences in the percentage of facilities with minor violations between the first year and the second year of placard grading?

$H_0$2: There are no statistically significant differences in minor violations in food facilities between the first year and the second year of placard grading.

H_A2: There are statistically significant differences in minor violations in food facilities between the first year and the second year of placard grading.

The results of the one-sample *z* tests for Research Question 2 showed insufficient evidence at the 0.05% level of significance for a statistically significant difference in minor violations for any type of food facility between the first year and second year of placard grading. This indicates that the differences in minor violations from the first year to the second year are explainable by random variation. Table 9 shows the results of the *z* tests for Research Question 2. While no type of food facility was significantly different in minor violations between the two years, institutions had the highest difference between the years at -.23 ($z = -1.19$, $p = .23$). Take-out facilities (two or fewer food handlers) had a much smaller difference at -.06, but a comparable *z* score ($z = -1.69$, $p = .09$). This was due to the larger sample size, decreasing variation, and enabling the test to detect significance with a smaller difference. Traditional restaurants (51–75 seats) had the smallest magnitude of difference of .01 ($z = .34$, $p = .73$). The overall difference of -.01 ($z = .43$, $p = .67$) for all food facility types clearly indicates the lack of difference in minor violations between the two years.

Table 9

Summary of Dependent Sample z Tests for Differences in Percentages of Minor Violations From First Year to Second Year for Different Food Facility Types

Type of facility	p_1	p_2	*d*	*SE*	*z*	*p*
Traditional restaurants Over 75 seats	.22	.19	-0.03	0.03	-1.06	.29
Traditional restaurants 51–75 seats	.16	.17	0.01	0.03	0.34	.73
Take-out facilities 3 or more handlers	.27	.27	0.01	0.04	0.20	.84
Take-out facilities 2 or fewer handlers	.25	.19	-0.06	0.04	-1.69	.09
Public school cafeterias	.40	.45	0.05	0.05	0.93	.35
Food markets	.45	.54	0.09	0.09	1.04	.30
Institutions	.54	.31	-0.23	0.19	-1.19	.23
Overall	.26	.25	-0.01	0.02	-0.43	.67

Note. p1 is the proportion of difference in the first year, *p2* is the proportion of differences in the second year, *d* indicates the difference between *p1* and *p2*, *SE* is the standard error of the difference, *z* is the *z* statistic, and *p* is the *p* value.

Research Question 3

Are there any statistically significant differences in the number of facilities with green and red placards between the first year and the second year of placard grading?

$H_0$3: There are no statistically significant differences in the number of green and red placards between the first year and the second year of placard grading in food facilities.

H_A3: There are statistically significant differences in the number of green and red placards between the first and the second year of placard grading.

The results of the one-sample *z* tests for Research Question 3 showed insufficient evidence at the 0.05% level of significance for a statistically significant difference in the number of green and red placards for any food facility category between the first year and second year of placard grading. This result indicates that the differences in green or red placards from the first year to the second year were explainable by random variation. Table 10 shows the results of the *z* tests for Research Question 3. While no type of food facility was significantly different in placard grading between years, institutions had the highest difference between the years at -.08 ($z = -1.02$, $p = .31$). Traditional restaurants (51–75 seats) had a smaller difference at .06 but a larger *z* score ($z = 1.87$, $p = .06$). This is due to the larger sample size, decreasing variation, and enabling the test to detect significance with a smaller difference. Public school cafeterias had the smallest magnitude of difference of -.01 ($z = -.46$, $p = .65$). The overall difference of .01 ($z = .66$, $p = .51$) of all food facility types clearly indicates the lack of difference in number of placards between the two years.

Table 10

Summary of Dependent Sample z Tests for Differences in Number of Green and Red Placards From First Year to Second Year for Different Food Facility Types

Type of facility	p_1	p_2	*d*	*SE*	*Z*	*p*
Traditional restaurants Over 75 seats	.80	.81	0.02	0.03	0.59	.56
Traditional restaurants 51–75 seats	.79	.85	0.06	0.03	1.87	.06
Take-out facilities 3 or more handlers	.90	.87	-0.03	0.03	-1.23	.22
Take-out facilities 2 or fewer handlers	.87	.85	-0.02	0.03	-0.75	.45
Public school cafeterias	.97	.96	-0.01	0.03	-0.46	.65
Food markets	.95	.98	0.03	0.02	1.63	.10
Institutions	.00	.92	-0.08	0.08	-1.02	.31
Overall	.86	.87	0.01	0.01	0.66	.51

Note. p1 is the proportion of difference in the first year, *p2* is the proportion of differences in the second year, *d* indicates the difference between *p1* and *p2*, *SE* is the standard error of the difference, *z* is the *z* statistic, and *p* is the *p* value.

Research Question 4

Are there any statistically significant differences in the number of confirmed foodborne illnesses between the first year and the second year of placard grading in food facilities in Alameda County?

$H_0$4: There are no statistically significant differences in the number of confirmed foodborne illnesses between the first year and the second year of placard grading in food facilities.

H_A4: There are significant differences in the number of confirmed foodborne illnesses between the first year and the second year of placard grading in food facilities.

The results of the one-sample *z* tests for research question 4 showed insufficient evidence at the 0.05% level of significance for a statistically significant difference in the number of confirmed foodborne illnesses for any type of food facility between the first year and the second year of placard grading. This result indicates that the differences in confirmed foodborne illnesses from the first year to the second year were explainable by random variation. Table 11 shows the results of the *z* tests for Research Question 4.

While no food facility category was significantly different in confirmed foodborne illnesses between the years, institutions had the highest difference between years at .23 ($z = 1.49$, $p = .14$). Take-out facilities (3 or more food handlers) had a smaller difference at .02 but a larger *z* score ($z = 1.64$, $p = .10$). This is due to the larger sample size, decreasing variation, and enabling the test to detect significance with a smaller difference. Traditional restaurants (over 75 seats) had the smallest magnitude of difference of -.01 ($z = -.33$, $p = .74$). The overall difference of .01 ($z = 1.16$, $p = .24$) of all food facility types clearly indicates the lack of difference in confirmed foodborne illnesses between years.

Table 11

Summary of Dependent Sample z Tests for Differences in Number of Confirmed Foodborne Illnesses from First Year to Second Year for Different Food Facility Types

Type of Facility	p_1	p_2	*d*	*SE*	*z*	*p*
Traditional restaurants Over 75 seats	.06	.05	-0.01	0.02	-0.33	.74
Traditional restaurants 51–75 seats	.02	.03	0.01	0.01	0.51	.61
Take-out facilities 3 or more handlers	.00	.02	0.02	0.01	1.64	.10
Take-out facilities 2 or fewer handlers	.02	.03	0.01	0.01	0.91	.36
Public school cafeterias	.00	.00	0.00	0.00	-	-
Food markets	.00	.00	0.00	0.00	-	-
Institutions	.08	.31	0.23	0.15	1.49	.14
Overall	.02	.03	0.01	0.01	1.16	.24

Note. p1 is the proportion of difference in the first year, *p2* is the proportion of differences in the second year, *d* indicates the difference between *p1* and *p2*, *SE* is the standard error of the difference, *z* is the *z* statistic, and *p* is the *p* value.

Summary

The statistical analysis in this chapter shows the results of data collected from the 1,410 food facilities in the study. The subcategories of the different types of food service facilities sampled were traditional restaurants, take-out food facilities, public school cafeterias, food markets, and institutional food facilities. Tables 6 and 7 show actual counts and percentages from the data collected by each subcategory of food facility. Tables 8, 9, 10, and 11 show statistical analysis for each category and provide answers to each respective research question. Results obtained from this chapter are essentially the

basis for the discussion in Chapter 5 of this study, which provides a detailed explanation and better understanding of these results.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

This research used secondary data, with samples collected randomly from food facilities in Alameda County, California. There are about 6,000 food facilities in the county, and a total of 1,410 restaurants were randomly selected for the study. The selected samples represented traditional restaurants, take-out food facilities (fast foods), public school cafeterias, food markets, and institutional food facilities.

Purpose of the Study

The purpose of this research was to determine whether the use of placard grading as a food facility inspection tool has any effect on food handling practices and prevents or reduces the number of foodborne illnesses among members of the public who eat in food establishments in Alameda County, California.

Food Safety Training

Food safety training is now a nationwide requirement in food facilities. The FDA/CDC mandate instituted in 2007 requires every health department and agency to provide food safety training to food facility managers and employees in an effort to control possible foodborne illnesses. As of 2011, CDC records indicated that about 1 in 6 Americans or 48 million people become ill, 128,000 are hospitalized, and about 3,000 die of foodborne illness each year (CDC, 2011a). In Alameda County, both food facility managers and food handlers are required to complete an 8-hour safe food certification training course. Initially designed for facility managers and operators, the certification training is now encouraged for all food handlers. The certificate issued after successfully

passing the course lasts for 5 years. Alternatively, food handlers may take a food handler training course specifically designed for food handlers and other food facility workers. The food handler course is secondary to safe food certification, and it expires every 3 years. It focuses on food handling basics and is available through classroom training or the Internet. Both the safe food certification and food handler trainings are available to restaurant operators and food handlers through every county and local environmental health agency and organization, as well as some certified private educators in California (Cal Code 2010). While the food service operator may embark on training employees on how to prepare and serve new menu items to customers, it becomes necessary for public health agencies to provide food safety education and training to both operators and food workers in an effort to protect the general public. Yarrow et al. (2009) conducted a study that showed better performance in the knowledge and practice of food safety after food facility workers received educational training.

Food Facility Categories

Traditional Restaurants (Over 75 Seats)

Restaurants of this size are often considered premium, because they are popular and well known in many cities. The interior settings are elegantly decorated, and the services are appealing. If the facility belongs to a chain of restaurant operators, the food handlers (cooks) are expected to be professionally trained. The manager is available onsite, and the facility is always provided with one or more persons responsible for cleaning equipment and tidying up the facility where and when needed. Although the food handlers might be professionally trained in food safety, differences exist in personal

hygiene and food handling practices. Group food handling culture may be present, depending on the effectiveness or ineffectiveness of the facility manager. Griffith, Livesey, and Clayton (2010) defined *group food handling culture* as a shared value that food facility operators and their staff follow to produce and provide foods to their customers. Food safety culture can be positive or negative; if a negative food handling culture exists in a facility, food safety could be compromised. Some privately owned and operated restaurants fall into the food handling culture pattern. Quite often, private facilities do not have professionally trained food handlers or designated facility cleaners. In this study, the second year of placard grading showed an increase of 16 CDC risk factor violations for the same group of restaurants. Although there was an increase in the CDC risk factors in the second year, it had a comparable z score ($z = 1.80$, $p = .07$) due to the larger sample size (Table 8). Therefore, the score was not statistically significant due to the large sample size.

Traditional Restaurants (51–75 Seats)

The majority of food facilities that are in this group are family-owned and operated. Only a few food handlers in these facilities are professionally trained. Within family-operated businesses, owners tend to pay more attention to profit and loss than to food safety management, avoiding anything that could cost extra money to the business. The CDC risk factors decreased by 4 points in the second year of placard grading, showing a little improvement. Statistically, the group had the smallest difference of .01 (z =.51, $p = .61$), indicating lack of significant difference in violations between the two years. The decrease could be attributed to better understanding of the objectives of food

safety, or the fear of the consequences of financial penalty if a serious health violation were noted during the placarding inspections—for instance, the possibility of the health department closing the facility. In many instances, there was no designated housekeeping employee for this group of restaurants. In most cases, it was the food handlers who were assigned to perform all of the cleaning duties. Lack of a designated cleaning person could lead to potential problems in a food facility. As noted earlier, poorly cleaned food processing or storage equipment is likely to produce residue that supports microorganism growth, causing cross-contamination, according to Schmidt and Erickson (2005).

The restaurants in this group are unique with special needs, because the majority of such facilities are owned and operated by ethnic-minority individuals or family groups. Language is often a barrier in communicating information on food safety and violations to workers, because many food handlers do not speak English (Yiannas, 2010). The only effective way to communicate violations and food safety matters may be by the "show and tell" method: At any point during the inspection and when a violation is observed, the health inspector describes the violation and its implications, offers instruction on how to correct it, and gives the operator a specified time to complete the necessary corrections.

Take-Out Food Facilities (Three or More Food Handlers)

It is not surprising that this group of food facilities performed better than others. The majority of the facilities in this group belong to chain food facilities and are operated under the description of "fast foods." In addition to established operational procedures, the managers are better trained and always on site. The company's policy for its business operation is the same for all the chain food facilities, and employees are required to

comply with established rules. Food preparation and hand contact with foods are reduced to a minimum, because most of the foods are premade and delivered from warehousing locations. The potentially hazardous foods in the warehouse are packaged and kept in a frozen state until they are delivered to the retail facility. In the retail facilities, the frozen foods are thawed and heated before serving. Cross-contamination could occur during heating and serving. Food handling culture is almost nonexistent because the site managers are regularly rotated to various locations by the proprietors to prevent long-term familiarity, or perhaps to avoid the development of food handling culture. If a manager is not at a site long enough, the workers may not have enough time to develop or form food handling culture with him or her (Redmond & Griffith, 2003). However, differences in personal hygiene sometimes create health problems, such as when employees fail to wash hands after using the restroom or before handling foods. Other problematic employee behaviors include failing to inform the facility manager of ill health before reporting to work. A study by Medeiros et al. (2001) showed that failure of an ill person to self-report the illness could produce a source of food contamination leading to possible foodborne illness outbreak. Some employees conceal their ill health in an attempt to avoid loss of income. The CDC risk factors for this sample group decreased by 9 points during the second year. The decrease in the second year was not sufficient to indicate significance at the 0.05 level due to the large sample size. All food facilities in this group retain designated cleaning employees. Due to the organizational structure within facilities, employees are not overworked as in the traditional restaurants (51–75 seats) category. The facility manager communicates the inspection violations and other

facility needs to the employees. Consequently, shared information helps the employees pay more attention to food safety.

Take-Out Food Facilities (Two or Fewer Food Handlers)

The majority of food facilities in this group are privately owned and operated. In some local health jurisdictions, the facilities are known as "delicatessens" or "delis." The food handlers in this group prepare and serve sandwiches, beverages, and occasionally soups. Food preparation may involve combining raw vegetables, fruits, and industrial prepackaged meat and poultry products. Maintenance is usually an issue because of lack of sufficient food handlers or workers. There is always the absence of a designated cleaning person, resulting in the food handler providing all services, including cleaning responsibilities. Food safety is a concern in this type of operation. The CDC risk factors for the group increased by12 points in the second year, indicating poor food handling operations. Two food safety issues exist in this type of operation. First, lack of cleaning staff may result in a filthy environment, poor equipment upkeep, and possible cross-contamination, as indicated by Schmidt and Erickson (2005). Second, in research conducted by Dagnew et al. (2012), it was shown that food handlers with poor personal hygiene could be potential sources of food contamination. In other words, if the same food handler with poor personal hygiene is also responsible for cleaning the facility, food safety could be seriously impacted. Although the observed difference in risk factors appears high, statistically it was not significant due to the large sample size at .05 (z = 1.37, p = .17) The difference in the second year can be explained by random variations.

The number of violations was the highest in comparison to other food categories in the study.

Public School Cafeterias

Public school cafeterias consist of elementary, junior high, high school, and summer school lunch meal programs. While all the schools offer lunch meals to the students, only a limited number of schools offer both breakfast and lunch. There are two types of school cafeterias, depending on the preference of the school district: (a) the on-site cafeteria prepares meals from scratch and serves them to the students; or (b) a district may opt to have a central kitchen in which all meals are prepared and distributed to various school site cafeterias during lunch time. In both cases, there is always a certified nutritionist, cafeteria manager, and a designated facility cleaner. The CDC risk factors decreased by 3 points in the second year of placarding for this group of food facilities. In school cafeterias, all the food handlers are safe-food certified. The food facility is strictly monitored, not only by the local health department, but also by the school district officials who are concerned about the students' health and well-being. (*Special Note:* About 17 years ago [1998] when I was a district health inspector, I had an incident involving 250 junior high students who contracted *norovirus* through food. It was an unforgettable experience!). Besides my personal experience of young people contracting foodborne illness, it is general knowledge that the young, the elderly, and immune-compromised individuals in the community have weakened immune systems. Constant monitoring of food safety among young children is important.

Food Markets (Over 10,000 Sq. Ft.)

Food markets (grocery stores) vary in size, ranging from corner stores selling candies, bread, milk, and milk products, to large wholesale food stores. This study did not include small corner/liquor stores because of the large number in that category. The research focused only on large retail food stores selling a variety of edible food items to members of the community. Each grocery store in the study group was divided into sections—for example, dry packaged foods, frozen foods, raw meats and poultry, vegetables and fruits, and in some cases, prepared and ready-to-serve foods. The different sections make it easy for the customers to locate specific items in the store. Most grocery stores in the sample belonged to chain food facilities owned and controlled by companies. Few large grocery stores in this group were owned and operated by private families. The chain food markets are managed by professional managers with experience in food safety. Food handlers are safe-food certified, especially if they work in raw or ready-to-eat food sections. Each grocery store in the study had a designated cleaning employee who had no other duties than to maintain the facility. Due to structured operations, large grocery stores have defined rules for the employees. One of the advantages of having a professionally trained food facility manager on site is that such manager regularly shares health inspection or violation results with the food handlers. By participating in the violation discussion, the food workers become aware of food safety requirements. Studies by Lynch et al. (2003) and Nummer et al. (2010) show that food facility managers who receive food safety training from health agencies perform better than managers who received only industry training, which focuses mainly on their specific food areas of

interests without generalization. It is likely that the food facility managers in this group received their food safety training from a public health department. However, individual differences do exist with regard to personal hygiene and behaviors. A store manager who is lacking in proactive skills tends to overlook such violations as expired dates on packaged foods, damaged goods, or spoiled produce on display shelves. Food handling culture may not exist because the grocery store manager is under close supervision by the company. In this research, the food markets in the sample scored minus 5 on the CDC risk factors in the second year.

Institutional Food Facilities

These food facilities, which include hospitals, assisted living facilities, prisons, and nursing homes, are controlled and managed by organizations and government agencies. The volume of foods served depends on the size of the facility, and in some cases the number of meals can be quite large, ranging from a few hundreds to thousands of meals per day; for example, large hospitals and prison facilities. Acute hospitals and nursing homes require special attention. These food facilities are staffed with professional food handlers (cooks), nutritionists, health inspectors, and possibly a nurse epidemiologist. Staffing of these food facilities with different health professionals is necessary in an effort to prevent {possible} foodborne outbreaks due to the ill, aged, and immunocompromised residents in the facilities. In his study of health facilities, Roseman (2007) stated that the United States has a large population with weakened immune systems, including many members of minority and cultural groups who have little or no idea about food safety. Each of the food facilities in the group is required by law to

employ and retain cleaning staff at all times. The recorded CDC risk factors for the group increased by 4 points during the second year of placard grading. High statistical results were observed in this group, indicating food handling problems. Residential nursing facilities and acute hospital settings naturally present suitable conditions for cross-contamination and infection. Previous studies in both long-term residential facilities and hospitals indicate frequent outbreaks of infections, including *norovirus.* A study of health facilities in Spain found that person-to-person infection transmission was responsible for 81.5% of the outbreaks, and the death rate was 0.25%. It was also noted that the incident rate was about the same in the hospitals (Godoy et al., 2015).

Problems with Food Operators

Ill Health Attributed to Something Other Than Food

Long-time restaurant operators find it difficult to believe that foodborne illness really occurs. They are reluctant and resistant to making any improvement that they consider unnecessary in food operations or equipment repair, upgrade, or replacements. The operators often comment that over the past 10, 20, or 30 years they have been in business, no one they know has died of food poisoning after eating in their restaurant or other food facility. When any of the food workers, or a friend or relative of the operator complains of foodborne illness symptoms such as vomiting or diarrhea, the illness is rarely attributed to the foods consumed in the food facility. Instead, the symptoms are attributed to an imagined stomach flu going around. The usual advice given to the ill person is to purchase over-the-counter medication or rest in bed until the stomach flu subsides. This poor perception of food safety and the denial of the existence of foodborne

illness replicates the statement made earlier in the Introduction by the restaurant patron who downgraded the usefulness of food facility health inspection programs, and claimed that she had not had foodborne illness after many decades of eating in restaurants. The statement is evidence that both food facility operators, as well as many members of the public, still need to be educated about food safety.

Why Me? Why My Restaurant?

Uncooperative, reluctant, and resistant food facility operators often question and argue with health inspectors, asking, "Why me? Why my restaurant?" This grudge is often harbored by food facility owners who are frequent food safety violators, and who perhaps think they are being singled out and harassed by the health inspectors when serious health violations are observed. Although not voiced, some of these operators believe they are being discriminated against for one reason or another. These operators sometimes become irate, nod their heads to agree to make the necessary changes in their operations while in the presence of an inspector, but return to their usual operational procedures after the inspector leaves the food facility. To defend his operations, the food operator often claims that his food facility is better than other local restaurants and yet the restaurants with more serious violations have not been closed by the health agency.

Ethnic Food Operators and Language Barriers

Language barriers can be a hindrance to food safety. It often happen that ethnic food facility operators can barely comprehend the technical English language terms used by the inspectors during restaurant inspections and evaluations. The usual inspection procedure is for an operator or facility manager (who is not fluent in the English

language) to accompany the inspector on a walk-through inspection. This method of restaurant inspection is effective and the best practical way to conduct a food facility inspection. While walking around the facility, when the inspector sees a health violation, he/she points it out and explains the problem and the consequences in as much detail as the operator or facility manager can understand. During this time, the inspector also makes notes of the problem in a clear and understandable format, followed by corrective action needed. At the end of the walk-around inspection, the inspector then reads the inspection report to the operator or facility manager, pointing out the major problems, while emphasizing the necessary corrective actions. In most instances, the ethnic food operator can only remember the observations he/she made during the walk-through visual inspection. Although the operator or manager receives a copy of the inspection report, the piece of paper has little or no meaning to him, because the English wording does not make sense any more. In place of the written report, the operator or manager now relies on his/her memory of the visual observations made during the walk-around practical inspection. If any of the noted violations escape the operator's memory, the corrective action could be lost and may not be taken until perhaps another inspection due date. If the violation is considered a risk factor, the inspector might schedule a follow-up inspection. When a facility operator who relies on his or her memory fails to make immediate corrections, any future attempt to correct the violation will be incomplete, because the original details of corrective action are now lost. Besides assigning ethnic inspectors to facilities with language and cultural differences, health authorities often weigh other alternatives, including increasing the frequency of inspections. While comparing the

effect of inspection frequency in food facilities, Newbold et al. (2008) noted that there was no difference in food safety when inspections were decreased or increased. Alameda County and other local health agencies are making efforts to remedy language barrier problems by employing qualified ethnic health inspectors and hiring support staff who communicate in the same language.

Poor Cleaning Schedule

The worst time to clean or correct health violations observed in food facility inspections is at the end of the workday shift (11:00 PM to 1:00 AM) at night. During this period, food workers are already tired and exhausted from their normal daily duties. In many instances, if there is no designated person, cleaning is assigned to each worker in accordance with his/her section of operation in the restaurant. It is understandable that by 11:00 PM, a worker who perhaps started work at about 10:00 AM is already weak and sleepy. These workers can barely function in performing additional duties. The assignment of cleaning or maintenance of equipment at this time generally results in a total failure, because the workers are too tired to adequately clean the equipment or pay close attention to the details of whatever is before them. It is likely that the majority of employee accidents in restaurant facilities occur during this time of the night. The unfortunate fact is that the same utensils and equipment will be immediately utilized in more food preparation and storage the next day, without further washing or cleaning, because the materials are assumed to be clean from the previous night. The use of poorly cleaned or inadequately sanitized equipment in food preparation and storage is likely to

result in food contamination due to the presence of moisture and the possibility of microorganism growth, according to Schmidt and Erickson (2005).

Food Safety Issues

Poor utensil and equipment cleaning and sanitizing, added to other possible environmental contaminants, including vermin and dust, count as part of the cross-contamination issues in a restaurant. Although this is often overlooked in some food safety training, it is undoubtedly important because improperly cleaned equipment surfaces, with probable moisture left overnight inside the equipment, will certainly serve as suitable incubators for varieties of bacterial growth. Regardless of the nature of the new foods, when mixed with or exposed to potential bacteria that have now incubated overnight on the poorly cleaned surfaces, the condition will provide a suitable environment for cross-contamination.

There are several benefits to the use and application of Hazard Analysis and Critical Control Points (HACCP) in food facilities; unfortunately, most small to medium retail food facilities do not have the time or resources to integrate the steps involved into their operations. The goal of the program is to follow the flow of food in the facility as it is being received, stored, prepared, and served to customers (McSwane et al., 2004, p. 11). As it was designed, any cross-contamination step observed during the process could be intercepted. However, although HACCP is not applicable in many retail food facilities, the program was the precursor of the risk-based food inspection system, including facility scoring points and grading. Rossvoll et al. (2012) conducted a survey and compared the risk-based system with the regular “right or wrong” method of food

inspection program. The researchers concluded that the risk-based inspection produced more realistic results.

Food Handling Culture

It is appropriate to define food handling culture as the tendency to do what has always been conveniently done, regardless of outside influences (Yiannas, 2010). "Food operators that generate significant profits from their food operations have no incentive to change what has always been done. Any attempt to change the process will be shunned and resisted, especially if the motive for change comes from outside the existing established procedure" (Yiannas, 2010). Another reason food facility operator's resist change is unwillingness to spend money that the operator may consider unnecessary; for example, to hire a designated person for cleaning equipment and the facility at the end of the day, or replace dysfunctional but manageable equipment. The following are practices of group culture that exist in food facilities and are often endorsed by the facility managers and operators:

1. Cleaning utensils and equipment without supervision.
2. Using the same dirty utensils and equipment the next day without further cleaning.
3. Mopping or cleaning the floor while foods are on the floor without proper coverings.
4. Preparing open foods on dirty floor areas instead of on table tops.
5. Using the restrooms without washing hands because there is another hand-washing facility in the kitchen.

6. Saving and serving leftover foods to the next customer in order to make more money.
7. Consistently using large and deep pots to save and store potentially hazardous foods (meats, poultry, and beans) overnight.
8. Stacking dirty food containers on top of one another inside refrigeration units.
9. Improper use of cutting boards, reusing the same boards without washing.
10. Food temperature abuse.
11. Failing to wash hands in between food handling.
12. Failing to use protective hair covers while handling foods.
13. Not sharing inspection report information with food workers.

What makes the above violations cultural practices is that they are often repeated violations, despite objections and warnings by the health inspectors. The operator or the food facility manager is usually aware of these repeated poor food handling practices. Although the operator or store manager has the power to change the circumstances, because of the accepted food handling culture, the manager generally ignores the habits or may have few or no comments when he witnesses any of the violations. (*Note*: The above-listed violations are reasons to focus food safety trainings and responsibilities on the food facility managers, owners, and operators.)

Each of the above violations is preventable if the facility operator is conscientious about food safety, according to studies on three planned behaviors (TpB) and personal beliefs (Pilling et al., 2008). This statement is supported by another study indicating that

behaviors involving unwillingness to perform actions interfere with duties (Chapman et al., 2011).

Other Factors Affecting Food Safety

Financial Constraints

A new food facility operator may have the desire and good intentions to operate a decent restaurant, but lack the financial resources to do so. As in other start-up businesses, it could take up to 12 months or longer before the business starts to generate sufficient income to offset its expenses. During this period, a part of the facility or equipment might need repair or replacement, involving major expense. Without the availability of financial resources to make the needed repairs, the operator may begin to experience food safety problems.

Individual Facility Operators

The second non behavioral problem in food facilities is the size of the facility and the number of individual operators. Local health agencies work with food operators at the initial stage of food facility establishment to determine the size of the facility, type of menu to be served, appropriate equipment needed, and other essential requirements such as availability of sufficient lighting, potable water, and liquid and solid waste disposal systems. As time progresses, some facility operators often start to ignore the specified requirements by expanding their food operations to introduce new ethnic foods into the initial specified menu without notifying the health department. The added food items could require special care beyond the basic food handling practices. For example, instead of prepackaged foods initially approved, the operator could start adding seafood, cooked

bean products, or beef and poultry meals. The added food items generally create some problems in preparation, storage space, specific equipment, and service because the facility was not designed to accommodate the newly introduced food products. In both of these cases, food operators attempt to conceal broken equipment or needed facility repair, or the newly added food items. If a health inspector fails to discover the unauthorized food items or the needed repair, this could result in possible food safety violations and future health risks. Placard grading requires inspection and evaluation of the entire food facility, including foods, equipment, physical characteristics of the restaurant, and the operational procedures (ACEHD, 2011). The type of placard (green, yellow, or red) issued to the facility is based on detailed observations and the recorded violations. The placard also requires thorough and detailed inspection of every aspect of the food establishment, including food temperatures, storage, preparation, and service. Each of these factors has a specific notation on the placard grading inspection report. It is therefore expected that the field inspector will be diligent in discovering any newly introduced food items or broken equipment before a serious health violation occurs.

Low Employee Wages

Many food workers are paid low hourly wages. First-time, younger employees might not be bothered about the level of their wages at this stage; however, older workers who probably have families feel the impact of low wages. The older employees barely earn sufficient income to support their families, and this inability to earn enough income affects their morale and behaviors. The consequence is that the employees feel inept and generally lose some interest and enthusiasm for practicing food safety, even when they

understand that a particular behavior is not encouraged. Some of the employees in this group find themselves stuck between being barely employed or not employed at all. For lack of an alternative source of income, the affected employees may choose to remain unhappily employed, meaning that food safety could be at risk with this group. Low-wage employees are more likely to ignore hand-washing rules and frequently fail to self-report personal ill health. This is a form of covert protest, primarily because the workers believe they need more money to support their family. Medeiros et al. (2001) consider this type of behavior dangerous to public health because of the likelihood of contaminating foods, possibly causing an outbreak of foodborne illness.

Illegal Food Vendors

One of the persistent problems affecting food safety is unauthorized food operation. It is not surprising that several local health agencies, and perhaps health departments nationwide, experience this problem. By definition, illegal food vendors are individuals or groups of people who cook, package, sell, or distribute any type of food item or beverage to the general public without authorization from the local health agency or public health department (FDA, 2007).

In the United States, as well as in many other parts of the world, public health law requires anyone who desires to sell foods to the general public to obtain a permit or an authorization from the local health agency prior to the proposed sale. The authorization is necessary for the health agency to verify that the intended food for sale is fit for human consumption and will not cause any public health problem. However, for various personal reasons, the illegal food operator attempts to ignore established laws by evading

authority while cooking, packaging, selling, and distributing foods and beverages to members of the community without the required permits. Food safety is always an issue in illegal food operation, because there is no accountability regarding the source of the food, where it was stored, how it was prepared and served, the health status of the person or persons who handled the food, and if the person or persons who ate the food became ill. Illegal food operation violates every food safety rule by ignoring the principles of safe food risk factors as stated in the Centers for Disease Control risk prevention factors (CDC, 2011b).

Poor Management

In many privately owned food facilities, the role of the owner or manager is not always clearly defined. The exception in this case could be in chain restaurants and large grocery stores, where there are written rules and organizational order. The lack of written operational rules and order in many large independent and privately owned restaurants is another source of food safety issues. The facility management is often delegated to the site manager with little or no support while the business proprietor is absent.

Here are some issues affecting the operation of this group of restaurants:

1. The management is only concerned that each employee takes the health department required training, but it does not verify if the employee practices food safety during work hours as taught in the course.
2. The operator or store manager does not share the inspection results with the food handlers. In most cases, the manager merely files the report, keeping the food handlers ignorant of any violation observed or how to make the

corrections. In other words, the food handlers are unaware of the nature of the violations or how to prevent such problems in the future. Lack of sharing inspection (violation) information with food handlers is a major deficiency in food facility management, because the practice keeps food workers ignorant of what is wrong or right in the performance of their restaurant duties.

3. The management's priority is how to quickly serve its customers and make more money, not on how to protect foods, even when food safety is in jeopardy.
4. There is rarely a designated cleaning person in most privately owned and operated food facilities. The cooks or food handlers occasionally attempt to spot-clean certain areas of the restaurant; unfortunately, the cleaning is occurring adjacent to exposed foods. Food contamination can be unavoidable in such practices due to lack of planning and organization.
5. Part of the inefficiency observed in the operational management of the restaurant is that the manager has no time to investigate or inspect the assigned cleaning duties, either due to lack of interest or the assumption that the cleaning was done appropriately. As Yiannas (2010) indicated, when a violation is observed, an employee may quickly correct such violation to avoid rebuke, but will ignore other violations when the threat is removed.

After a study involving 50 states on the needs of public health agencies nationwide, the Council of States and Territorial Epidemiologists (CSTE) emphasized that more training is needed for food facility managers and restaurant employees in an

effort to prevent foodborne illness outbreaks, according to Boulton and Rosenberg (2011).

Statistical Analysis Results

Table 8 shows the results of the CDC major risk violations for each food facility category. There was lack of evidence to indicate significant difference between the 2 years for combined food facility categories. The overall result for the total food facility categories was .01 ($z = .51$, $p = .61$). The differences observed in institutional facilities could be attributed to random variations and also the low sample size for the particular food facility category. Additionally, nursing homes and hospitals consist of a mostly aging population and other immunocompromised individuals, as noted in the literature (Simmons et al., 2013; Godoy et al., 2015).

Conclusions and Recommendations

It was noted earlier in this study that food safety is an ongoing event. Food service operation and food handling will continue to present various problems due to the differences in individuals involved in food preparation, and the different ways in which foods are handled. Another concern in food safety is the health condition of the individuals who consume foods in a variety of ways, depending on their individual choices; for example, the consumption of raw milk (ACEHD, 2010; CDC, 2012a). The outbreak of *E. coli 0157:H7* among people who consumed aged raw milk Gouda cheese was another case involving personal food choices, food handling issues, and poor sanitation in a food facility.

Future studies on food safety should explore the relationship between the role of the food facility operator or facility manager and the food handlers. Unlike other businesses, food facility management requires close supervision as well as continuous education and monitoring of activities of each food handler, especially during food preparation periods. This monitoring is necessary because each food handler has the tendency to perform his or her assigned duty in the most convenient way. On the contrary, the individual's convenient way is not always the best way to protect foods from cross-contamination.

It is also important for managers to identify and separate unhappy food handlers who are not willing to practice food safety in their assigned duties. The existence of food handling culture in the food establishment is evidence that the operation or food facility management is ineffective.

Food facilities are important components of every community. First, as a business establishment, food facilities generate income for the operator who employs food workers. Second, food facilities serve to entertain members of the community, creating a reciprocal relationship. This study involved the use of placard grading as a health inspection tool in an effort to improve food handling practices in food facilities. The social change goal of this study is to inspire and motivate food facility operators and food handlers to practice food safety and prevent possible foodborne illnesses in the community.

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Appendix A: Confidentiality Agreement, Data Use Agreement, and Letter of Cooperation

During the course of my activity in collecting data for this research: **"Effect of Placard Grading on Food Safety in Food Facilities"** I will have access to information, which is confidential and should not be disclosed. I acknowledge that the information must remain confidential, and that improper disclosure of confidential information can be damaging to the participant.

By signing this Confidentiality Agreement I acknowledge and agree that:

1. I will not disclose or discuss any confidential information with others, including friends or family.
2. I will not in any way divulge, copy, release, sell, loan, alter or destroy any confidential information except as properly authorized.
3. I will not discuss confidential information where others can overhear the conversation. I understand that it is not acceptable to discuss confidential information even if the participant's name is not used.
4. I will not make any unauthorized transmissions, inquiries, modification or purging of confidential information.
5. I agree that my obligations under this agreement will continue after termination of the job that I will perform.
6. I understand that violation of this agreement will have legal implications.
7. I will only access or use systems or devices I'm officially authorized to access and I will not demonstrate the operation or function of systems or devices to unauthorized individuals.

Signing this document, I acknowledge that I have read the agreement and I agree to comply with all the terms and conditions stated above.

DATA USE AGREEMENT

This Data Use Agreement ("Agreement"), effective as of ***July 30, 2014*** **("Effective Date"), is entered into by and between *Christopher Ogbonna Ogbu*** ("Data Recipient") and ***Alameda County Environmental Health Department*** ("Data Provider"). The purpose of this Agreement is to provide Data Recipient with access to a Limited Data Set ("LDS") for use in research in accord with the HIPAA and FERPA Regulations.

1. Definitions. Unless otherwise specified in this Agreement, all capitalized terms used in this Agreement not otherwise defined have the meaning established for purposes of the "HIPAA Regulations" codified at Title 45 parts 160 through 164 of the United States Code of Federal Regulations, as amended from time to time.

2. Preparation of the LDS. Data Provider shall prepare and furnish to Data Recipient a LDS in accord with any applicable HIPAA or FERPA Regulations

3. Data Fields in the LDS. No direct identifiers such as names may be included in the Limited Data Set (LDS). In preparing the LDS, Data Provider shall include the **data fields specified as follows,** which are the minimum necessary to accomplish the research (list all data to be provided*): 200 Traditional Restaurants; 100 Fast--Food Restaurants; 60 Food Markets; 40 Delicatessen Food Facilities; 20 School Cafeterias; and 10 Institutional Food Facilities.*

4. Responsibilities of Data Recipient. Data Recipient agrees to:

    a. Use or disclose the LDS only as permitted by this Agreement or as required by law;

    b. Use appropriate safeguards to prevent use or disclosure of the LDS other than as permitted by this Agreement or required by law;

    c. Report to Data Provider any use or disclosure of the LDS of which it becomes aware that is not permitted by this Agreement or required by law;

    d. Require any of its subcontractors or agents that receive or have access to the LDS to agree to the same restrictions and conditions on the use and/or disclosure of the LDS that apply to Data Recipient under this Agreement; and

    e. Not use the information in the LDS to identify or contact the individuals who are data subjects.

5. Permitted Uses and Disclosures of the LDS. Data Recipient may use and/or disclose the LDS for its Research activities only.

6. Term and Termination.

   a. Term. The term of this Agreement shall commence as of the Effective Date and shall continue for so long as Data Recipient retains the LDS, unless sooner terminated as set forth in this Agreement.

   b. Termination by Data Recipient. Data Recipient may terminate this agreement at any time by notifying the Data Provider and returning or destroying the LDS.

   c. Termination by Data Provider. Data Provider may terminate this agreement at any time by providing thirty (30) days prior written notice to Data Recipient.

   d. For Breach. Data Provider shall provide written notice to Data Recipient within ten (10) days of any determination that Data Recipient has breached a material term of this Agreement. Data Provider shall afford Data Recipient an opportunity to cure said alleged material breach upon mutually agreeable terms. Failure to agree on mutually agreeable terms for cure within thirty (30) days shall be grounds for the immediate termination of this Agreement by Data Provider.

   e. Effect of Termination. Sections 1, 4, 5, 6(e) and 7 of this Agreement shall survive any termination of this Agreement under subsections c or d.

7. Miscellaneous.

   a. Change in Law. The parties agree to negotiate in good faith to amend this Agreement to comport with changes in federal law that materially alter either or both parties' obligations under this Agreement. Provided however, that if the parties are unable to agree to mutually acceptable amendment(s) by the compliance date of the change in applicable law or regulations, either Party may terminate this Agreement as provided in section 6.

   b. Construction of Terms. The terms of this Agreement shall be construed to give effect to applicable federal interpretative guidance regarding the HIPAA Regulations.

   c. No Third Party Beneficiaries. Nothing in this Agreement shall confer upon any person other than the parties and their respective successors or assigns, any rights, remedies, obligations, or liabilities whatsoever.

   d. Counterparts. This Agreement may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

e. Headings. The headings and other captions in this Agreement are for convenience and reference only and shall not be used in interpreting, construing or enforcing any of the provisions of this Agreement.

IN WITNESS WHEREOF, each of the undersigned has caused this Agreement to be duly executed in its name and on its behalf.

DATA PROVIDER

Signed: Ronald Browder

Print Name: RONALD BROWDER

Print Title: CHIEF, ENV PROTECTION DIV

DATA RECIPIENT

Signed: C.O. Ogbu

Print Name: CHRISTOPHER O. OGBU

Print Title: Student

Appendix B: Inspection Report and Placard Grading

County of Alameda
Department of Environmental Health
1131 Harbor Bay Parkway, Suite 200
Alameda, CA 94502-6577
510-567-6700 http://www.acgov.org/aceh

OFFICIAL RETAIL FOOD INSPECTION REPORT

Date: _____
Time In: _____
Time Out: _____
Page 1 of _____

Facility Name: Address: City: CT:

Permit #: Exp Date: PR: SR: CO: Inspection Type R FU C/O

Pmt Holder: Food Safety Cert Name: Exp Date: FBInv Const Consult

Major violations pose threats to public health and must be corrected immediately. Non-compliance may warrant closure of the facility.

CDC RISK FACTORS	OUT	PTS	-PTS
Demonstration of Knowledge			
1. Demonstration of food safety knowledge		2	
Employee Health & Hygienic Practices			
2. Compliance w/ Communicable disease procedures		4	
3. No discharge from eyes, nose & mouth		2	
4. Proper eating, tasting, drinking or tobacco use		2	
5. Hands clean and properly washed; gloves used properly; RTE food handling		4	
6. Adequate handwashing facilities supplied & accessible		2	
Time & Temperature Relationships			
7. Proper hot and cold holding temperatures		4/2	
8. Time as a public health control; procedures/ records		4/2	
9. Proper cooling methods		4	
10. Proper cooking time & temperatures		4	
11. Proper reheating procedures for hot holding		4	
Protection from Contamination			
12. Returned and reservice of food		2	
13. Food in good condition, safe and unadulterated		4/2	
14. Food contact surfaces: clean and sanitized		4/2	
Food from Approved Sources			
15. Food obtained from approved source		4	
16. Compliance with shell stock tags, condition, display		2	
17. Compliance with Gulf Oyster Regulations		2	
Conformance with Approved Procedures			
18. Compliance with variance, specialized process & HACCP Plan		2	
Consumer Advisory			
19. Consumer advisory for raw undercooked foods and foods with ½ of 1% alcohol		2	
Highly Susceptible Populations			
20. Licensed health care facilities/ public & private schools; prohibited foods not offered		4	
Water/ Hot Water			
21. Hot and cold water available _____Temp		4/2	
Liquid Waste Disposal			
22. Sewage and wastewater properly disposed		4/2	
Vermin			
23. No rodents, insects, birds, or animals		4/2	

APPROVED RETAIL PRACTICES	OUT	PTS	-PTS
Supervision			
24. Person in Charge present & performs duties		1	
Personal Cleanliness			
25. Personal cleanliness & hair restraints		1	
General Food Safety Requirements			
26. Approved thawing methods used, frozen food		1	
27. Food separated and protected		1	
28. Washing fruits and vegetables		1	
29. Toxic substances properly identified, stored, used		1	
Food Storage/Display/Service			
30. Food storage; food storage containers labeled		1	
31. Consumer self-service		1	
32. Food properly labeled & honestly presented		1	
Equipment/Utensils/Linens			
33. Nonfood contact surfaces clean		1	
34. Warewashing facilities: installed, maintained, used; testing devices		1	
35. Equipment/Utensils ANSI approved		1	
36. Equipment, utensils and linens: storage & use		1	
37. Vending machines maintained		1	
38. Approved & adequate ventilation and lighting		1	
39. Food thermometers provided and accurate		1	
40. Wiping cloths: properly used and stored		1	
Physical Facilities			
41. Plumbing: proper backflow devices		1	
42. Garbage and refuse properly disposed; facilities maintained		1	
43. Toilet facilities cleaned, supplied, maintained		1	
44. Premises; personal/cleaning items; vermin-proofing		1	
Permanent Food Facilities			
45. Floor, walls and ceilings are maintained and clean		1	
46. No living or sleeping quarters inside facility		1	
Signs/ Requirements		1	
47. Signs and permits posted; last inspection reports and food safety certificates available		1	
Compliance & Enforcement			
48. Compliance with plan review requirements		1	
49. Facility operating with valid permit		1	

Received by: _____ **EHS:** _____

ALAMEDA COUNTY
DEPARTMENT OF ENVIRONMENTAL HEALTH

PASS

FACILITY NAME

FACILITY ADDRESS

This facility has been inspected by the Alameda County Department of Environmental Health, Environmental Protection Division in accordance to the California Health & Safety Code and passed the inspection conducted on

Date by Registered Environmental Health Specialist

A copy of the most recent inspection report is available upon request at this location. Inspection report results can also be viewed at: http://www.acgov.org/aceh/

Ariu B. Levi, Director
Department of Environmental Health
Alameda County

PREVIOUS INSPECTION

Results of previous inspection conducted on Date

☐ PASS ☐ CONDITIONAL PASS ☐ CLOSURE

For additional information contact Alameda County Department of Environmental Health at 510-567-6700
This placard is the property of Alameda County Department of Environmental Health and shall not be removed, copied or altered in any way
ALAMEDA COUNTY CODE OF ORDINANCES

ALAMEDA COUNTY
DEPARTMENT OF ENVIRONMENTAL HEALTH

CONDITIONAL PASS

FACILITY NAME

FACILITY ADDRESS

This facility has been inspected by the Alameda County Department of Environmental Health, Environmental Protection Division in accordance to the California Health & Safety Code and conditionally passed the inspection conducted on

Date by Registered Environmental Health Specialist

A copy of the most recent inspection report is available upon request at this location. Inspection report results can also be viewed at: http://www.acgov.org/aceh/

Ariu B. Levi, Director
Department of Environmental Health
Alameda County

PREVIOUS INSPECTION

Results of previous inspection conducted on Date

☐ PASS ☐ CONDITIONAL PASS ☐ CLOSURE

For additional information contact Alameda County Department of Environmental Health at 510-567-6700
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ALAMEDA COUNTY
DEPARTMENT OF ENVIRONMENTAL HEALTH

CLOSED

DUE TO THE TEMPORARY SUSPENSION OF HEALTH PERMIT
THIS FOOD FACILITY IS CLOSED

FACILITY NAME

FACILITY ADDRESS

This facility has been inspected by the Alameda County Department of Environmental Health, Environmental Protection Division in accordance to the California Health & Safety Code and failed the inspection conducted on

Date by Registered Environmental Health Specialist

Inspection report results can also be viewed at: http://www.acgov.org/aceh/

This food facility is ordered to remain closed until the permit to operate is reinstated.

Ariu B. Levi, Director
Department of Environmental Health
Alameda County

For additional information contact Alameda County Department of Environmental Health at 510-567-6700
This placard is the property of Alameda County Department of Environmental Health and shall not be removed, copied or altered in any way
ALAMEDA COUNTY CODE OF ORDINANCES

Appendix C: Major CDC Risk Factors and Non-CDC Risk Factors

Table C1 lists items in the Alameda County Environmental Health Department (ACEHD) Official Inspection Report (OIR) that address food handling practices directly or indirectly related to the CDC Risk Factors.

Table C1

CDC Risk Factors Listed in ACEHD Official Inspection Report

CDC risk factors and food safety	Corresponding number in inspection form (OIR)	Recorded inspection reports	Points subtracted (risk factors)
Employee health and hygiene	2	Compliance with communicable disease risk factors	4
	5	Proper hand washing before handling ready-to-eat foods	4
Time & temperature requirements	7	Proper hot and cold holding temperature	4
	8	Time as a public health control	4
	9	Proper cooling methods	4
	10	Proper cooking time & temperature	4
	11	Proper reheating procedures for hot holding	4
Protection from contamination	13	Food in good condition, safe and unadulterated	4
	14	Food contact surfaces: clean and sanitized	4
Foods from approved sources	15	Food obtained from approved sources	4
Highly susceptible populations	20	Prohibited foods not served in public and private schools and health facilities.	4
Water/Hot water	21	Hot and cold water available	4
	22	Sewage and waste water properly disposed	4
Vermin	23	No rodents, insects, birds, or Animals	4

Table C2 lists items in the Alameda County Environmental Health Department (ACEHD) Official Inspection Report (OIR) that address types of behaviors directly or indirectly related to Non-CDC Risk Factors.

Table C2

Non-CDC Risk Factors Listed in ACEHD Official Inspection Report

OIR official inspection form	General report: Health risk factors	Points subtracted
24	Person in charge present & performs duties	1
25	Personal cleanliness and hair restraints	1
26	Approved thawing methods for frozen foods	1
27	Food separated and protected	1
28	Washing fruits and vegetables	1
29	Toxic substances properly identified and stored	1
30	Food storage containers properly labeled and stored	1
31	Consumer self-service	1
32	Foods properly labeled and honestly presented	1
33	Nonfood contact surfaces clean	1
34	Washing ware facilities adequately installed and well maintained	1
35	Equipment/Utensils ANSI	1
36	Improper storage of equipment and utensils.	1
38	Lack of adequate lighting and ventilation system	1
39	Food thermometer provided and accurate	1
40	Wiping clothes properly used and stored	1
41	Plumbing proper backflow devices	1
42	Failure to maintain regular disposal of refuse and garbage	1
43	Toilet facilities clean and supplies maintained	1
44	Premises clean and vermin proofed	1
45	Floor, walls, and ceiling clean and well maintained	1
46	No living or sleeping quarters inside facility	1
47	Signs, inspection reports, and food safety certificates posted and available	1
48	Compliance with plan review requirements	1
49	Facility operating with required permit	1