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Poverty Rate and Occurrence of Foodborne Illness Risk Factors in Retail Facilities

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Abstract

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BS Chemistry, University of Florida

BS Zoology, University of Florida

Dissertation Submitted in Partial Fulfillment

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Doctor of Philosophy

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Abstract

Despite the efforts of food safety regulations and rules, food contamination remains a public health concern and prevalent vehicle of pathogens. This study identifies the predictors of food risk in different types of food establishments in Miami Dade County, Florida during the period November 2014 - November 2016. Guided by the epidemiologic triangle model, this correlational study analyzed the log number of risk factor violations and failure rates controlling for US Census sociodemographic data (2010 to 2014) for the food establishment neighborhoods by using linear and logistic regression. Results indicated that most of food entity types are significant predictors of risk violations. Among all the significant predictor food establishments, grocery stores ($b = 2.877$. $p < 0.001$) had a higher increase in violations. For the demographic variables, the only significant variable was the number of single parent households ($B = .001$, $p = 0.022$). The result reveals a significant association between food entity types and failing inspection ($p < 0.005$). Among all the entity types, convenience store with significant food service and/or packaged ice (22.2 %) have the highest percentage fail rate within inspection rate outcome. Findings indicate that a risk-based approach to food risk factor violations frequency could reduce the number of violations, particularly in convenience and grocery stores with the most violations and failing rate.

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Dedication

I dedicate my dissertation work to my family and many friends. A special feeling of gratitude to my loving husband, Ernst Cesar and wonderful son, Toussaint Joseph, for being there for me throughout the entire doctorate program. Both of you have been my best cheerleaders. My lovely cousin/best friend, Cindy Watson, have never left my side and have spent many hours of proofreading. I also dedicate this dissertation to my many friends, co-workers, and church family who have supported me throughout the process. I will always appreciate all they have done, especially Mark French and Patty Lewandowski for recommending me for a scholarship, Deloris Lloyd whose words of encouragement and push for tenacity ring in my ears, and Jonathan Pelt for helping me with the topic.

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At the exceptionally onset, I yield myself before the Almighty Lord for favoring me with the leading of what I could have had. Be it this dissertation, the personnel associated with or the outcome of this research pursuit, all of it HIS GRACE, MERCY, and BLESSINGS. He has made this possible, and I thank the Almighty Lord with all humility and surrender. I am grateful to everyone who has helped me in my struggle to achieve my dream of becoming a Ph. D. I want to thank my committee members who were more than generous with their expertise and precious time. A special thanks to Dr. James Rohrer, my committee chair for his countless hours of reflecting, reading, encouraging, and most of all patience throughout the entire process. Thank you Dr. Maria Martin, for agreeing to serve on my committee. I would like to acknowledge and thank my school division for allowing me to conduct my research and providing any assistance requested. I also would like to acknowledge the inspirational instruction and guidance of Dr. Miller Tiffiani. Finally, I would like to thank Sara Wander and Jacqueline Johnson who assisted me with the data for this project. Their excitement and willingness to provide the data made the completion of this research an enjoyable experience.

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Chapter 1: Introduction to the Study

Chapter Overview

This chapter provides the introduction and background to the study, including the statement of the problem, purpose, research questions, hypotheses, theoretical basis, nature, operational definitions, significance, scope, delimitations, and limitations of the study.

Introduction

Foodborne illnesses are a serious public health concern. Centers for Disease Control and Prevention (CDC) estimates that each year roughly 1 in 6 Americans (or 48 million people) gets sick, 128,000 are hospitalized, and 3,000 die of foodborne diseases (CDC, 2016). Foodborne illnesses are closely linked to improper food safety practices that lead to the proliferation of pathogenic microorganisms in food (Hamade, 2015). Biological hazards are the biggest threat to food safety. There are 31 known pathogens that can cause foodborne illness (CDC, 2016), and they are responsible for about 21 % of the foodborne illnesses and the remaining 79 % are caused by unspecified agents (CDC, 2016). These unspecified agents were defined as: agents with insufficient data to estimate agent-specific burden; known agents not yet identified as causing foodborne illness; microbes, chemicals, or other substances known to be in food whose ability to cause illness is unproven; and agents not yet identified (CDC, 2016).

Most outbreaks of foodborne illness are caused by consumed contaminated products that have entered the food chain at some point from farm to fork. Hospitalization rates reflect the seriousness of foodborne disease outbreaks; for example, 88% of patients with Listeria infections required hospitalization, compared with 36% for Yersinia, 37% for E. coli O157, and 22% for Salmonella. Food-borne diseases are known to contribute to both human morbidity and mortality as well as to health care costs (Campbell et al., 1998). The United State Department of Agriculture (USDA-ERS) also estimates that food-borne illness triggered by just five foodborne pathogens - Campylobacter, Salmonella, E. coli O157:H7, Listeria monocytogenes and Toxoplasma gondii- cause $6.9 billion in medical costs, lost productivity, and premature deaths each year in the United States (USDA-ERS, 2000). A recent study conducted by Roberts (2007) estimates the societal costs of all acute food-borne illness is a total of U$1.4 trillion.

Today, most Americans do not question the safety of the food that they choose to consume (Goodacre, Doel, Habron, & Petruv, 1999) in part because of the existence of government organizations, such as the Food and Drug Administration (FDA), the U.S. Department of Agriculture (USDA), the Centers for Disease Control and Prevention (CDC), and even local and state health departments, all of which implement safety protocols that have greatly influenced the way that food is produced and prepared in the United States (Wilcock et al., 2004). The American public generally trusts that the food they purchase and eat is safe for consumption, but the most current evidence states that, despite the regulations imposed by these oversight organizations and the current knowledge of disease-causing agents in relation to food and food sources, food-borne illness still accounts for upwards of 48 million illnesses annually in the United States (Wilcock et al. 2004 & Gould et al. 2011).

Of these illnesses, any occurrence of two or more similar illnesses that result from the consumption of a common food is considered a "food-borne disease outbreak," as per CDC standards since 1992 (CDC 2011).

While all are at risk, other than what is known about food-borne illness in younger and older age groups, the relationship between foodborne illness risk and access to food entity establishments is unclear. Little is known about which demographic groups or entity establishment type in the United States are at highest risk for food borne infection and which groups should be targeted for educational efforts. Race, ethnicity, or income has not traditionally been used to track the incidence rates of food-borne illness. Regarding the relationship between demographic area and foodborne illness, relatively few studies have been conducted and the findings are inconsistent. For example, the Food-borne Diseases Active Surveillance Network (FoodNet) quantifies and monitors the incidence of laboratory-confirmed cases of Salmonella, Campylobacter, Listeria, Shiga-toxin producing E. coli, Shigella, Yersinia and Vibrio. The FoodNet catchment area was not chosen to equally represent all racial and ethnic groups, and even in the expanded FoodNet population, Hispanics and those living below the poverty level are underrepresented when compared to the general American population (6% *vs*. 12%, and 11 *vs*. 14%, respectively) (Hardnett et al., 2004). Some limited numbers of studies have found that low income populations are more likely to experience greater rates of gastrointestinal illness. Over the past decade, analysis of FoodNet tracking data to examine the burden of food-borne illness on minority racial and ethnic populations has revealed trends related to their demographics. Additionally, since 2008, FoodNet final reports each year have reported incidence rates of bacterial pathogens by race and ethnicity (CDC, 2016). There is growing evidence that individuals of minority racial and ethnic groups suffer from greater rates of some food-borne illnesses (Quinlan, 2013).

Socioeconomic populations might experience greater risks for food-borne illness at supermarkets or convenient stores. A growing collection of public health research (Bermudez-Millan et al., 2004; Dharod et al., 2007; Henley et al., 2012; Kwon et al. 2008; Meer & Misner, 2000; Quinlan, 2013; Trepka et al., (2006); Wenrich et al., 2003) has indicated that low-income neighborhoods have different access to food sources at the retail level. The concept of neighborhood disparities, in accessibility of food outlets, has been recognized by the U.S. Department of Agriculture as Food Deserts. Food Deserts mean there is a lack of large supermarkets and tends to be an abundance of smaller grocers, convenience, and fast food retailers (Quinlan, 2013). Studies have started to investigate food safety risk available at small independent retailers in the food desert environment. Those studies are included a combination of surveys at the retail level as well as use of inspection violation rates as a deputation for safety (Quinlan, 2013).

The lack of accurate statistics and limited scholarly research concerning microbial violation practices among low economic status areas and different entity types can contribute to this phenomenon. It is essential that research on food safety practice compliance and noncompliance among food service workers in low-income areas be conducted in their sociocultural setting to be able to contribute varying health promotion programs. It is also essential in that it will help generate scholarly documentation that may assist health policy makers to create new policies to improve public health.

Background

Food safety is a high priority around the world. Regulatory agencies such as local, county, and state health departments conduct routine health inspections of food handling facilities. Although food safety regulatory efforts address the entire food chain (from production to the retail level) (National Research Council, 2010), these processes do not guarantee that food products, especially uncooked fresh foods, are free from potentially pathogenic bacteria.

There are many opportunities for food to become contaminated and are responsible for several illnesses worldwide. The CDC documents five contributory factors in the occurrence of foodborne illness in restaurants: food items from unsafe sources, poor personal hygiene, inadequate cooking temperatures, improper cold or hot holding temperature of foods, and unclean food contact equipment (FDA, 2010). Manes et al. (2013) reported that approximately 25% of food employees did not always wash their hands, 33% did not change gloves between tasks, and more than 50% of food handlers did not ensure the food's required minimum cooking temperature. Over the past few decades, the CDC and the Environmental Health Specialist network (EHS-net) collaborated on several research projects to understand the contributing factors for foodborne illness in restaurants and food establishments. In each study, sick employees, poor personal hygiene, and insanitary food preparation practices greatly contributed to foodborne outbreaks in different areas (Brown, 2013). The microbial load present in ready-to-eat (RTE) is a function of the number of microorganisms present in the raw materials, opportunities for further microbial growth and survival, their destruction due to processing, and the extent of any additional contamination. These commodities, which are ready for immediate human consumption, are considered high-risk for several microbial hazards, receiving special attention from official controls regulation and food business operators. RTE food are appreciated for their unique flavors and convenience, however, the unhygienic conditions in which these foods are prepared, stored, and served raise a question regarding their microbiological quality. Researchers have investigated the microbiological quality of street vended foods in different countries. Syn et al. (2013) conducted a bacteriological assessment of the environment and food products at different stages of processing during the manufacture of RTE chicken franks, chicken bologna and bacon at a large meat processing plant in Trinidad, West Indies. The findings suggest that 50% (10 of 20) of precooked mixtures of bacon and bologna were contaminated with Listeria spp., including four with L. monocytogenes. Pre-cooked mixtures of franks and bologna also contained E. coli (35 and 0.72 log10 CFU/g individually) while 5 (12.5%) of 40 pre-cooked mixtures of chicken franks had Salmonella spp(species). Aerobic bacteria exceeded acceptable international standards in 46 (82.1%) of 56 pre-cooked and 6 (16.7%) of 36 post cooked samples.

In addition to the above study, 1,049 samples of pre-packed ready to eat sliced meats purchased in SME's (small to medium sized enterprises) in the United Kingdom were examined to detect and/or enumerate Listeria monocytogenes and other Listeria spp. Samples were also examined to determine numbers of the hygiene indicator organisms Escherichia coli and Enterobacteriaceae. The overall result show that Listeria monocytogenes was detected in 3.8% of samples and Listeria spp. was detected in 7.0% of samples. Enterobacteriaceae were enumerated from 36.2% of samples and the mean count (log10 cfu/g) was 2.96 ± 1.47. E. coli were enumerated from five samples (0.48%). Infections with this organism are associated with a high rate of sickness or mortality; therefore, it is important that prevalence of exposure to this organism are pinpointed and factors contributing to infections identified.

Because of the heightened concern in foodborne illnesses and outbreaks, the Food Safety Department of Agriculture developed local regulation, routine, complaint, follow-up, and other special food establishment inspections, to ensure effective food preparation and handling practices (Waters et al., 2013). To improve food safety practices, the U.S. Food and Drug Administration (FDA) recommends that local regulatory agencies utilize innovative methods of effective food establishment inspection, including the use of critical violations as an indicator of foodborne illness (FDA, 2010).

The Florida Department of Agriculture and Regulation Administration (HLRA) enforced the 2012 food code through their food safety and hygiene inspection service division to safeguard public health. Additionally, the program inspected and monitored establishments to ensure food was safe, unadulterated, and honestly presented to their consumer. The department conducted periodic inspections of the city's existing food establishments. These inspections help the department to assess the risk of foodborne illness such as priority, priority foundation and core violations and to evaluate food safety practice. However, the frequency of priority violations and its relationship to foodborne illness and resident complaint has not been investigated in the State of Florida.

Problem Statement

Despite the efforts of food safety regulations and rules, food contamination remains a public health concern and a prevalent vehicle of pathogens (Quinlan, 2013). According to the Centers for Disease Control and Prevention (CDC, 2016), 1 in 6 Americans (or 48 million people) gets sick, 128,000 are hospitalized, and 3,000 die of food-borne diseases each year. Those diseases are transmitted through contaminated food by the major pathogens, Campylobacter, Salmonella, Listeria, and E. coli O157 (Quinlan, 2013). Two-thirds of foodborne illness outbreaks in the United States are associated with restaurants or delis (Gould et al., 2013). Several outbreak investigations have shown that the main contributors to Food Borne Illnesses (FBI) outbreaks in food service establishments are predominantly linked to (a) bare hand contact when handling ready to eat foods, (b) improper hand washing, (c) poor maintenance of food contact surfaces of equipment and utensils, (d) cross-contamination of raw or cooked foods, and (d) inadequate temperature maintenance (Todd et al., 2007). Access to contaminated foods exposes the population to an increased exposure of food pathogens (Quinlan, 2013). Evidence indicates that individuals of low income and minority groups may have greater risk to food contamination exposure at the food retail or food service level (Quinlan, 2013). Studies have shown that high microbial loads were found on produce from markets in low income areas (Koro et al., 2010; Newman et al., 2015). Since 2008, FoodNet has released reports quantifying the incidence rates of bacterial pathogens by race and ethnicity (Quinlan, 2013). If, as emerging data suggest, low income and minority populations experience greater rates of food-borne illnesses, the question that arises is to identify the retail outlet types these populations might be experiencing greater risk of exposure to foodborne pathogens (Quinlan, 2013; Cheng et al, 2013; Thomas, 2012; Varga et al, 2013). Studies have also failed to identify whether these differences are associated with risk for FBI. Currently, FBI are of increasing concern and the proportion of illnesses experienced by communities in different SES and/or demographics is still unclear (Newman et al., 2015). Harris et. al (2014) suggested that further research is appropriate to direct to the locations where critical food safety violations are high where training program could be developed to eliminate these differences in locations.

Purpose of the study

The goal of the study is to identify the predictors of food-borne illness and food safety risks from food entity establishments available to populations of different income levels and different racial compositions in Florida during the period 2014-2016. The unit of analysis will be the food entity establishments (retail facilities). Quantitative statistical analysis was used to examine the relationship between the poverty rates and the foodborne illness risk in food entity establishments in Florida, while controlling for and evaluating effects of covariates known to affect poverty status.

Existing data datasets, utilizing records from Florida Department of Agriculture Food Safety, will be used to answer the research question. The Florida Department of Agriculture has a program that provides a functional database and supports food safety and consumer protection in the state of Florida. Records (2013 to 2016) of sanitation and safety inspections conducted by Department of Agriculture Food Safety on public food entity establishments will be used to analyze retail food service and food safety risks. Samples are obtained from *routine inspections*, *Re-inspections*, and *complaint inspections*. Routine inspections are periodic inspections that are performed as a part of the on-going food safety initiative. Re-inspections are completed when a facility has violations that need corrections in more than the standard period. Complaint inspections are performed in response to a citizen's complaint. Both routine and complaint inspections are unannounced inspections (FDACS, n.d.). Each inspection report is a print of conditions present at the time of the inspection. On any given day, an establishment may have fewer or more violations than noted in their most recent inspection. Local retail entities will either be independent businesses or have a sister retail entity within the state of Florida only. The entity categories of interest were as follows: Supermarkets, grocery, convenience stores, health market, retail bakery, minor outlet, shopping center kiosk, flea market, mobile vendor, and specialty store.

Geographic information systems (GIS) will be used to plot entity establishments' listings from the database, and foodborne illness risk violations over poverty in Miami Dade County. For my project, I will extract data from the Florida Department of Agriculture and Consumer Services database to analyze the trend of food safety violations and factors of food borne illnesses. This data set will assist in identifying foodborne illness risk factors that need priority attention.

Research Questions/Hypotheses

RQ1- Quantitative: What are the associations between the frequencies of inspection rating fail and the poverty level of the area when controlling for food facility type, race/ethnicity, age, gender, and income level?

*H*O1: There is no association between the frequency of inspection rating fail and the poverty level of the area when controlling for food facility type, race/ethnicity, age, and gender.

*H*O2: There is an association between the frequency of inspection rating fail and the poverty level of the area when controlling for food facility type, race/ethnicity, age, and gender.

RQ2- Quantitative: Is there a relationship between the number of risk violations (food from unsafe sources, inadequate cooking, improper hot/cold holding temperatures, contaminated equipment, and poor personal hygiene) and the poverty level of the area when controlling for food facility type, race/ethnicity, age, and gender?

*H*O1: The number of risk violations (food from unsafe sources, inadequate cooking, improper hot/cold holding temperatures, contaminated equipment, and poor personal hygiene) is associated with the poverty level of the area when controlling for food facility type, race/ethnicity, age, and gender.

*H*O2: The number of risk violations (food from unsafe sources, inadequate cooking, improper hot/cold holding temperatures, contaminated equipment, and poor personal hygiene) is associated with the poverty level of the area when controlling for food facility type, race/ethnicity, age, and gender.

RQ3- Quantitative: Is there a relationship between food entity type (Supermarkets, grocery, convenience stores, health market, retail bakery, minor outlet, shopping center kiosk, flea market, mobile vendor, and specialty store) and the number of food violations cited when controlling for poverty level, race/ethnicity, age, and gender?

*H*O1: There is no association between the food entity type and the number of food violations when controlling for poverty level, race/ethnicity, age, and gender.

*H*O2: There is association between the food entity type and the number of food violations cited when controlling for poverty level, race/ethnicity, age, and gender.

RQ4—Quantitative: Does the food entity operation type (Supermarkets, grocery, convenience stores, health market, retail bakery, minor outlet, shopping center kiosk, flea market, mobile vendor, and specialty store) have an impact on the number of inspection failures when controlling for poverty level, race/ethnicity, age, and gender?

*H*01: There is no association between the food entity operation type (Supermarkets, grocery, convenience stores, health market, retail bakery, minor outlet, shopping center kiosk, flea market, mobile vendor, and specialty store) and number of inspection failures when controlling for poverty level, race/ethnicity, age, and gender.

*H*O2: There is an association between the food entity operation type (Supermarkets, grocery, convenience stores, health market, retail bakery, minor outlet, shopping center kiosk, flea market, mobile vendor, and specialty store) and the number of inspection failures when controlling for when controlling for poverty level, race/ethnicity, age, and gender.

Framework

The Epidemiologic Triangle is a model that scientists have developed for studying essential characteristic of the disease. Epidemiology triangle helps in identifying the major risk factors and shows the relationship between the three characteristic factors that influence the occurrence and prevention of the disease. For this study, the epidemiologic triangle represented diagrammatically where it represented the interaction between person, place, and time (Fig 1). Time is the periodic trend, and the periodic trend may indicate a change or stability in the establishment characteristics. A person, individual or group of individuals who are susceptible to the risk factors and the pertinent characteristics noted as age, sex, socioeconomic status, race/ethnicity, and education. The place is the entity establishment type in the geographic zone where the individual can be, where the violation can occur, and where the individual can become infected from the food violated source. The three above mentioned components of the triad co-exist independently; a condition occurs only when there is an interaction between them (Fig 1). The epidemiological triangle model would be the most effective framework for this study because it will help in the designing of intervention strategies for food safety.

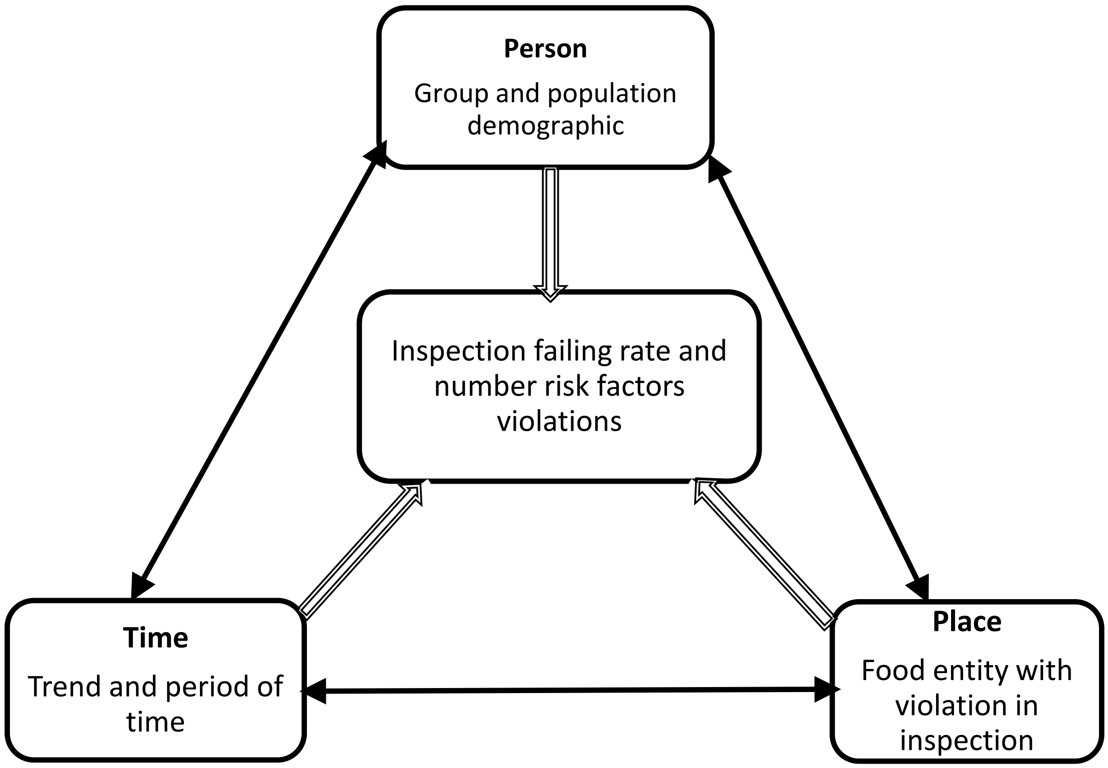

Figure 1. Epidemiology triangle. Adapted from [Nelson, K.E. & Williams C. F. (2007). *Infectious Disease Epidemiology: Theory and Practice*, 2nd Edition. Jones and Bartlett Publishers. Boston, Massachusetts.]

Nature of the Study

This quantitative study will employ an observational design. The presence of foodborne illness risk factors and fail ratings in food entity will be the dependent variable and percent poverty in the area with the primary independent variable with the type of retail facility (supermarkets, grocery, and convenience stores), and the percent estimates of housing units, households, persons below poverty, civilian (age 16+) unemployed, persons aged 65 and older, persons aged 17 and younger, civilian noninstitutionalized population with a disability estimate, single parent household with children under 18 estimate, minority (all persons except white, non-Hispanic), persons (age 5+) who speak English "less than well", mobile homes, households with no vehicle available, persons in institutionalized group quarters, serving as control variables. Data on food entity facilities (collected for period 2013 to 2016) will be obtained from the Florida Department of Agriculture database to compare the prevalence of foodborne illness risk factors and fail ratings from the location of food store. The database will provide the information on the location of food entity establishment by type (Supermarkets, grocery, convenience stores, health market, retail bakery, minor outlet, shopping center kiosk, flea market, mobile vendor, and specialty store), as well as a description of the inspection results. Data available from the U.S. Census Bureau will be used to identify census tracts of the categories that fit our definition for the different population demographics.

Definition of study variable

Food borne illness risk factors: are some extensive categories of contributing factors directly relate to food safety concerns within retail and food service establishments. Example of Food borne illness risk factors include: food items from unsafe sources, poor personal hygiene, inadequate cooking temperatures, improper cold or hot holding temperature of foods, and unclean food contact equipment (FDA, 2010).

Facility/Entity: means any establishment, structure, or structures under one ownership at one general physical location, or, in the case of a mobile facility, traveling to multiple locations, that manufactures/processes, packs, or holds food for consumption in the United States 21 CFR1.227(Code of Federal Regulations, Title 21, Volume 1).

Various types of entities used in this study, and the FDACS have defined them as:

Super-Market: A store that allows individuals to purchase an array of foods that may contain five or more registers, 15,000 or greater total square footage, including display, preparation, and storage areas.

Grocery stores: A store like supermarkets in which they offer consumers by contain four or fewer checking out registers, and they are less than 15,000 total square footage, including display, preparation, and storage areas.

Convenience stores: A store that offers a limited array of groceries or fuel for motor vehicles; such stores will likely offer coffee and other beverages to consumers.

Convenience Stores with limited food service: A store that offers consumers prepared foods, individually portioned. These stores mainly offer snack foods and other processes foods, such as hotdogs. No retail food processing occurs on site.

Convenience Stores with significant food service: A store that prepares food on site but also sales limited groceries.

Minor Food Outlet: A store that mainly functions as a grocery store but likely offer food service to consumers on a minor scale than convenience stores.

The US Census Bureau is in accordance with the American Community Survey (ACS) on the definition of demographic. The ACS break the poverty level and the demographic area down into different elements as follows:

-Population estimate, 2010-2014 ACS

-Housing units estimate, 2010-2014 ACS

-Households estimate, 2010-2014 ACS

-Persons below poverty estimate, 2010-2014 ACS

-Civilian (age 16+) unemployed estimate, 2010-2014 ACS

-Persons aged 65 and older estimate, 2010-2014 ACS

-Persons aged 17 and younger estimate, 2010-2014 ACS

-Percentage of civilian noninstitutionalized population with a disability estimate, 2010-2014 ACS

-Single parent household with children under 18 estimate, 2010-2014 ACS

-Minority (all persons except white, non-Hispanic) estimate, 2010-2014 ACS

-Persons (age 5+) who speak English "less than well", 2010-2014 ACS

-Mobile homes estimate, 2010-2014 ACS

-Households with no vehicle available estimate, 2010-2014 ACS

-Persons in institutionalized group quarters estimate, 2010-2014 ACS

Scope/Delimitation/Limitations

Scope

The scope of this study is to explore how food-borne illness and food safety risks and inspection rating from food entity neighborhood sociodemographic characteristics could predict the foodborne illness exposure from food safety inspection outcomes. The prevalence of those foodborne-illness and safety risk factor violations considered to be food from unsafe sources, inadequate cooking, improper hot/cold holding temperatures, contaminated equipment, and poor personal hygiene. Only those risk factors violations are presented. Other risk factor or contaminants, including chemical (e.g., pesticides, pharmaceutical agents, and toxins) and physical (e.g., metal fragments, dust, and dirt) violation, are not discussed.

Delimitation

The data in this study was limited to food establishment routine inspection collected in district 13 with results, fail. Hence, the data collected are not representative of the entire state of Florida or the United States. Only data from the period of 14 January 2014 through December 2016 were analyzed. The Florida Department of Agriculture, food safety program is based on the 2009 Food Code Model (FDA, 2009a) and the Florida Health and Safety Code, which has the purpose of safeguard public health, assure that consumers obtain food that is safe, unadulterated, detect food establishment’s operational needs and prevent food-borne illness outbreaks (HCPHES,2011).

Limitations

The main limitations to this study came from the use of secondary data. However great the use of secondary data is they do come with certain limitation. A major limitation of using secondary data is there is a chance of mistakes in the data due to such things as incorrect reporting or incorrect data inputting or just simple human error. Due to the large sample size, this will be minimized. Data randomization will not be done; some of the limitations the researcher cannot control for as it were critical in this study to have all the available data on food safety practices included due to their importance. Another limitation was the possibility that the documentation of inspections was not consistent. High risk food establishments require three routine inspections a year and medium risk establishments 14 require two routine inspections. Thus, there may be a lack of data regarding health inspections conducted because health inspectors were not able to conduct routine inspections as required due to varying reasons, such as lack of time, high work load, and other pressing public health issues that are the responsibilities of public health inspectors.

Significance

In 2014, there were 8,061 food products recalls by Food and Drug Administration (Thrall, 2016). Many of these recalls have been high risk recalls, largely due to potential contamination due to either E. coli O157:H7, Salmonella, or undeclared allergens. Chang et al. (2009) indicates that the incidence rates of salmonellosis and shigellosis are positively and independently associated with high poverty areas. The food supply chain is one of the most important supply chains in the US economy. However, it has also suffered from many safety incidents. Quinlan (2013) found that food safety problems are more prevalent at small, independently owned markets, low-income and minority populations shop. Risks include produce with high microbial counts, bacteria in milk, and fecal coliform contamination (Quinlan, 2013; Silbergeld et al, 2013). Populations with low socioeconomic status (SES) and minority populations have greater access to small corner store markets and less access to supermarkets (Quinlan, 2013). Currently food-borne illnesses are of increasing concern, and the proportion of illnesses experienced by low income groups compared to high income groups is still not clear (Newman et al., 2015). The study will help to fill a gap in the literature about the association between food retail risk and the different demographic risk factors to food-borne illnesses, which may lead to decreased food-borne illness risk in South Florida with similar characteristics. This study will contribute to the professional practice in public health in the areas of food safety helping to reduce the risks of food-borne illnesses. It could also bring positive social change by increasing awareness and understanding of food-borne illness risks to consumers from different population groups in South Florida.

The purpose of Chapter 1 was accomplished as stated in the introduction by establishing the framework of the study. An introduction of the subject matter and a statement of the problem were provided, and the purpose of the study was described. Research questions/hypotheses were presented, along with a justification of the need for the study. In addition, basic assumptions, delimitations, limitations, and definitions of terms were discussed. Chapter 2 follows with a comprehensive review of the literature related to the study topic and methodology.

Chapter 2: Literature Review

Introduction

Foodborne illnesses are an important public health problem worldwide (Quinlan, 2016). The World Health Organization (WHO) has created an initiative to estimate the global burden of foodborne illnesses, and they have stated that the achievement of certain Millennium Development Goals is being directly compromised due to foodborne illness (McLinden, 2014). However, governments have finite resources with which to address the health of their populations, and thus require high-quality scientific evidence to prioritize resource allocation. Accurate burden of illness estimates is useful for decision makers seeking to allocate resources to address the issues caused by foodborne pathogens (McLinden, 2014).

Foodborne illnesses are costly not only to those who suffer from it, but they also generate a considerable disease burden and economic loss. According to the United States Department of Agriculture (USDA), foodborne illness costs the United States economy between $10-83 billion United States dollars (USD) per year (McLinden et. al, 2014). In Australia and New Zealand, the cost of foodborne illness has been estimated at $1.289 billion and $86 million USD per year (McLinden et. al, 2014). In Europe, the annual cost of foodborne illness was estimated to be $171 million USD in Sweden and $2 million USD in Croatia (McLinden et. al, 2014).

There are numerous areas inside the food establishment chain, from the cultivated to the retail foundation, where foods may be contaminated and/or misused. It is subsequently critical for all ranges of food production to be carefully observed and controlled so that the hazard of food-borne illness is diminished. Contributing components to foodborne infection in the food establishment incorporate food handler (e.g., norovirus), insufficient hand washing by nourishment handlers, and cross-contamination between items. Numerous foodborne illnesses happen since of misused food in foodservice and food retail foundations. Research has demonstrated that food preparation practices in the establishment were most commonly associated with outbreaks of Escherichia coli O157 (100% of outbreaks), C. perfringens (81%), *and* Salmonella (58%) infections. Variables relating to defilement exterior the eatery were most common among outbreaks of Vibrio infection (100% of outbreaks), histamine fish poisoning (89%), and E. coli O157:H7 infection (80%). Since foods prepared in these establishments are the closest link to ingestion by the consumer, monitoring, and control of food-borne risks is most critical at the foodservice and food retail end of the food production.

In this chapter, I provide a review of the extant literature related to this research where the summarized evidence indicates that individuals of low economic and minority groups may have greater exposure to food-borne illness. In the first section, I illustrate the current food safety system in the United States and the evidence related to the role of food safety programs and inspectors in food-borne Illness. I discuss the causes of food-borne illness in establishments and how food safety surveillance data provide a guideline as to what areas of food safety need improvements to reduce the occurrence of food-borne illness. Studies use food safety surveillance data to understand the epidemiology of food-borne diseases. Following this, I present studies that show disparities in trends of foodborne diseases for different populations. Finally, I highlight the gaps in the current literature on food safety.

Literature Search Strategy

I conducted a literature review search to reveal theoretical gaps in food-borne disease research. I reviewed articles from 2013 to 2016 that addressed factors related food borne infections, food safety program and inspector roles in national level food safety surveillance data, food-borne illness in relation to ready-to-eat foods at the retail level, and incidence of food-borne illness for populations of different races/ethnicities, and socioeconomic status populations. Academic Search Premier, Walden University library, Proquest, PubMed, and Google Scholar were used to extract scholar (Peer Reviewed) journals that related to food borne illness and to the gaps of research on food borne illness in America. Key search terms were *food safety, food safety education, certified food safety managers, food safety practices, ServSafe, restaurants food-borne illness outbreaks, critical violations,* and *food safety training*. Additional research was conducted using citations of articles in the literature. Further research was conducted to identify and download more articles related to food safety using the key terms. The result of the search included 80 journals where 16 journals were selected, and the remaining journals were expelled as less important sources. I focused on the 16 significant journals that published in the past 5 years. Significant articles selected are summarized in the literature matrix in Table 1.

Theoretical Framework Foundation: The Epidemiologic Triangle

This study was guided by the conceptual of Epidemiologic Triangle model in figure 1. The Epidemiologic Triangle model is a model that scientists have developed for studying health problems. Epidemiology triangle helps in identifying the major risk factors and shows the relationship between the three factors that influence the occurrence and prevention of disease and injury. I applied the Epidemiologic Triangle in this study to demonstrate the relationship between of the person, place, and time. The epidemiological triad of the person, place, and time, a relatively simple, but important, model of disease transmission (Figure 1), describes the relationship between the person, place, and time. Person, place, and time co-exist independently, and a condition occurs only when there is an interaction between the person and the place or the time of the condition. The presence (or absence) of the person is necessary for infection to occur (or be prevented). The environment must support the conditions, and the conditions must transmit to a susceptible person in an appropriate time, manner, and sufficient dose to occur the conditions. For this research, the disease will describe by various characteristics of the person (groups and population demographic who is affected), place (food establishment and retail food types where the condition), and time (pattern of the condition over time).

In this model, food in the retail establishments is considered safe when it has reasonably demonstrated that no harm will result from its consumption by people. Food is considered contamination if there is anything in the establishment that reduces the safety or quality of the food. Food can be contaminated by biological, chemical, or physical hazards. This study will focus primarily on biological hazards and chemical since they are the most common hazard in foodservice and food retail. There are many areas within the food production chain, from the farm to the retail establishment, where foods may be contaminated and/or mishandled. It is therefore important for all areas of food production to be carefully monitored and controlled so that the risk of foodborne illness is decreased. Many foodborne illnesses occur because of mishandled foods in foodservice and food retail establishments.

Review of Studies Related to Key Concept: Food- borne Disease Inspections, and Food Safety

Definition of Food-borne Disease

Foodborne illness is a preventable public health challenge that causes an estimated 48 million illnesses and 3,000 deaths each year in the United States. An illness comes from eating contaminated food (USDA, 2013). The onset of symptoms may occur within minutes to weeks and often presents itself as flu-like symptoms, as the ill person may experience symptoms such as nausea, vomiting, diarrhea, or fever. Because the symptoms are often flu-like, many people may not recognize that harmful bacteria or other pathogens in food cause the illness (USDA, 2013). The problems of food safety in the developed countries differ considerably from those of developing countries. Whereas, in developing countries traditional methods of processing and packaging, improper holding temperature, poor personal hygiene of food handlers is still observed during food marketing and technology (Mensah et al., 2002).

Food Safety

Food is crucial for life but can as it served such as a critical reason if it is secure and secure to ingest. Food can be characterized as eatable substances whether in common or made state which, from an open wellbeing point of view frame portion of the human count calories (Will and Guenther, 2007). Understanding the need of getting to sound and nutritiously sound foods is imperative for all. Food security is a broader term, which implies an affirmation that food will not cause hurt to the customer when it is arranged and/or eaten agreeing to its expecting utilize. This can be accomplished through the utilization of different assets and techniques to guarantee that all sorts of foods are legitimately put away, arranged, and protected so that they are secure for utilization (WHO, 2000). Practicing this level of food sanitation starts with the buy or securing of distinctive food items and closes with the appropriate capacity of scraps for future utilize. One of the most vital viewpoints of practicing food security includes anticipating foods from getting to be sullied. Making beyond any doubt, foods are put away appropriately goes a long way in dodging any sort of food defilement. Essential kitchen sanitation rules are imperative component of any food security methodology (Jevs'niket al., 2006a). Food elaborated with satisfactory hygienic standards is one of the essential conditions for promoting and preserving health, and inadequate control is one of the factors responsible for the occurrence of foodborne disease outbreaks (Oliveira et al., 2003).

Lacking food security is a significant contribution to the burden of disease in developing countries including Kenya and ought to be tended to as the food framework creates along with related speculation in public health. The overwhelming burden of foodborne illnesses forces considerable financial misfortunes to person, families, health system and entire nation. Financial misfortunes because of rejected nourishment sends out due to deficiencies in food security and too regularly exceptionally critical.

Food Contaminants

Separated from objectionable materials, such as rust, earth, hair machine parts, nails, and jolts (physical contaminants), food contaminants drop into two wide categories; biological agents such as bacteria, viruses, molds, antibiotics, parasites, and their toxins, which can cause a wide range of illnesses and chemicals such as lead cadmium, lead, mercury, nitrites, and organic compounds which can have both acute and chronic health effects. Such contaminants can pick up to get the food chain at any of many stages during growing, processing, preparation, or storage. Microbiological sources stand out for posturing an awesome hazard to public health since of the seriousness of the clinical indications and the expansive number of food and microorganisms that can be involved (Silva et al., 2003).

Generally, pathogenic microbes have been the most predominant food security danger, with viral cases taking after closely behind concurring to a CDC report on the etiology of foodborne sickness (CDC, 2004). Such pathogens cannot be recognized organoleptically (seen, noticed, or tasted) but can cause infection of shifting seriousness, which may result in passing. Microbial sources account for upwards of 95% of all detailed foodborne infection episodes (Marshal and Dickson, 1998). Studies of microbial pathogens and poisons have been distributed in a few valuable compilations (CDC, 2002, Lynch et al., 2006). Most of the outlines concur in their conclusion that bacterial pathogens are dependable for the lion's share (>80%) of flare-ups cases. Individual of the Enterobacteriacea, Salmonella serovas, enterophathogenic E. coli, and Shigella ssp and individuals of the campylobacterageic, Campylobacteraceae, campylobacter jejuni and C. coli, are mindful of the lion's share (>70%) of foodborne bacterial sickness. Of auxiliary significance are harmful contamination by Clostridium perfringens and Bacillus cereus, intoxications by Streptoccoccus spp and Listeria monocytogenes (Johnson, 2003, pp 30). Chemical nourishment security dangers change broadly, but the most common issues cited in the writing incorporate defilement with pesticides, allergens, and characteristic poisons, counting scrombotoxins found in angle and mycotoxins found in crops. Remote objects, or physical dangers, are the slightest likely to influence expansive numbers of individuals and a rule are effectively recognized (Johnson, 2003, pp 30).

Epidemiology of Foodborne Diseases

A foodborne disease outbreak defines as two or more illnesses caused by the same germ (e.g., a toxin, virus, or bacteria) which link to eating the same food. Each year, >9 million foodborne illnesses are estimated to be caused by major pathogens acquired in the United States. CDC estimates that each year roughly 48 million people gets sick from a foodborne illness, 128,000 hospitalized, and 3,000 die. 9.4 million of these estimated illnesses are caused by 31 known pathogens, but the majority (38.4 million) are the result of "unspecified agents" (Scallan et al. 2011). Because the difference in illness caused by known and unknown foodborne agents is so great, when the CDC released its foodborne illness reports in 2011, the authors published two separate reports, one detailing the 31 known pathogens and the other explaining the large amount of illness unaccounted for by an identified agent (CDC, 2011). The "top five pathogens causing domestically acquired foodborne illness" are norovirus (5,461,731 per year), Salmonella (nontyphoidal, 1,027,561 per year), Clostridium perfringens (965,958 per year), Campylobacter spp. (845,024 per year), and Staphylococcus aureus (241,148 per year) (Scallan et al. 2011). The "top five pathogens causing domestically acquired foodborne illness resulting in hospitalization" are Salmonella (nontyphoidal, 19,336 per year), norovirus (14,663 per year), Campylobacter spp. (8,463 per year), Toxoplasma gondii (4,428 per year), and E. coli (STEC) O157 (2,138 per year) (Scallan et al. 2011). Finally, the "top five pathogens causing domestically acquired foodborne illnesses resulting in death" are Salmonella (nontyphoidal, 378 per year), Toxoplasma gondii (327 per year), Listeria monocytogenes (255 per year), norovirus (149 per year), and Campylobacter spp. (76 per year) (Scallan et al. 2011).

Although outbreak-associated infections account for only a small proportion of culture-confirmed infections, outbreaks are associated with substantial morbidity and played an important role in our understanding of the epidemiology of foodborne illness (Gould et al., 2013). Outbreaks can occur in many settings, but eating in a restaurant is a risk factor for acquiring a foodborne illness (Gould et al., 2013). More than half of all foodborne disease outbreaks reported to the Centers for Disease Control and Prevention (CDC) are associated with eating in restaurants or delicatessens (Gould et al., 2013). Guzewich and Ross (2013) and Olsen et al. (2000) suggested that poor personal hygiene of food workers is a contributing factor to foodborne illness outbreaks. With restaurants being the location commonly identified for food-borne illnesses, it is critical that employees and managers understand the causes of food-borne illness and ways to prevent food-borne illness.

Risk factors contributing to foodborne illness in food service establishments

Risk factors and food safety violations typically cause foodborne illnesses commonly to occur in five categories: food from unsafe sources, inadequate cooking, improper hot/cold holding temperatures, contaminated equipment, and poor personal hygiene (Roberts et al., 2012). The criticality of violation is interpreted by a safety and quality of food that produced for human consumption in developing countries continue to increase because of foodborne disease outbreaks attributed to unsafe raw food, abused temperature, poor storage infrastructures, inadequate cooking, poor personal hygiene, improper handling methods, and cross- contamination of cooked food with uncooked raw food.

Risk factors associated within establishments

To gain a better understanding of the risks associated with restaurants and foodborne illness, a network of environmental health specialists referred to as EHS-Net was established. EHS-Net conducts food safety research and surveillance in restaurants, identifying how and why food-borne illness outbreaks occur and translating the knowledge into preventive practices (Hedberg et al., 2013). EHS-Net is a network of environmental health specialists and epidemiologists collaborating and exchanging ideas with laboratories, food protection programs, the Environmental Health Branch of the National Center of Environmental Health at CDC, the Food and Drug Administration, and FoodNet. Important information on food safety policies and practices have been found by EHS-Net in conducting to these environmental assessment studies. Gould et. al (2013) found among 457 foodborne disease outbreaks reported in 2006 and 2007 by FoodNet sites, 300 (66%) were restaurant associated, and of these 295 (98%) had at least one reported contributing factor. Of the 257 outbreaks with a single etiology reported, contributing factors associated with food worker health and hygiene were reported for 165 outbreaks (64%), factors associated with food preparation practices within the establishment were reported for 88 outbreaks (34%), and factors associated with contamination introduced before reaching the restaurant were reported for 56 outbreaks (22%).

Risk factors associated with cross-contamination

The transfer of germs from one food items to another is called cross contamination. Inadequate food preparation practices, including cooking and cross-contamination factors, are associated with approximately 3.5 million cases at a cost of4.3 billion USD, annually Approximately 10 to 20% of food-borne disease outbreaks are due to contamination by the food handler (Zain & Naing, 2002). It is also well known that cross-contamination and improper cooking temperatures contribute to the burden of food-borne illness; several studies have been conducted and have observed these two risk factors. Improper food-handling practices in the food industry are the number one cause of staphylococcus foodborne disease outbreaks. Aseffa (2015) was assessed the bacterial hand contamination and associated factors among 230 food handlers working in the student cafeterias of Jimma University main campus. They found that 114 (49.6%) were tested positive for one or more potential foodborne bacterial contaminants, and 73 (31.7%) were tested positive for enteric pathogens. A total of 171 bacterial hand contaminants was isolated. S. aureus 54(23.5%), Klebsiella spp. 37 (16.1%), *E. coli* 25 (10.9%), Enterobacter spp. 21(9.1%), Citrobacter spp. 10 (4.3%), Serratiamarcescens 6 (2.6%), Pseudomonas aeruginosa 8 (3.5%), Proteus spp. 5 (2.2%), Providencia rettegri 3 (1.3), and salmonella spp. 2 (0.9%) were isolated with their corresponding prevalence rate. Bacterial hand contamination rate has significant association with service years.

Food handlers frequently have small understanding of the chance of microbial or chemical defilement of nourishment or hot dodge them (Hobbs and Roberts, 1993). A survey conducted by Williamson, Gravani & Lawless (1992) revealed that unsafe use of kitchen utensils was common. Their result showed that 37% of the survey respondents would only rinse the knife and cutting board used to cut fresh meat prior to using the same items again to chop fresh vegetables for a salad. On the other hand, 5% of the respondents would simply start chopping the vegetables with the same knife and cutting board. They summarized that only 54% would wash the knife and cutting board with soap and water prior to chopping the fresh vegetables.

Risk factors associated with personal hygiene

Poor hygiene and handling food cause more than 90% of the food safety problems. Insights appeared that disgraceful hand washing alone accounts for more than 25% of all foodborne diseases (Weinstein, 1991). Manning & Snider (1993) found that some personal hygiene and handling practices of workers did not support their knowledge and attitudes about hygiene and cross contamination. Food handlers play a major role in the transmission of food borne pathogens via hands. Food handlers are the most important sources for the transfer of microbial pathogens to food either from their hair, skin, hand, digestive systems, respiratory tracts, or from contaminated food prepared and served by them. The hands are the last line of defense against exposure to pathogens which can occur either directly from the hand to the mouth, eye, nose, or other area of the skin, or indirectly by "handling" of food or water. A research was designed to determine the level of bacterial contamination among food handlers working at various restaurants in Kano state metropolis, Kano Nigeria. 135 samples were collected from the palm of food handlers of 15 different restaurants, in which each sample obtained, were cultured, bacteria isolated, identified, and characterized per standard procedure. Result shows that among 8 different species of bacteria isolated and identified, Escherichia coli has the occurrence of 20.3%, Enterobacter spp 15.4%, Shigella spp 14.7%, Staphylococcus aureus 14.7%, Salmonella spp 13.9%, Klebsiella spp 11.9%, Streptococcus spp 6.2%, and Vibrio spp with occurrence of 2.8%. The result of this research shows the occurrence of pathogenic bacteria on the hands of food handlers working in these various restaurants (Yusuf, 2016).

Risk factors associated with associated with the temperature of food

As explained by McSwane et al. (2004), controlling temperature of food cook is vital in assuring that food service establishment complies with food safety regulations. Food borne illness may be resulted from temperature abuse while preparing a dish. National Restaurant Association Educational Foundation (NRAEF) (2012) has reported that time temperature abuse arises when food has been allowed to remain for a long time at temperatures favorable to bacterial growth. McSwane et al. (2004) further added that the abuse of temperature also may be caused by insufficient amount of cooking or reheating time and desired temperatures that should eliminate the existence of harmful microorganism. The usage of devices in measuring food temperature such as thermometers, thermocouples and infrared reading is essential in determining whether the food was in the danger zone or otherwise (McSwane et al., 2004). Nott & Hall (1999) explained that the major purpose of cooking is to increase the palatability of food, the heating of many foods is essential to kill bacteria thereby increasing the foodstuff's safety and storage life. In practice, pasteurization and other sterilization processes require stringent assurance that all parts of the food product have been heated above a certain temperature for a defined period (Nott & Hall, 1999). Several studies have reported that poor holding and cooking temperature control was a main factor contributing to food borne outbreaks (Todd, 1997). Improper holding temperature of food also can contribute to the growth of certain bacteria through its spores because not all these spores will be destroyed with heating processes (McSwane et al., 2004). Thus it is important for all food handlers to recognize their responsibilities in ensuring that all food prepared were monitored in every stages of its preparation.

The risk that is of greatest concern for food-borne illness transmission involves employees working while ill. Carpenter et al. (2013) interviewed food service workers and discovered that 20% reported working while having symptoms such as vomiting and diarrhea. From 2001 through 2008 in the United States, food service workers were linked to food-borne illness outbreaks of norovirus (Hall et al., 2012). The FDA (2012b) has designated symptoms associated with food-borne illness, which include vomiting, diarrhea, jaundice, sore throat accompanied by a fever, and open wounds. The FDA indicated that five food-borne illnesses are commonly transmitted through food— Salmonella, Shigella, Norovirus, Shiga-toxin producing E. coli, and Hepatitis A—and must be reported by an employee to a manager or person in charge. Clearly, it is important that managers and employees understand the causes of food-borne illness and appreciate the need for not working while ill, good hygienic practices, and practicing food safety to prevent food-borne illness outbreaks. In addition, employees should be trained to understand and gain knowledge of food safety practices and should be observed by a manager who is certified in food safety.

Importance of food safety

Over the past two decades, food security safety measures have been basic thought of the consumer's in-house and restaurant assurance decision-making plan (Onyeneho, S. N., & Hedberg, C. W. (2013). The noteworthy of food security has extended during the on-going press releases recognizing contaminated food products sold to the public and the partiality of restaurateurs to continue harming secure taking care of directions (Harris et al., 2014). Disillusionments of restaurateurs and sellers to prepare staff, implement safe food handling practices, and implement systems to deliver safe food as mandated by the United States Department of Agriculture (USDA), the United States Food and Drug Administration (FDA), and the Centers for Disease Control and Prevention (CDC), proceeds to be a concern for food safety systems nation-wide (Harris et al. et al., 2014). Consumers are uncertain almost whether restaurants are genuinely secure places to eat, and they have small certainty that retail food outlets are centering on ensuring their supporters (Harrington, 2009). In despite o proceeded endeavors to direct food safety in foodservice operations, most the detailed cases of foodborne illness can be followed back to open eating foundations that incorporate eateries (Harris et al. et al., 2014).

Importance of Inspections in Food Safety and Food-Borne Illness

Inspections have been a part of food safety regulatory activities since the earliest days of public health. The term "routine inspection" has been used to describe periodic inspections conducted as part of an on-going regulatory scheme. Routine Health inspections are conducted in restaurants and food establishment service to prevent food-borne illness by ensuring that food is handled correctly and prepared safely. However, health inspections alone have not been effective in reducing critical violations due to unsafe food handling practices (Cruz et al., 2001; Jones et al., 2013; Newbold et al., 2015; Phillips et al., 2012).

In a prior r study, Irwin et al. (2012) analyzed the association between routine inspections and food-borne illness in restaurants and found a significant association between inspections and food-borne illness from restaurants. Reproducing the think about by Irwin et al. 1989, Cruz et al. (2001) tested the association between food-borne illness and violations cited during routine inspections using a random sample of 127 restaurants that were divided into those that had outbreaks (n = 51) and those with no outbreaks (n = 76). However, there were factually critical different between the two groups, and no basic infringement had been cited among 45% of the case restaurants prior to an outbreak. Results demonstrated that restaurant inspections alone do not effectively predict outbreaks, but that food safety training and a HACCP plan are required in the prevention of food-borne illness. Cruz (2016) conducted a study with 51 outbreak inspection reports of restaurants to determine the usefulness of restaurant inspections in predicting food-borne outbreaks in Miami–Dade County, Fla. Result show that restaurant inspections in Miami–Dade County did not predict outbreaks.

Basic infringement posture considerable health hazards and likely to contribute to foodborne illness. Statewide survey data (1993-2000) from restaurants in Tennessee were reviewed by Jones et al. (2004). A total of 167,575 restaurant inspections was examined to determine whether inspection scores could predict food-borne illness. Researchers reported that there was no critical distinction between mean scores of restaurants with reported outbreaks and mean scores for those with no reported outbreaks. Violations most commonly cited during routine inspections among restaurants with reported outbreaks were the same ones cited among restaurants that were not involved in outbreaks. However, Cruz et al. (2001) found that case restaurants, when compared to the controls, were three times more likely to be cited for vermin and had larger seating capacities; both variables are related to outbreaks. Jones et al. reported that before an outbreak was reported, the mean score for the restaurant's last inspection was 81.2% and was 81.6% for the previous inspection was, whereas restaurants with no reported outbreak had mean scores from 80.2% to 83.8%. However, in the Cruz et al. study, case restaurants' scores were less to be the most favorable (70%), while the control group had a rating of 80%. One limitation to the Jones et al. study was limited data on outbreaks in Tennessee, which suggested that scores alone are not a direct reflection of a restaurant in the prediction of food-borne illness. In both studies, violations most commonly cited during routine inspections improper heating and cooling, improper cooking, holding, and storage. More education and food safety training is needed in restaurants; along with the appropriate regulatory action such as inspection follow-up to prevent the occurrence of food-borne illness.

Scores alone are not a coordinate reflection on a restaurant in the prediction of foodborne illness. Just because a restaurant scores 90 or above, one ought to not expect that there was no basic violation cited that might pose a risk; moreover, a restaurant with a score of <80 may have a few violations but no basic that pose a risk for food-borne illness. To avoid food-borne illness, there are different extra factors such as extensive education, training, or HACCP (Hard Analysis Critical Control Point) plan that must be established. In addition, researchers in the past studies suggested that other factors such as policies and standardization of inspectors have an influence the inspection process of restaurants in preventing food-borne illness. Health inspections of restaurants play a part in food security but alone are not sufficient in avoiding foodborne illness. Reviews, in common, allow a preview appearing what ranges of a foundation require enhancement.

Food safety in Florida

Levels of participation between the CDC, USDA, state-regulated restaurant and lodging licensing boards, and inspection services offering training and support to restaurant operators and food handlers are at an all-time high; however, the consistent monitoring of the quality of these programs is not (Murphy et al., 2011). In Florida, a food service establishment is defined as any place where food is prepared or provided in individual proportions for consumption on or off the premises and includes restaurants, delis, take-out food premises, and similar type establishments (Florida Health, 2012a). All food service establishments are subject to the requirements of Florida Regulation 339/88R, Food and Food Handling Establishments Regulation under The Florida Public Health Act (Florida Health, 2014b). Food safety programs in Florida mandate that both food handlers and managers of retail food operations achieve certification within 60 days of employment. Specifically, Florida Food Statutes (#509-049) require the Division of Business and Professional Regulation (DBPR) to monitor certifications, and re-certification every three years. Training must do by an approved state-evaluated provider (U.S. Public Health Service, 2001).

Public Health Inspectors conduct food service establishment inspections. The Florida Department of Agriculture and Consumer Services (FDACS), Division of Food Safety Bureau of Food and Meat Inspections regulate food establishments. FDACS regulates over 4,500 manufactured food entities in the State of Florida and is responsible for permitting these facilities. Public health inspections determine if regulatory requirements and industry standard practices are being followed with respect to food temperature control, food protected from contamination, employee hygiene and hand washing, food handling and procedures for cleaning and/or sanitizing equipment or food contact surfaces, pest control and storage/removal of waste (Allwood et al., 1999; Yeager et al., 2013). Health Inspection can happen as 1) a routine inspection, which is an inspection of a facility that perform at relatively consistent intervals and determine compliance with the Florida Food Regulation (Florida Health, 2014a). 2) A re-inspection, which is an inspection of a facility that is performed to determine if noncompliant food safety practices noted in the previous routine inspection have been corrected. 3) Additional inspections which occur as necessary, such as investigation of food-borne illnesses and food-borne outbreaks, investigation of consumer complaints and correction of noncompliance with the Florida Food and Food Handling Establishments Regulation (Florida Health, 2012).

Each visit by the Public Health Inspector creates an inspection report that is given to the operator. The health inspection reports either affirm that the food premise is compliant with regulations, or to illuminate that there are food safety practices that are not being followed and that must be addressed. Those food premises that are compliant will be reviewed as per next schedule routine inspection date (Florida Health, 2012). Those food premises with food safety practice(s) noncompliance will require a re-inspection inside and endorsed time, which is demonstrated by the health inspector to guarantee compliance with the regulation.

In Florida, food establishments are classified in three categories: food handling establishment, food processing plant and food service establishment. A food handling establishment includes a food service establishment, retail food store, food processing plant, temporary food service establishment, meat processing plant or any place, premise were food is manufactured, processed, prepared, packaged, stored, or handled, or sold or offered for sale (Manitoba Health, 2014a). A food processing plant is a Commercial establishment in which food is manufactured, processed, or packaged. A food services establishment is any place where food is prepared or provided for individual consumption, does not include a food processing plant or retail food (Florida Health, 2012).

Food safety practices of the regulation may be considered critical or non-critical. Critical practices are those that, on the off chance that cleared out uncorrected, are more likely to cause or contribute if let uncorrected, are more likely to cause or contribute to food contamination or food-borne illness. Critical conditions include the following; water supply, food source, food condition, food protection, food handling, cold food storage, hot food storage, pest/animal control, equipment Sanitation, utensil sanitation, staff/employee health and hygiene, manual dishwashing and mechanical dishwashing and construction (Florida Health, 2014a). During each routine inspection, the inspector checks all conditions. When a food safety practice is considered critical, an immediate corrective action is required by the food establishment operator and a re-inspection is to be conducted in a timely manner. When a food safety practice is considered non-critical, more time is generally given to the operator to provide corrective action (Florida Health, 2012).

At the time of this study, violations found in restaurant inspections in Florida are categorized as critical violations, non-critical violations, and risk factors. This study investigates the high-risk infractions (critical violations) that inspectors found in low SES foodservice operations. Further, foodservice status as a chain or a non-chain type and location of the food business depended on the district where the foodservice operates.

Critical food safety violations are those infractions that, if not corrected, are more likely to directly contribute to food contamination or illness. Some examples of these include poor temperature control, improper cooking or holding of food, cross contamination, or improper reheating of food items (Florida Department of Business and Professional Regulations, 2013).

Non-critical violations are those practices that do not directly relate to foodborne illness risk, but are preventative measures used to control environmental conditions. Some examples include poor maintenance of food and non-food contact surfaces, improper storage and handling of clean equipment and utensils. Risk factors are those food preparation practices and behaviors that increase the chances of foodborne illness outbreaks such as improper holding times and temperatures, contaminated equipment, cross contamination, poor personal hygiene, employee health, and demonstration of knowledge (Florida Department of Business and Professional Regulations, 2013).

Number of food safety inspections

Most of regulatory agencies use scoring methods to rate food establishments. Depending on the system used, establishment scoring may provide an indication of how well a food establishment is complying with the food safety rules of the regulatory agency. The number of food safety inspections that are conducted in restaurants varies by city, county, and state. This variation in the number of inspections may be one of the reasons that there is disparity in the number of food safety incidents in restaurants. Another variable in ensuring that the public is protected while dining out is the ability to have consistent results from health inspectors. Because the health code allows professionals to use their own judgment when grading food safety inspections, there is room for error. The health inspectors around the country do not have consistent standards that they must follow and training in which they must participate (Lee et al., 2012). This fact seems to highlight the need to have health inspections more frequently to help the restaurant operation get a more consistent and less biased perspective of their restaurant. It should also be noted that Lee et al. (2012) discovered that inspector and operation type influences inspection scores. With the number of districts in the state of Florida and inspectors assigned to each, inspection scores may vary based on the individual knowledge and training of the inspector. The current study will determine how many health inspections are performed relative to chain and non-chain restaurants to determine if there are any differences.

Foodborne Illness in Relation to Food Establishment Inspections

Jones et al. published a state-wide study from Tennessee that correlated mean inspection scores of restaurants to mean scores of restaurants who had foodborne disease outbreaks (Jones et al. 2012). Very few studies correlating restaurant inspections to foodborne illness outbreaks exist, and this 2004 study appears to be the most rigorous. Though they did not include “special inspections performed in response to customer complaints or to follow-up on deficiencies noted in semi-annual inspections” or “inspections of schools, correctional facilities, and bars that did not serve food," they did include the inspection results from the semi-annual inspections (Jones et al. 2012).

The researchers discovered that inspection results were extremely variable and dependent on the year in which they were performed, the person performing the inspection, and the region where the restaurant had been established (Jones et al. 2012). All the different types of restaurants (fast food, independent, chain) had similar mean inspection scores, but restaurants serving types of cuisine had some variation in mean inspection scores, with Thai scoring highest and Indian scoring almost ten points below Thai on average (Jones et al. 2012). However, the mean inspection scores of restaurants over the seven-year study period were very similar, and no significant conclusion linking poor inspection scores to foodborne illness outbreaks could be established (Jones et al. 2012).

Citing "methodological problems" with performing these kind of studies, the authors discuss the "rarity of reported foodborne outbreaks in relation to the number of restaurants and the small percentage of suspected foodborne illnesses linked to epidemiologically confirmed, restaurant associated outbreaks," which poses major problems to the scientific analysis of restaurants and foodborne illness (Jones et al. 2012). Jones et al. mention that the few other similar studies have churned up varied results, with some finding that routine inspection scores can accurately predict the occurrence of foodborne illness, as in the Seattle-King County Experience (Irwin et al. 2014), and a few finding that there is no relationship, as in a study of Miami-Dade County in 2001 (Cruz et al., 2013).

Foodborne Illness in Relation of Different Races/Ethnicities, Socioeconomic Status Populations

There are few numbers of population-based ecological studies that assessed area-level associations between enteric infections and socioeconomic status (SES) indicators. A past study in the Greater Toronto Area has shown a relationship between socioeconomic status and S. Enteritidis infection. Retrospective data on S. Enteritidis infections from 2007 to 2009 were obtained from Ontario's reportable disease surveillance database and were grouped at the forward sortation area (FSA) – level. The study demonstrated that FSAs with high and low average median family income, medium proportion of visible minority population, and high average number of children at home per census family had the highest S. Enteritidis infection rates (Varga et al, 2013). In 2001, the incidence of Shigella infection in Miami Dade was greater in Non-Hispanic Blacks (9.4 per 100,000) when compared to Non-Hispanic White (2.0) and Hispanic (4.2) (Thomas, 2012). Similarly, Cheng et al. (2013) reviewed Foodborne Diseases Active Surveillance Network (FoodNet), reports of laboratory-confirmed non-Typhi Salmonella infections in infants from 1996–2008 found that 2008 incidence remained highest among blacks (141.0 of 100 000 vs 113.5 of 100 000 among whites and 109.9 of 100 000 among Asians). Recent FoodNet data continues to show that Hispanics and African Americans, but not Asians, experience greater incidence of Shigella when compared to Caucasians. Percent African American, percent Hispanic, percent urban population and number of food handlers in the population were all positively associated with incidence of shigellosis (Quilan, 2013).

Goldstein (2016) recently evaluated the association between community socioeconomic factors, animal feeding operations, and campylobacteriosis incidence rates from the Foodborne Diseases Active Surveillance Network (FoodNet) case data (2004–2010; $n = 40{,}768$) and socioeconomic and environmental data from the 2010 Census of Population and Housing, the 2011 American Community Survey, and the 2007 U.S. Census of Agriculture. The study found Community socioeconomic and environmental factors were associated with both lower and higher campylobacteriosis rates. Zip codes with higher percentages of African Americans had lower rates of campylobacteriosis (incidence rate ratio [IRR]) = 0.972; 95 % confidence interval (CI) = 0.970,0.974). In Georgia, Maryland, and Tennessee, three leading broiler chicken producing states, zip codes with broiler operations had incidence rates that were 22 % (IRR = 1.22; 95 % CI = 1.03,1.43), 16 % (IRR = 1.16; 95 % CI = 0.99,1.37), and 35 % (IRR = 1.35; 95 % CI = 1.18,1.53) higher than those of zip codes without broiler operations. In Minnesota and New York FoodNet counties, two top dairy producing areas, zip codes with dairy operations had significantly higher campylobacteriosis incidence rates (IRR = 1.37; 95 % CI = 1.22, 1.55; IRR = 1.19; 95 % CI = 1.04,1.36) (Goldstein, 2016)

Table 1

Summary of the Literature on Foodborne illnesses, Food safety, Food Establishment, and populations of different races/ethnicities, Socioeconomic Status food safety Outcomes

Author/ Date	Research Question(s)/ Hypotheses	Methodology	Analysis & Results	Conclusions
Assefa T., Tasew H., Wondafrash B., Beker J. (2015)	Food handlers play a major role in the transmission of food borne pathogens via hands	Descriptive cross-sectional study design	Among 230 food handlers, 114(49.6%) were tested positive for one or more potential food borne bacterial contaminants, and 73(31.7%) were tested positive for enteric pathogens. A total of 171 bacterial hand contaminants were isolated. S. aureus 54(23.5%), Klebsiella spp. 37(16.1%), E. coli 25 (10.9%), Enterobacter spp. 21(9.1%), Citrobacter spp. 10(4.3%), Serratiamarcescens 6 (2.6%), Pseudomonas aeruginosa 8(3.5%), Proteus spp. 5(2.2%), Providencia rettegri 3(1.3%), and salmonella spp. 2(0.9%) were isolated with their corresponding prevalence rate. Bacterial hand contamination rate have significant association with service years (Chi-square=13.732, DF=4, P=0.008), age ($\chi 2$=11.308, P=0.010) and cleanness of outer garments ($\chi 2$=7.653, P=0.006).	The findings of this study emphasized the importance of food handlers' hands as a potential vector for potential food borne bacterial contaminants which could constitute a potential risk to food borne outbreaks.
Cheng, L. H., Crim, S. M., Cole, C. R., Shane, A. L., Henao, O. L., &Mahon, B. E. (2013)	Infants have increased risk for salmonellosis	Descriptive cross-sectional study design	Average annual incidence of salmonellosis per 100 000 infants was 177.8 (95% confidence interval [CI], 152.7–202.8) in blacks, 129.7 (95% CI, 94.8–164.7) in Asians, and 81.1 (95% CI, 70.2–92.0) in whites. Our analysis of ethnicity independent of race showed salmonellosis incidence of 86.7 (95% CI, 74.6—98.9) in Hispanics and 69.4 (95% CI, 54.8—84.1) in non-Hispanics. Salmonellosis was invasive more often in blacks (9.4%) and Asians (6.4%) than whites (3.6%, P <.001 and P = .01, respectively). Asian infants with salmonellosis were older (median, 31 weeks [range, 0–52]) than black (24 weeks [range, 0–52], P < .001) or white infants (23 weeks [range, 0–52], P < .001). Incidence of all salmonellosis remained stable for whites from 1996–1998 through 2008, but blacks had a sustained decrease, with relative risk of	Black infants had a greater risk of salmonellosis and invasive disease than other racial groups, and despite the greatest decrease in incidence over the study period, they continued to have the highest incidence of salmonellosis.

Author/ Date	Research Question(s)/ Hypotheses	Methodology	Analysis & Results	Conclusions
			0.48 (95% CI, .37–.63) in 2008 compared with 1996–1998. However, 2008 incidence remained highest among blacks (141.0 of 100 000 vs 113.5 of 100 000 among whites and 109.9 of 100 000 among Asians).	
Dahiru, Y.J., Abubakar, F.A., Idris, H., and Abdullahi, S.A (2016)**.**	Food can become contaminated via dirty hands if there is lack of proper hygiene among the food handlers when handling food.	Descriptive cross-sectional study design	Result shows that among 8 different species of bacteria isolated and identified, Escherichia coli has the occurrence of 20.3%, Enterobacter spp 15.4%, Shigellaspp 14.7%, Staphylococcus aureus 14.7%, Salmonella spp 13.9%, Klebsiellaspp 11.9%, Streptococcus spp 6.2%, and Vibrio spp with occurrence of 2.8%.	The result of this research shows the occurrence of pathogenic bacteria on the hands of food handlers working in these various restaurants.
Jacob, R. (2012)	The temperature of storage of eggs and milk will be higher in stores located in low SES and minority racial/ethnic areas compared to stores of high SES and Caucasian areas. 2. The aerobic plate count (APC) in RTE lunchmeat, sandwiches, fruits, greens, herbs and milk will be higher in stores located in low SES and minority racial/ethnic areas compared to stores in high SES and Caucasian census tracts. 3. Counts of indicator organisms (total coliform and fecal coliforms) will be higher in RTE lunchmeat, sandwiches, fruits, greens and herbs in stores located in low SES and minority racial/ethnic areas compared to stores in high SES and Caucasian census tracts. 4. The percentage of RTE lunchmeat, sandwiches, fruits, greens and herbs contaminated with *E. coli* will be higher in stores located in low SES and minority racial/ethnic areas compared to stores in high SES and Caucasian census tracts. 5. The percentage of RTE lunchmeat, sandwiches, fruits, greens and herbs contaminated with	Methods described in the Food and Drug Administration *Bacteriological Analytical Manual* (FDA, 2001) were used to enumerate the levels of Aerobic Plate Count, Coliforms, Fecal coliforms, *Escherichia coli* and *Staphylococcus aureus* and detect the resence/absence of *Listeria monocytogenes.*	Retail stores located in low SES tracts had higher temperature of storage of eggs and higher aerobic plate counts in milk than any other tract category studied. These results indicate that low SES populations may be exposed to products stored in-store at less safe temperatures, which could compromise the quality and safety of the final product.	microbial counts for these products appear to be high in samples from retail stores located in Asian census tracts, but the limited number of samples from this study did not make possible any comparison between the different tract categories.

Author/ Date	Research Question(s)/ Hypotheses	Methodology	Analysis & Results	Conclusions
	S. aureus will be higher in stores located in low SES and minority racial/ethnic areas compared to stores in high SES and Caucasian census tracts.			
Jones, T. F., Pavlin, B. I., LaFleur, B. J., Ingram, L. A., & Schaffner, W. (2004)	We postulated that an inspection system that effectively addressed the goal of improving food safety would be uniform, consistent, and focused on identifying characteristics known to affect food safety.	Inspections were performed by using standardized forms including 44 scored items with a possible total score of 100. Of those 44 items, 13 were designated as "critical".	None of the 12 most commonly cited violations were among those designated as "critical" food safety hazards. The critical violation most commonly cited was the improper storage or use of toxic items (for example, storing cleaning fluids on a shelf next to food), which was the 13th most commonly cited violation during routine inspections.	These items include condition surfaces that do not contact food, floors, walls and ceilings, lighting, and ventilation. Such factors would be expected to substantially influence an observer's impression of overall cleanliness and safety of an operation, but isolated characteristics have not been shown to correlate with food safety.
Silbergeld, E.K., Frisancho, J.A., Gittelsohn, J., Anderson, E. T., Steeves, Matthew F. Blum & Carol A. Resnick, 2013	differences in neighborhood level food access may be associated with consumer exposure to food borne microbial contamination.	neighborhood level risk factors for differential exposures to food borne microbes	Microbial contamination of both chicken and beef products was highly prevalent (*S. aureus*-13/32 for chicken and 14/32 for beef; *E. coli* 21/32 for chicken and 12/32 for beef). Small stores were more likely to sell food carrying these microbes as well as MDR strains of both *E. coli* and *S. aureus*, and chicken was more likely to carry *E. coli* as compared to ground beef.	this study must be considered as exploratory as it is the first study designed to test associations between food access and food safety
Scallan E, Hoekstra RM, Angulo FJ, Tauxe RV, Widdowson M-A, Roy SL, et al. (2011).	we estimated the number of laboratory-confirmed illnesses in the United States by applying incidence from FoodNet to the estimated US population for 2006	Descriptive cross-sectional study design	Most (58%) illnesses were caused by norovirus, followed by nontyphoidal *Salmonella* spp. (11%), *Clostridium perfringens* (10%), and *Campylobacter* spp. (9%). Leading causes of hospitalization were nontyphoidal *Salmonella* spp. (35%), norovirus (26%), *Campylobacter* spp. (15%), and *Toxoplasma gondii* (8%). Leading causes of death were nontyphoidal *Salmonella* spp. (28%), *T. gondii* (24%), *Listeria monocytogenes* (19%), and norovirus (11%).	Data used in the current study came from a variety of sources and were of variable quality and representativeness. FoodNet sites, from which we used data for 10 pathogens, are not completely representative of the US population, but 1 study indicated that demographic data from FoodNet and from the 2005 US census did not differ much

Critique of the Methodology

The main purpose of this research project is to establish the relationship between food-borne illness and food safety risks from food service establishments available to populations of different income levels and different racial compositions in Florida food establishment risk categories (defined as very high risk, high risk, and moderate risk), and the CDC risk factors to foodborne illness outbreaks of improper holding times, improper hand washing, poor hygiene practices, bare hand contact, and inadequate cleaning and sanitizing of food contact surfaces. This research question has the goal to identify the potential risk of foodborne illness caused by food establishments in Florida. Studies exploring this question in other settings have approached their research methodology implementing a case-control design, descriptive epidemiology, or the use of secondary data from a local health department.

Harris et al. (2014) conducted a case-control study to determine the relationship between the number of critical food safety violations and the restaurant's status as either a chain or independent foodservice provider and location. The State of Florida categorized the restaurant operations per the type of license obtained, chain or independent. Chain restaurants are defined as multi-unit restaurants owned or operated by the same company or individual that total seven locations or more. Data for the current study was retrieved from the public records for the fiscal years 2009–2010 and 2010–2011. The study found that both the aggregate number of critical violations and risk factors and the number of individual critical violations and risk factors were significantly different among chain and non-chain restaurants in the state of Florida. Results indicate that the number of critical violations received is impacted by both the location of the restaurant and whether the restaurant is independently operated or a chain. The current study assists in explaining underlying reasons for repeated food safety violations despite Florida have required food safety training certification of restaurant managers and training of their staff; providing implications for academics and foodservice practitioners alike. The study was significant as it assessed changes in critical violations over a three-year period. However, a weakness of the study was location; it was only representative of one county in Alabama, thus the findings could not be generalized to all food establishments. Additionally, data examined was not consistent, it was not until 2010 that non-compliant food establishments received critical violations (personnel training/certification), which would account for the large increase of violations in 2010. The study provided no statistical difference between food safety practices among food certified staff and non-food certified staff.

In a similar study, Russo (2012) quantitatively analyzed 2005- 2010 foodborne illness data, restaurant inspection data, and census-derived socioeconomic and demographic data within Harris County, Texas. The main research question investigated involved determining the extent to which contextual and regulatory conditions distinguish outbreak and non-outbreak establishments within Harris County. Two groups of Harris County establishments were analyzed: outbreak and non-outbreak restaurants. Contextual and regulatory conditions were found to be minimally associated with the occurrence of foodborne outbreaks within Harris County. Across both the categories (outbreak and non-outbreak establishments), variables included were extremely similar in means, and when possible to observe, distributions. The variables analyzed in this study, both regulatory and contextual, were not found to significantly allocate the establishments into their correct outbreak or non-outbreak categories. The implications of these findings are that regulatory processes and guidelines in place in Harris County do not effectively to distinguish outbreak from non-outbreak restaurants. Even when this study suggests that no socioeconomic or racial/ethnic patterns are apparent in the incidence of foodborne disease, it also showed the benefits of using secondary data to examine characteristics expected to be associated with a foodborne illness from food retail operations.

Petran et al. (2013) used data collected during inspections in Minnesota to illness likelihood compared with data from routine inspections conducted at non-outbreak restaurants. The goal was to identify differences in recorded violations. Significantly more violations were recorded at restaurants that had outbreaks. Most these violations were related to contamination in the facility and environment and to food handling procedures. Relative risks also were calculated for violations significantly more likely to occur at locations that had outbreaks of norovirus infection, Clostridium perfringens infection or toxin-type illness, and Salmonella infection. These three pathogens are estimated to cause most foodborne illnesses in the United States. Meta-analysis of composited data for the three pathogens revealed 11 violations significantly more likely ($\alpha < 0.05$) to be identified during routine inspections at outbreak restaurants than during inspections at no outbreak restaurants. The study was significant because it assessed a variety of critical violations associated with food safety. The results indicated that both outbreak restaurants and no outbreak restaurants differ in number of violation by overall inspection outcome and that critical violation was a concern in food outbreaks of norovirus infection establishments. However, a limitation of the study was the findings were not generalized to more pathogen that could occur in food establishments. Also, Data from other states should be evaluated to determine what differences if any might be detected.

The best study that attempts to explain the purpose and methodology of this dissertation is the risks of access study by Darcey & Quinlan (2011). The researchers used the Geographic information systems (GIS) to plot retail food listings, from two databases, and foodservice critical health code violations (CHV) over poverty in Philadelphia Co., Pennsylvania. Chi-square statistic was utilized to test interaction between poverty and store type of retail food access produced by both source. These results confirm an association of increased access to chain food markets for low poverty areas and increased access to corner markets/groceries for high poverty areas in Philadelphia. Furthermore, results suggest that data source can affect the assessment of food environments and subsequent interpretation of degree of impact on residents' health. These results also indicate an association of higher rates of violations and longer periods between inspections with lowest poverty rates.

Summary and Conclusions

Despite intensified prevention efforts, foodborne illness remains a persistent problem in the United States. Food can become contaminated at any point in the farm-to-table continuum, as well as in consumers' own kitchens. Taken together, there were three case control studies (Harris et al., 2014; Russo, 2012; Darcey & Quinlan, 2011; and

Petran et al., 2013) of the nine studies that demonstrated the relationship between the number of critical food safety violations and the restaurant's status. These studies demonstrated the potential needs for tracking risks for FBI. Majority of the three typically utilizing very similar comparison of critical code violations method to indicate sanitation challenges in the retail outlet or foodservice facility. Most of them have also demonstrated that variety of critical violations associated with foodborne risk factors. Most of the researchers used define the variables as well as explain how those variables have been studied. That helped in gathering a better understanding of the amount of research that had been done on each of these variables.

The limited amount of data and implications of these study findings however, makes it impossible to draw conclusions as to whether retail food access may be contributing to higher rates of foodborne illnesses among populations who access their food from these types of retailers. The study by Russo (2012) identified lack of a control group as a study limitation. If feasible, future studies should include control groups to assist in determining associations between the intervention and outcomes of such disease. More retrospective studies such as the one by Gillespie et al. (2010) may provide more insight as to whether the food environment is contributing to greater rates of foodborne illness.

The design is appropriate to answer the questions of the studies. A critically weakness of some of study design is the appropriate sample size to answer the research question was not demonstrated. The approach of thinking about how sample is statistically representing the population is not present. To be able to find how sample as being statistically representative of a wider population requires using a probability sampling method. There are formulas that are used to estimate the sample size needed to produce a confidence interval estimate with a specified margin of error, or to ensure that a test of hypothesis has a high probability of detecting a meaningful difference in the parameter if one exists (Sullivan, 2012). Determining the appropriate sample size will help strength the study and limit the sampling error (Sullivan, 2012). Sampling error can occur when there is a fluctuation of the statistical value from one sample to another when it is calculated from the same population to minimize those type errors in a study,

In overall, the results of all the studies are presented clearly and specifically address each research question. Every hypothesis was tested. Appropriate descriptive (mean and standard deviation) and inferential statistics are presented in organized tables and described in the text. The authors set and specify the probability value before addressing the results of the study. Results are related to the original hypotheses and other research studies. Generalizations are consistent with results. The authors recommend future research based on their statistical as well as practical findings. For example, they discuss the need to continue their longitudinal study to better understand food safety risks associated with food service facilities (Quinlan, 2013)

Gap Addressed by this Study

Most studies described using case control and individual hospital data were prospective; some were randomized controlled studies. While these studies are assisting in established associations of foodborne illness risk factors in food establishments, they do not directly reflect the safety of food service facilities in low income environment as compared to food service facilities available to population of higher income. Thus, it is surprising that the issue of food establishment in low-income and foodborne illness risk factors has received relatively little attention. In part because key databases food establishment violations and related foodborne illness do not contain information on household income or do not track foodborne illness risk by income.

In the connections between income and foodborne illnesses, there are few recent studies on the subject. The greatest attention to the issue has demonstrated that low income and minority populations have different patterns of access to food at the retail level. A growing body of public health research (Quinlan, 2012) has demonstrated that low income and minority populations have different patterns of access to food at the retail level. This concept has been recognized and defined by the U.S. Department of Agriculture as "Food Deserts" where there is a lack of large supermarkets and tends to be an abundance of smaller grocers, convenience, and fast food retailers (USDA, 2013, USDA,2016). A small body of research has begun to attempt to assess the food safety risks of food deserts and the small independent retailers they are made up of through a combination of survey at the retail level as well as use of inspection violation rates as a proxy for safety. Retrospective studies of where food was purchased by those who did become ill from such pathogens are needed to determine if the food desert presents a greater risk of exposure. One study linked increased listeriosis with increased social deprivation also found that when compared to the public, those with listeriosis were less likely to purchase foods from supermarkets and more likely to purchase food from convenience and smaller local stores

Given the high rate of foodborne outbreaks associated with foodservice, increased dependence of populations living in food deserts on foodservice, and evidence that both independent ethnic restaurants (Kwon et al, 2010,Darcey et al. 2011) and retail food facilities in the food desert environment (Signs et al, 2011, Koro et al, 2010) may face greater challenges to food safety and sanitation, this study seems demonstrating that low income is an area which needs further exploration to determine if retail foodservice facilities are contributing to increased rates of some foodborne illnesses by minority and low SES populations.

Summary

The purpose of this literature review was to construct groundwork and analyze the current literature existing for the anticipated epidemiological study, which intended to identify the predictors of food-borne illness and food safety risks from food service establishments available to populations of different income levels and different racial compositions in Florida during the period 2014-2016. As well, the literature review explained potential Risk factors and food safety violations that typically cause foodborne illnesses in food in food establishments. The significance of this problem in the United States was also discussed, including a discussion of the leading pathogens contributing to acquiring foodborne illness, hospitalization, and deaths follow, as well as their epidemiology in the United States. Due to the complexity of this issue, studies related to foodborne Illness in Relation to food establishment inspections and incidence of foodborne illness for populations of different races/ethnicities, socioeconomic status Populations were also discussed. A section was dedicated to studies associated with food establishments, food handling and preparation, and foodborne illness. Existing federal and state regulations and health inspections as part of the food safety surveillance system in the United States were also described. A short section regarding the correlation in inspection scores of restaurants and disease outbreaks was also presented. Lastly, different methodologies of studies related to food establishments, food handling and preparation, and potential risks of foodborne illness, were discussed to point out gaps in the literature, as well as to justify the methodology of this study.

The focal points of the following chapters were on the design of the study, the results of the study, the discussion of findings and conclusions from the study. In Chapter 3 presented detailed information on the design of the study and analysis of the data. Chapter 4 shows the results of the study, followed by the discussion of findings in Chapter 5, which attempted to answer the different research questions of the relationship between the food establishment risk categories and the risk factors to foodborne illness previously described.

Chapter 3: Research Methodology

Introduction

This quantitative cross-sectional study used secondary analysis of data previously collected by Food Safety, Florida Department of Agricultural, and inspection report from the period of January 2014 to December 2016. The purpose of this research project was to establish the relationship between food establishment risk categories and the poverty level. The main objective was to predict the food-borne illness and food safety risks from food service establishments available to populations of different income levels and different demographic compositions in Florida. The data on contributing risk factors to foodborne illness and categories of food establishments were obtained from Florida Department of Agriculture Division- Food Safety Program. I address the proposed methodology and justification for this study in this chapter.

In addition, I elaborate on the research design and the setting and sample set of the data I utilized, the instrumentation and materials required to obtain the secondary data set, the method of data collection, and analysis of data. To conclude the chapter, I discuss the protective and safeguard measures of participants' rights and data set.

Research Design and Approach

The supporting evidence of this research design is presented in Chapter 2. Even though many case-control studies have been used to determine the risk of foodborne illness (Buchholz et al., 2002; Cruz, Katz, & Suarez, 2001; Irwin et al., 1989), recent studies have also demonstrated the effective use of secondary data in a cross-sectional design (Jones et al., 2004; Serapiglia, Kennedy, Thompson, & de Burger, 2007). A case control study starts from cases and controls (i,e. from diseased patients and absolutely disease free controls), therefore, the information about risk factors responsible for occurrence of disease in patients and controls should be collected. The cross sectional design is a prevalence study that looks at single point of time. Cross sectional studies inform on certain study variables; diseases under study should collect from defined study population in a defined geographic area at a defined period time. Since a cross sectional study involves the observation of a population at one point in time (Babbie, 2007), this study quantitatively analyzed foodborne illness risk factors data, with census-derived economic, socioeconomic, and demographic data within Miami Dade (district 13) area. This study did not attempt to assess causes of foodborne illness due to the absence of causal relationship criteria, but rather researched contributing risk factors measured in an inspection system that attempts to prevent foodborne illness.

Miami Dade inspection data from January 2014 through December 2016 was analyzed to determine the risk factor level in establishment. Annual inspections are required of all stores with permits for preparing and serving food, but only routine inspections during this period were included in the analysis. Special inspections performed in response to customer complaints or to follow-up on deficiencies noted in semiannual inspections were not included. In the proposed study, some strategies were employed to measure the independent variable, the dependent variable, and the covariate (demographic) variables. These are outlined below.

Independent Variable

Percent poverty (social vulnerability) and facility/entity types are the independent variables in this study. The U.S. Census Bureau 's American Community Survey (ACS) is a continuing statistical study that offers 1-year and 5-year data on U.S. demographic, social, housing, and economic characteristics. American Community Survey 2010-2014 data were processed at the census tract level to create the social vulnerability data. The social vulnerability was compiled at census tract boundary level. This dataset includes select data on the percent of population, b) housing units' estimate, c) households estimate, d) persons below poverty estimate, e) persons aged 65 and older estimate, f) persons aged 17 and younger estimate, g) percentage of civilian noninstitutionalized population with a disability estimate, h) single parent household with children under 18 estimate, e) minority (all persons except white, non-Hispanic) estimate, g) persons (age 5+) who speak English "less than well" estimate, K) mobile homes estimate, l) households with no vehicle available estimate, and m) persons in institutionalized group quarters estimate.

Data on retail food store outlets were from the inspectors' reports which provide information on the location of food entity by type (supermarkets, grocery, and convenience stores). In this database, the establishment location by address was provided, as well as the food entity category and a description of the inspection reason (routine and customer complaint). Florida Department of Agriculture database classified each food entity per the categories described by the North American Industry Classification System (NAICS). Categories for food store outlets are defined as follows (NAICS, 2002):

- Super-Market: A store that allows individuals to purchase an array of foods that may contain five or more registers, 15,000 or greater total square footage, including display, preparation, and storage areas.
- Grocery stores: A store like supermarkets in which they offer consumers by contain four or fewer checking out registers, and they are less than 15,000 total square footage, including display, preparation, and storage areas.
- Convenience stores: A store that offers a limited array of groceries or fuel for motor vehicles; such stores will likely offer coffee and other beverages to consumers.
- Convenience Stores with limited food service: A store that offers consumers prepared foods, individually portioned. These stores mainly offer snack foods and other processes foods, such as hotdogs. No retail food processing occurs on site.
- Convenience Stores with significant food service: A store that prepares food on site but also sales limited groceries.
- Minor Food Outlet: A store that mainly functions as a grocery store but likely offer food service to consumers on a minor scale than convenience stores.
- Convenience stores: "this industry comprises establishments known as convenience stores or food marts (except those with fuel pumps) primarily engaged in retailing a limited line of goods that generally includes milk, bread, sodas, and snacks".

Supermarkets, grocery, convenience stores, health market, retail bakery, minor outlet, shopping center kiosk, flea market, mobile vendor, and specialty store that were in the identified census tracts for this study were randomly selected for sampling in each different rate of poverty and social vulnerability. Food service establishments such as restaurants, take-out restaurants and fast foods were excluded from this study.

If food store outlets are incorrectly classified as supermarkets, grocery, convenience stores, health market, retail bakery, minor outlet, shopping center kiosk, flea market, mobile vendor, and specialty stores. My best judgment was used to exclude food stores which categories were not correct for our sampling purposes. This exclusion was done by carefully revising each inspector record. If the food store was an incorrect category for study purposes, that food store will excluded from my sampling list and the next random generated store will revise.

Dependent Variables

The dependent variables in this study are inspection rating fail and risk factors violations in retail food entities. A failing rating means foodborne illness risk factors violations that were found, which could contribute directly to a foodborne illness or injury. This method of measuring was result in ordinal-level variables. Foodborne illness risk factors are defined as:

- Food from Unsafe Sources
- Improper Holding/Time and Temperature
- Inadequate Cooking

• Poor Personal Hygiene

• Contaminated Equipment/Prevention of Contamination

Covariate Variables

In addition to the above independent and dependent variables, secondary independent or moderator variables were considered. Data available from the U.S. Census Bureau (U.S. Census Bureau, 2016) was used to identify census tracts of categories that fit our definition of the different population demographics. The categories were as follows: a) population estimate, b) housing units' estimate, c) households estimate, d) persons below poverty estimate, e) persons aged 65 and older estimate, f) persons aged 17 and younger estimate, g) percentage of civilian noninstitutionalized population with a disability estimate, h) single parent household with children under 18 estimate, e) minority (all persons except white, non-Hispanic) estimate, g) persons (age 5+) who speak English "less than well" estimate, K) mobile homes estimate, l) households with no vehicle available estimate, and m) persons in institutionalized group quarters estimate.

Methodology

Target population and method

This study was quantitatively analyzed foodborne risk factors data, census-derived economic, socioeconomic, and demographic data within Florida district 13 between 2010 and 2014. Records from Department of Agriculture Food Safety was used to answer the research question. The sample were included routine inspection from retail entity located in district 13. Florida is composed of 13 districts (See Figure A1). Only routine inspection results from district 13 entities were included in the study. On any given day, an entity may have fewer or more violation collected than noted in their most recent inspection. The study population was included foodborne risk factor findings and poverty level in District 13, Florida.

Another possibility is that these populations are receiving food that is less safe at the level of the retail entities or foodservice facilities. Records of local retail store inspections by Florida Department of Agriculture were used to analyze retail food service and food safety risks. Local retails were either being independent store or had a sister retail within the state of Florida only. The entity types of interest were as follows: grocery, supermarket, convenience, health market, retail bakery, minor outlet, shopping center kiosk, flea market, mobile vendor, and specialty store. Geographic information systems (GIS) was be used to map retail food listings, from database, and foodborne number of foodborne risk factors over poverty level in district 13.

Sampling of Risk factors assessment and routine food products for Laboratory analysis

The Florida Department of Agriculture approach to food safety involves investigating problematic areas and focusing on reducing violations in a team effort between state organizations, federal organizations, and the foodservice provider. In trying to ensure that food served in foodservice establishments is safe, the State of Florida mandates that all foodservice operations establishments are inspected. According to

Florida Department of Business and Professional Regulation (DBPR) State of Florida conducted 118,136 public food service and lodging establishment inspections (DBPR, n.d). Regulated establishments include supermarkets and grocery stores, convenience stores, coffee shops, bakeries, retail meat markets, seafood markets, juice and smoothie bars, bottled water plants, ice and water vending machines, all food processing plants, food warehouses, food salvage stores, and certain mobile food units selling only prepackaged foods or non-potentially hazardous food items.

Risk factors assessment

Risk factors are food preparation practices and employee behaviors most commonly reported to the Centers for Disease Control and Prevention (CDC) as contributing factors in foodborne illness outbreaks. The Centers for Disease Control and Prevention (CDC) Surveillance identified five broad categories of risk factors, food from unsafe sources, inadequate cooking, improper holding temperature, contaminated equipment, and poor personal hygiene.

The food establishment assessment program in Florida was conducted by a “Marking Instruction” report, which was created to help in deciding these items in compliance with the Food Code when conducting retail reviews. The Marking Instruction enlightening were based on the 2009 FDA Food Code as a show to create the food security rules and to be reliable with national food regulatory policy. Items were required a compliance status appraisal for each observation. Each observation contains the Food

Inspection Management System (FIMS) citation, citation description, an appropriate reference, and additional notes.

For each observation item on the inspection report form in the risk factors section, the inspector should indicate one of the following for compliance status:

- *IN* means that the item is in compliance
- *OUT* means that the item is not in compliance
- *N/O* means that the item applies to the operation, but was not observed during the inspection
- *N/A* means that the item is not applicable for the facility.

On the off chance that N/A is not recorded as an alternative for an item, this regularly implies that this thing must be assessed as IN or OUT of compliance amid the review. In any case, this assessment organize was planned for food substances that get ready foods or handle open foods. Since our specialist will utilize this arrange for all retail food entities, when a retail food entity serves or offers as it were pre-packaged or non-potentially dangerous food (non time/temperature control for safety (TCS) food, there may be occasions when there is no alternative N/A. In those cases, the food entity would be IN compliance since they would not be OUT of compliance. When these circumstances are experienced, check the thing as IN (e.g. a retail food entity that does not prepare foods, all foods are prepackaged and there are not food employees- Employee Health Policy would not be required).

If an item is checked OUT, select the most fitting citation portrayal, and give subtle elements to depict each violation on the review report. Regularly, compliance status is decided because of direct observation. In any case, there are a few occurrences where a design of non-compliance may be vital to stamp as OUT. These special cases are included in the marking instructions. Also, thought ought to be given to reality of a perception with respect to prevention of foodborne illness.

For item checked OUT, advance shows the status of the infringement by marking an X in the comparing box for Corrected On-Site (COS) during the review and /or Repeat Violation. Marking COS shows that all violations cited beneath that item number have been corrected and verified sometime before completing the assessment. For example, item #7 Handwashing sink is checked out of compliance since the food entity does not have soap and paper towels at the handwashing sink. The individual in charge mostly amends the issue by putting soap at the sink, but does not supplant the paper towels or give any other compelling implies for drying hands. The corrective action taken for the soap is not checked for Item #7 since the quotation beneath that item was not corrected. Making R demonstrates that the same violation beneath an item number was cited in the final review report. Utilizing the same situation, on the ensuring review in case the arrangement of soap and paper towels is not an infringement, but employees are not washing hands the adjust sink (which is moreover cited beneath item #7 Handwashing sink), R would not be marked since this is an unused quotation beneath Item #7, which was not cited on the assessment report.

The strategies for inspections stretch open communication between the inspector and operator. To be a successful communicator, inspector is anticipated to inquire questions relative to the stream of food through the food establishment, preparation, and cooking procedures, as well as employee wellbeing and typical ordinary operation of facility. Reactions to questions give the inspector a superior thought of the controlled and uncontrolled Risk Factors found in the facility and permits for way better budgeting of time assets while conducting the review. By evaluating Risk Factors that are suspected of being uncontrolled at times other than during the review, time can be superior went through legitimate intercession techniques.

The inspector is anticipated to transfer lacks in the operation to the PERSON IN CHARGE so that on site and long-term correction can be started.

During this addressing, articulations made by the Individual IN Charge or food workers can regularly be utilized to bolster or increase direct observations and, in a few cases, can be utilized as the sole basis for deciding compliance with provisions of the Food code (Table A1).

Food Code Interventions:	**Risk Factors:**
Demonstration of knowledge	Unsafe food sources
Hands as a vehicle of contamination	Poor personal hygiene
Employee health	Contaminated equipment
Time temperature relationships	Inadequate cooking
Consumer advisory	Improper holding temperatures

After each visit to a food entity, inspectors are required to complete an inspection report where the report will be designated either as Pass, Fail, or Non-Rated (Figure A2). If it is an unpermitted Food Entity an Ancillary visit will be conducted. Then all applicable documents to the inspection visit must be attached to the Visit Details screen.

For the current study, all retail food establishments in Miami Dade County were analyzed for fail status and number of foodborne illness risk factor violation sand then were broken down into type of establishment (Supermarket, convenient, and grocery stores) as well as by location or region in the state. The foodborne illness risk factors are of focus in this investigation, as these are based on the hazardous food safety risk factors identified by the United States Food and Drug Administration (FDA). Critical food safety violations are those items which are more likely to directly contribute to food contamination or illness. Some examples of these include food from unsafe Sources, inadequate cooking, improper holding temperature, contaminated equipment, and poor personal hygiene (U.S. Food and Drug Administration, 2009).

To determine sample size and the strength of significance among the variables studied, a power analysis was conducted using G Power 3. Some of the conventional standards reported in the literature for sample size estimation and statistical power analysis are a mean effect size of .30, an alpha level of .05, and a power of .80 (Lipsey &Wilson, 1993). The power of 80% will help in ensure that Type I and Type II errors are balanced. Nevertheless, due to the large sample size used for the study (over 24,265reports), the input parameters chosen for the “a priori” power analysis were set to an effect size of .1, an alpha level of .05, a power of .95, and 10 degrees of freedom according to a two-way table for chi-square distribution being the equation for degrees of freedom (r-1) * (c-1) (Gertsman, 2008; Faul, Erdfelder, Lang, & Buchner, 2007) Calculations for these parameters suggested 2,439 reports as an adequate sample size to detect any significant difference, if one truly does exist.

Instrumentation and Operationalization of Constructs

For the current study, all retail food establishments in Miami Dade County were analyzed for the number of inspection and number of risk factor violation. Then the retail food establishments were broken down into grocery, supermarket, and convenient stores as well as by location or region in the County. The risk factors identified in the interpretation list of food service violations, as identified on the FDACS website, are considered critical violations. These include such areas as facilities maintaining proper product temperature, thermometers being provided and conspicuously placed, and potentially hazardous food being properly thawed. In addition, risk factors that are in the process of being determined as risk factors include food from unsafe sources, inadequate cooking, improper holding temperature, contaminated equipment, and poor personal hygiene.

Entity names, locations, and inspection results were obtained from the database, compiled by the Florida Department of Agriculture and Consumer Services. This database contains aggregated data that are automatically updated from the online website of the Florida Department of Agriculture and Consumer Services, which conducts all restaurant safety inspections in Florida. The Florida Department of Agriculture uses a modified inspection protocol based on FDA recommendations, and it aims to conduct routine inspections of all restaurants within the city limits once per year.

Florida food establishment inspection data reported from January 2014 through December 2016 collected. These data included details on inspections (date, time, purpose, type, inspector name), restaurants (name, license number, location, name of person in charge), and violations (number and type of violations). The database includes tabulated reports of 2 types of violations: foodborne illness risk factors and good retail practices. Foodborne illness risk factor violations are practices or procedures that, scientists say, play a direct role in transmitting germs, and they include food kept at improper temperatures and failure to properly clean equipment used to prepare food. Good retail practice violations, which are less critical violations, are deficiencies in practices or procedures that, research suggests, can prevent the conditions that lead to contamination but do not cause illness directly, such as dirty floors or improper garbage storage.

Data set was filtered out in several ways. Routine annual inspections were only included, and inspections that were compliance checks, re-inspections, environmental assessments, or responses to complaints were excluded. We limited the type of facilities to retail food establishment; thus, we excluded daycare facilities, schools, residential facilities, and caterers. Some variables (e.g., name of the inspector, person in charge of the restaurant) were also excluded because they were not pertinent or were difficult to analyze quantitatively.

US Census American Community Survey block group data were accessed to collect social vulnerability information related to the location of each entity in the study. The inspection database included latitude and longitude coordinates for each facility, used to locate the facility on the US Census maps of Miami Dade County. In the US Census, block groups are contiguous areas of land that are divisions of a census tract and typically contain 600 to 3000 residents (US Census, n.d). Block groups are the smallest geographical unit with census socio-demographic data available and were considered most representative of the area surrounding each facility. By merging the facility geographic data with the census block group data, facility neighborhood data was obtained on the variables of interest, including total population count, persons aged 65 and older of residents, proportion of college-educated residents, single parent household income, minority (all persons except white, non-Hispanic), and persons below poverty.

Statistical analysis

To properly analyze the data, several statistical tests were undertaken using the statistical program SPSS 2.1. Continuous variables were summarized using means and standard deviations (SDs), and facility types were compared using t-tests. Categorical variables were summarized using frequencies and percentages. The number of violations (total by type) were analyzed and reported for each establishment inspection conducted during the study period. Because multiple inspections could occur in a single establishment or in a single geographic block group, we adjusted for multiple instances of the same establishment and block group.

Linear regression was used to determine the relationships between the frequencies of inspection rating fail at each facility type during the 2-year period and the number of inspection violations found at each facility, stratified by establishment type. The model was adjusted for block group sociodemographic characteristics, including population estimate, b) housing units' estimate, c) households estimate, d) persons below poverty estimate, e) persons aged 65 and older estimate, f) persons aged 17 and younger estimate, g) percentage of civilian noninstitutionalized population with a disability estimate, h) single parent household with children under 18 estimate, e) minority (all persons except white, non-Hispanic) estimate, g) persons (age 5+) who speak English "less than well" estimate, K) mobile homes estimate, l) households with no vehicle available estimate, and m) persons in institutionalized group quarters estimate. The frequencies of inspection rating fail category were coded as a factor variable to assess the relationship between inspection rate frequency and number of violations per inspection.

Logistic regression was used to assess the relationships inspection failures and entity types, adjusted for all block group sociodemographic characteristics. These relationships among all entities assessed; then, entities relationship results were compared with sociodemographic characteristics relationship results. The nested model was used to adjust for random effects of multiple inspection outcomes within the same individual entity and within the same block group.

Reliability and Validity

Validity refers to the extent how well a procedure measures what it is intended to measure, whereas Reliability refers to a condition where a measurement process yields consistent scores (given an unchanged measured phenomenon) over repeat measurements. Because the data collected by the health inspectors, not me, it was not feasible to directly measure the reliability and validity of the data used in the study. The agencies administer surveys that are sampled routinely for regulating the commercial food supply for compliance with state and federal regulations and minimizing the risk of foodborne illness in food products. Therefore, one can automatically generalize that reliability is based upon what the health inspector documents on the food inspection report form. In the Bureau of Food Inspection, all inspectors go through standardization. In standardization, the food inspector must (a) complete and pass an examination that is accredited by the Conference for Food Protection and (b) demonstrate knowledge and understanding of Florida Department of Agriculture Statues Chapter 500, food-borne illness risk factors, public health interventions, HACCP principles, and communication skills necessary to conduct food service inspections.

Conclusion

The purpose of Chapter 3 was to discuss the research design, methodology, and procedures used to collect, tabulate, and analyze the research data. This chapter addressed the methodology employed in conducting the research project, including materials, collection of samples, statistical analysis, reliability, and validity. A quantitative research design was used to examine to identify the predictors of food-borne illness and food safety risks from food service establishments available to populations of different income levels and different racial compositions in Miami Dade County. The following chapter provides the results of the analysis.

Chapter 4: Results

Purpose of the Study

This cross-sectional quantitative study was conducted to identify the predictors of food-borne illness and food safety risks from food entity establishments available to populations of different income levels and different racial compositions in Miami Dade County, Florida. In the study, I compared the poverty rates and the foodborne illness risk violation in food entity establishments in Miami Dade County. Miami Dade County has a population of 2,712,945, which makes it the most populous county in Florida and the seventh-most populous county in the United States (United States Census Bureau, 2011). Miami Date County holds approximately 4,000 retail food establishments located in the county's unincorporated areas as well as 21 cities without a local health department (United States Census Bureau, 2011). Retail food facilities have been monitored by the Florida Department of Agriculture food safety inspection in accordance with the recommendations of the United States Food and Drug Administration (FDA) Food Code. The determination of foodborne illness risk violation was based on routine inspections. In this chapter, I explain the findings and the results.

Data Collection Source

Figure A2 is a similar setting form that the inspectors used to record the data. The form contains information including details on inspections (date, time, purpose, type, inspector name), food entity (name, number, location, type, the name of owner), and violations (number and type of violations). The risk factor variables were marked as IN compliance, where the process was observed and found to meet the standards; OUT of compliance, where it was observed and found to not meet the standard; Not Observed (NO), where the process occurs in the facility but the inspector was unable to verify if it met standards; and Not Applicable (NA) if it is a process that the facility does not perform. The risk factor variable is a proportion of the number of times that the factor was observed in compliance (IN/IN+OUT). The non risk factor variables are counts of the frequency that a violation was debited per inspection.

Selection of Food Establishment Entity Type

Data on entity food store outlets were obtained from the FDACS food safety database. This study was limited only to those entity types with the violation risk factors

- grocery
- supermarket
- convenience store limited food service/ convenience store significant food service and/or packaged ice
- health food store w/food service
- retail bakery/retail bakery w/food service
- bakery outlet store, minor outlet with perishables/minor outlet w/limited food service/minor outlet w/significant food service and/or packaged ice
- minor outlet/prepackaged/no PHF (Potential Hazardous Food)
- minor outlet

- shopping center kiosk
- flea market kiosk
- mobile vendor

Thus, I excluded daycare facilities, schools, residential facilities, and caterers. I included only routine annual inspections by Miami Dade County from January 2015 to December 2016 and excluded inspections that were compliance checks, re-inspections, or consumer complaints. Data available online also provided two types of violations: foodborne-illness risk factors and good retail practices, but this study was limited only to foodborne-illness risk factors. Foodborne-illness risk factor violations are practices or procedures that play a direct role in transmitting germs, and they include food kept at improper temperatures and failure to properly clean equipment used to prepare food (Duan et. al, 2011). Good retail practice violations, which are less critical violations, are deficiencies in practices or procedures that, researchers have suggested, can prevent the conditions that lead to contamination but do not cause illness directly, such as dirty floors or improper garbage storage (Duan et. al, 2011).

Geographic Information System (GIS) software was used to locate FDACS food establishments with census tract boundaries. All the mapped FDACS Food Safety Facilities in Miami Dade County that were inspected within the geographic location were taken from FDACS database. I identified them with the 2016 census tract that they fell into based on their geographic location (grocery, supermarket, convenience store limited food service/convenience store significant food service and/or packaged ice, health food store w/food service, retail bakery/retail bakery w/food service, bakery outlet store, minor outlet with perishables/minor outlet w/limited food service/minor outlet w/significant food service and/or packaged ice, minor outlet/prepackaged/no PHF/ minor outlet, shopping center kiosk, flea market kiosk, mobile vendor, and others).

Data Sources – U.S. Census Bureau American Community Survey (ACS)

After mapping entity locations, I then used the American Community Survey, which provided demographic information to the census block level that was used to create sociodemographic index indicator variables. The level of social deprivation and socio economic status has been previously used to classify neighborhoods. A study has identified minority groups to be at an increased risk for foodborne illness (Darcey, 2010). It can also be assumed that if a population has a lower rate of auto ownership, they would be limited to the food establishments in their neighborhood. Lastly, residents who are employed in food-handling occupations would have a greater knowledge of acceptable practices and would hold restaurants that they visited to those standards.

Research Questions and Hypotheses

The research questions were as follows:

1. What are the associations between the frequencies of inspection failing rating and the poverty level of the area when controlling for food facility type, race/ethnicity, age, gender, and income level?
2. Is there a relationship between the number of risk violations (food from unsafe sources, inadequate cooking, improper hot/cold holding temperatures,

contaminated equipment, and poor personal hygiene) and the poverty level of the area when controlling for food facility type, race/ethnicity, age, and gender?

3. Is there a relationship between food entity type (grocery, supermarket, convenience store limited food service/convenience store significant food service and/or packaged ice, health food store w/food service, retail bakery/retail bakery w/food service, bakery outlet store, minor outlet with perishables/minor outlet w/limited food service/minor outlet w/significant food service and/or packaged ice, minor outlet/prepackaged/no PHF/ minor outlet, shopping center kiosk, flea market kiosk, mobile vendor, and others) and the number of food risk factor violations cited when controlling for poverty level, race/ethnicity, age, and gender?
4. Does the food establishment operation type (grocery, supermarket, convenience store limited food service/convenience store significant food service and/or packaged ice, health food store w/food service, retail bakery/retail bakery w/food service, bakery outlet store, minor outlet with perishables/minor outlet w/limited food service/minor outlet w/significant food service and/or packaged ice, minor outlet/prepackaged/no PHF/ minor outlet, shopping center kiosk, flea market kiosk, mobile vendor, and others) have an impact on the number of inspection failing rate when controlling for poverty level, race/ethnicity, age, and gender?

The hypotheses that were created from these questions are as follows:

$H_0$1: There is no association between the frequency of inspection failing rate and the poverty level of the area when controlling for food facility type, race/ethnicity, age, and gender.

H_A1: There is an association between the frequency of inspection rating fail and the poverty level of the area when controlling for food facility type, race/ethnicity, age, and gender.

$H_0$2: The number of food risk factor violations (food from unsafe sources, inadequate cooking, improper hot/cold holding temperatures, contaminated equipment, and poor personal hygiene) is not associated with the poverty level of the area when controlling for food facility type, race/ethnicity, age, and gender.

H_A2: The number of food risk factor violations (food from unsafe sources, inadequate cooking, improper hot/cold holding temperatures, contaminated equipment, and poor personal hygiene) is associated with the poverty level of the area when controlling for food facility type, race/ethnicity, age, and gender.

$H_0$3: There is no association between the food entity type and the number of food risk factor violations when controlling for poverty level, race/ethnicity, age, and gender.

H_A3: There is association between the food entity type and the number of food risk factor violations cited when controlling for poverty level, race/ethnicity, age, and gender.

$H_0$4: There is no association between the food entity operation type (supermarket, grocery, convenience store limited food service (FS), convenience store significant food service (FS) and/or packaged ice, health food store with food service, retail bakery, retail bakery with food service, bakery outlet store, minor outlet with perishables, minor outlet with Limited food service, minor outlet with significant food service and/or packaged ice, minor outlet/prepackaged/no PHF(Potential Hazardous Food) and number of inspection failures when controlling for poverty level, race/ethnicity, age, and gender.

H_A4: There is an association between the food entity operation type (supermarket, grocery, convenience store limited food service (FS), convenience store significant food service (FS) and/or packaged ice, health food store with food service, retail bakery, retail bakery with food service, bakery outlet store, minor outlet with perishables, minor outlet with Limited food service, minor outlet with significant food service and/or packaged ice, minor outlet/prepackaged/no PHF(Potential Hazardous Food) and the number of inspection failures when controlling for when controlling for poverty level, race/ethnicity, age, and gender.

The dependent variables for this study were the inspection fail/pass rating and risk factor violations in retail food outlets, determined by the food safety inspection data. The independent variables were food establishment types, percent poverty, and the covariates, which are race/ethnicity, age, and household types. This analysis included facility type accounted for in Miami Date County, Florida. The facility type variables were coded as a) supermarket, b) grocery, c) convenience store limited FS, d) convenience store significant FS and/or packaged ice, e) health food store w/FS, g) retail bakery, h) retail bakery w/FS, e) bakery outlet store, g) minor outlet with perishables, K) minor outlet w/limited food service, l) minor outlet w/significant food service and/or packaged ice, m) minor outlet/prepackaged/no PHF, n) minor outlet, flea market kiosk, o) mobile vendor, and others. The food risk factor violations in establishment food outlets were coded as food from 1) unsafe sources, 2) inadequate cooking, 3) improper hot/cold holding temperatures, 4) contaminated equipment, and 5) poor personal hygiene violations. Although food contamination does not have a specific demographic, the demographic variables were a) population estimate, b) housing units' estimate, c) households estimate, d) persons below poverty estimate, e) persons aged 65 and older estimate, f) persons aged 17 and younger estimate, g) percentage of civilian noninstitutionalized population with a disability estimate, h) single parent household with children under 18 estimate, e) minority (all persons except white, non-Hispanic) estimate, g) persons (age 5+) who speak English "less than well" estimate, K) mobile homes estimate, l) households with no vehicle available estimate, and m) persons in institutionalized group quarters estimate.

The results of the data analysis are described in detail and are reported in terms of the main research questions. This chapter provides tables of the data analysis results, including summary statistics of descriptive, frequency, ANOVA, regression, and Chi-square tests. These results show the relationship between each independent variable and the dependent variable. The association between food-borne illness and food safety risks from food entity establishments available to populations of different demographic are reported. The multiple logistic regressions are presented and discussed, and the conclusion is a summary of the findings as they relate to the research questions.

To answer the research questions and test the independence of the variables, the analysis of each independent variable within each risk category was followed.

Research Question 1

The first research question addressed the associations between the frequencies of failing an inspection failing rating and the demographic level of the area. The hypothesis predicted that there is no association between the frequency of inspection fail rating and the demographic level of the area. The alternative hypothesis predicted that there is association between the frequency of inspection fail rating and the demographic level of the area. To test this hypothesis, I conducted a chi-square test of independence and logistic regression analysis.

Research Question 2

The second research question addressed a relationship between the number of risk violations (food from unsafe sources, inadequate cooking, improper hot/cold holding temperatures, contaminated equipment, and poor personal hygiene) and the demographic level of the area. The hypothesis predicted that the number of risk violations (food from unsafe sources, inadequate cooking, improper hot/cold holding temperatures, contaminated equipment, and poor personal hygiene) is not associated with the demographic level of the area. The alternative hypothesis predicted that the number of risk violations (food from unsafe sources, inadequate cooking, improper hot/cold holding temperatures, contaminated equipment, and poor personal hygiene) is associated with the demographic level of the area. For this null hypothesis, a one-way ANOVA and a linear regression analysis were performed with the number of risk factors cited during establishment inspections as the dependent variable and the percentage demographic level of the area as the independent variable.

Research Question 3

The third research question of this study addressed a relationship between food entity types and the number of food violations cited. The hypothesis predicted that there is no association between the food entity type and the number of food violations cited. The alternative hypothesis predicted that there is association between the food establishment type and the number of food risk factor violations cited. A one-way ANOVA and linear regression analysis was performed to compare the association between the food entity type and the number of food violations cited.

Research Question 4

The fourth research question addressed the impact on the number of failed inspections and the food entity operation types. The hypothesis predicted that there is no association between the food establishment operation types and number of inspection failures. The alternative hypothesis predicted there is association between the food entity operation types and number of inspection failures. To test the null hypothesis, a chi-square test of independence and logistic regression analysis were performed to compare association between the food entity operation types and number of inspection failures.

Descriptive Statistics of Violations

Table 2 presents the descriptive statistic for food inspection violations in the sample of 3435 food entities. The analysis included the dependent variable of all 3435 food entities violation rate. The results were as follows: mean (2.32), standard deviation (1.23), skewness (-0.128), kurtosis (-0.667), minimum (0.000) and maximum (5.38). The histogram in figure 2 shows that the bell curve distribution of the data is good fit.

Table 2
Descriptive Statistics: Dependent Variable
(Number of risk Violations)

N	Valid	3435
	Missing	1
Mean	2.32	
Std. Error of Mean	0.02	
Std. Deviation	1.23	
Skewness	-0.128	
Std. Error of Skewness	0.042	
Kurtosis	-0.667	
Std. Error of Kurtosis	0.084	
Minimum	0.00	
Maximum	5.38	

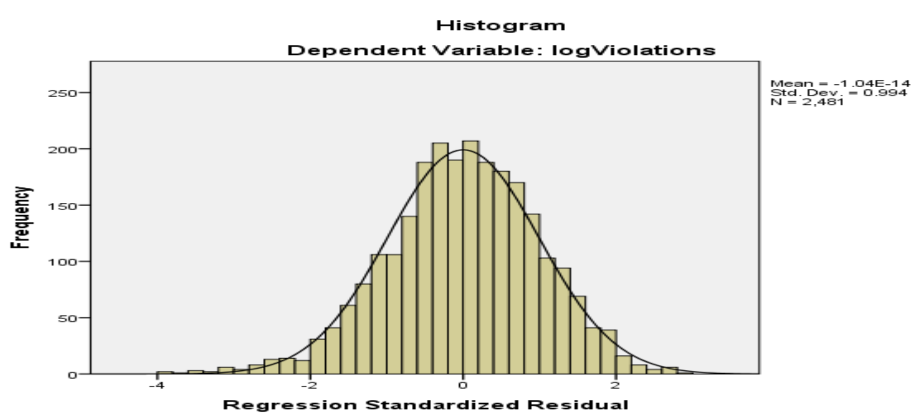

Figure 2. Histogram chart: dependent variable (number of risk violation).

Table 3 shows the frequency for the other dependent variable, pass and fail rate. Food establishments (*N* = 2858, 83.2%) passed inspection. However, passing was by no means guaranteed (*N* = 577, 16.8 %).

Table 3
Frequency of Pass/Fail Rating

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Pass	2858	83.2	83.2	83.2
	Fail	577	16.8	16.8	100.0
	Total	3435	100.0	100.0	
Missing	System	1	.0		
Total		3436	100.0		

Table 4 presents a total of 3435 cases in the food entity category and the frequency of the number of cases in the food entity type in the sample. The independent variables in this table includes supermarket (*N*=271, 7.9%), grocery (*N*=229, 6.7%), convenience store limited FS (*N*=662, 19.3%), convenience store significant FS and/or packaged ice (*N* = 519, 15.1%), health food store w/FS (*N*= 83, 2.4%), retail bakery (*N* =232 , 6.8), retail bakery w/FS (*N*= 99, 2.9%), bakery outlet store (*N*= 32, 0.9%), minor outlet with perishables (*N*= 407, 11.8%), minor outlet w/limited food service (*N* =61, 1.8%), minor outlet w/Significant food service and/or packaged ice(*N*=31, 0.9%), minor outlet/prepackaged/no PHF(*N*= 316, 9.2%), minor outlet (*N*=107, 3.1%), flea market kiosk (*N*=137, 4.0%), mobile vendor (*N*=40, 1.2%), other (*N*=59, 1.7%).

Table 4
Frequency Table: Independent Variables Food Entity Types

Food entity types	Frequency	Percent	Valid Percent	Cumulative Percent
supermarket	271	7.9	7.9	12.3
grocery	229	6.7	6.7	18.9
convenience store limited FS	662	19.3	19.3	38.2
convenience store significant FS and/or Packaged Ice	519	15.1	15.1	53.3
health food store w/FS	83	2.4	2.4	55.7
retail bakery	232	6.8	6.8	62.5
retail bakery w/FS	99	2.9	2.9	65.4
bakery outlet store	32	0.9	0.9	66.3
minor outlet with perishables	407	11.8	11.8	78.1
minor outlet w/limited food service	61	1.8	1.8	79.9
minor outlet w/significant food service and/or packaged	31	0.9	0.9	80.8
minor outlet/prepackaged/no PHF	316	9.2	9.2	90.0
minor Outlet	107	3.1	3.1	93.1
flea market kiosk	137	4.0	4.0	97.1
mobile vendor	40	1.2	1.2	98.3
others	59	1.7	1.7	100.0
Total	3436	100.0	100.0	

Table 5 presents the mean table for both the dependent variable and independent variables. The dependent variable in this table includes number of violations (N = 3435) and the percentage for each demographic variable (N = 2562). The categories with higher means as follows minority (all persons except white, non-Hispanic) estimate (4638.73), housing units' estimate (1970.82), households estimate (1704.33), persons (age 5+) who speak English "less than well" estimate (1212.92), persons below poverty estimate (1211.63), persons aged 17 and younger estimate (1113.15), persons aged 65 and older estimate (826.67), percentage of civilian non-institutionalized population with a disability estimate (589.91), civilian (age 16+) unemployed estimate (323.73), households with no vehicle available estimate (218.07), single parent household with children under 18 estimate (187.47), persons in institutionalized group quarters estimate (78.27), mobile homes estimate (51.09).

Table 5
Mean Block Group Socio-demographic Characteristics Associated with 3435 Routine Risk Violation Inspection

Measure	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std Error	Statistic
number of violation	3435	1	218	20.1	0.4	25.6
population estimate	2562	0	15425	5371.3	40.3	2038
housing units' estimate	2562	0	6340	1970.8	15.1	766.4
households estimate	2562	0	4733	1704.3	12.3	624.7
persons below poverty estimate	2562	0	4562	1211.6	16.7	847.3
civilian (age 16+) unemployed estimate	2562	0	941	323.7	3.7	186.9
persons aged 65 and older estimate	2562	0	2514	826.7	8.9	452.1
persons aged 17 and younger estimate	2562	0	4422	1113.2	11.7	590.5
percentage of civilian non-institutionalized population with a disability estimate	2562	0	1648	598.9	6.5	329.6
single parent household with children under 18 estimate	2562	0	954	187.5	2.4	123.9
minority (all persons except white, non-Hispanic) estimate	2562	0	13990	4638.7	40.6	2052.5

persons (age 5+) who speak English "less than well" estimate	2562	0	4315	1212.9	18.7	944.6
mobile homes estimate	2562	0	1716	51.1	3.2	162.3
households with no vehicle available estimate	2562	0	1247	218.1	4.4	224.8
persons in institutionalized group quarters estimate	2562	0	2391	78.3	3.8	193.8

One Way Analysis of Variance of Violations

Table 6 shows the one-way ANOVA analysis of violations across food entity types. The categories with higher means for the risk violation rates were as follows: grocery (3.5851), supermarket (3.2976), retail bakery (3.1302), convenience Store significant FS and/or packaged Ice (3.0363), convenience store limited FS, retail bakery w/FS (2.6855), minor outlet w/significant food service and/or packaged (2.3229), minor outlet w/limited food service (2.1019), health food store w/FS (2.0991), minor outlet with perishables (1.6568), bakery outlet store (1.4002), and flea market kiosk (1.1337). minor outlet (1.0555), minor outlet/prepackaged/no PHF (1.1319), and mobile vendor (.8276) had the lowest means. The significance value is 0.000 ($p < 0.05$), therefore, there is a statistically significant difference in the mean across food entities.

Table 6

One-Way ANOVA of Violations: Independent Variables, Entity Types (p < 0.001)

entity types	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound	Minimum	Maximum
supermarket	271	3.30	0.99	0.06	3.18	3.42	.00	5.35
grocery	229	3.59	0.88	0.06	3.47	3.70	.69	5.38
convenience store limited FS	662	2.69	0.78	0.03	2.63	2.74	.00	4.80
convenience store significant FS and/or packaged ice	519	3.04	0.76	0.03	2.97	3.10	.00	5.28
health food Store w/FS	83	2.10	0.90	0.10	1.90	2.30	.00	4.51
retail bakery	232	3.13	1.12	0.07	2.99	3.28	.00	5.26
retail bakery w/FS	99	2.58	1.12	0.11	2.36	2.81	.00	4.53
bakery outlet store	32	1.40	0.88	0.16	1.08	1.72	.00	3.74
minor outlet with perishables	407	1.66	0.82	0.04	1.58	1.74	.00	3.95
minor outlet w/Limited FS	61	2.10	1.05	0.13	1.83	2.37	.00	4.38
minor outlet w/significant FS and/or Packaged	31	2.32	1.06	0.19	1.93	2.71	.00	4.43
minor outlet/prepackaged/no PHF	316	1.13	0.76	0.04	1.05	1.22	.00	3.09
minor outlet	107	1.06	0.72	0.07	0.92	1.19	.00	2.71
flea market kiosk	137	1.13	0.92	0.08	0.98	1.29	.00	3.33
mobile vendor	40	0.83	0.72	0.11	0.60	1.06	.00	2.48
others	59	1.48	0.90	0.12	1.24	1.71	.00	3.83
Total	3285	2.40	1.20	0.02	2.36	2.44	.00	5.38

Regression Analysis of Violations

Table 7 demonstrates multiple linear regression model where the assumptions have been not violated. This analysis was conducted to show the relationship between the variables. This table provides an adjusted R^2 of .519 with the $R^2 = .525$, which means that the linear regression explains only 52.5% of the variance in the dependent viable (natural log violations) can explained by the independent variables (food entity type and social vulnerability). The R value represents the simple correlation, and it is 0.725, which indicates a moderate degree of correlation as approaching to 1. The correlation coefficient, R, is positive; therefore, we can conclude that violation is positively correlated food entity type and social vulnerability. Thus the relationship is weak because R is positive and is closer to 1. The Durbin-Watson d =1.820 which is between the two critical values of $1.5 < d < 2.5$; therefore, it is assumed that there is no linear autocorrelation in this multiple linear regression model. Based on the linear regression below, the overall model was significant ($p < 0.05$). The F-test is highly significant (p = 0.000, which is less than 0.05), thus I can assume that the model explains a significant amount of the variance in risk violation rate.

Table 7 shows the multiple linear regression estimates including the intercept and the significance levels. All variables were forced into the multiple linear regression model. Among those social vulnerability variable, the single parent households were significant (B = 0.001, p = 0.022). Most of the food entities are significant predictors of risk violations, except for bakery outlet store (B = 1.325, p = 0.116), minor outlet/prepackaged/no PHF (*B* = 0.303, *p* = 0.62). Among all the significant predictor food entities, grocery (*b* = 2.877, *p* < 0.001) have more violations than the other category of food entities. Minor outlet with perishables (*b* = 0.797, *p* < 0.001) have the least violations. We can also see that supermarket (Beta = 0.623), grocery (Beta = 0.602), convenience store limited FS (Beta = 0.637), convenience store significant FS and/or packaged ice (Beta = 0.700), and retail bakery (Beta = 0.545) have a higher impact than the other entity types by comparing the standardized coefficients, the closer the coefficient is to 0, the weaker the effect of that independent variable.

Table 7

Linear Regression Analysis of Risk Factor Violations (adjusted R-square = 0.519, P<0.001)

		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
	Measure	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	.853	.162		5.278	.000	.536	1.169
	population estimate	-3.278E-5	.000	-.056	-.471	.638	.000	.000
	housing units’ estimate	-3.558E-5	.000	-.023	-.462	.644	.000	.000
	households estimate	.000	.000	-.078	-.974	.330	.000	.000
	persons below poverty estimate	5.968E-5	.000	.042	1.125	.261	.000	.000
	civilian (age 16+) unemployed estimate	.000	.000	.040	1.700	.089	.000	.001
	persons aged 65 and older estimate	.000	.000	.064	1.957	.050	.000	.000
	persons aged 17 and younger estimate	.000	.000	-.058	-1.026	.305	.000	.000

percentage of civilian noninstitutionalized population with a disability estimate	6.433E-5	.000	.018	.494	.621	.000	.000
single parent household with children under 18 estimate	.001	.000	.070	2.286	.022	.000	.001
minority (all persons except white, non-Hispanic) estimate	4.744E-5	.000	.082	1.293	.196	.000	.000
persons (age 5+) who speak english "less than well" estimate	-1.910E-5	.000	-.015	-.525	.600	.000	.000
mobile homes estimate	.000	.000	.021	1.374	.169	.000	.000
households with no vehicle available estimate	.000	.000	-.040	-1.423	.155	-.001	.000
persons in institutionalized group quarters estimate	.000	.000	-.031	-1.894	.058	.000	.000
supermarket	2.465	.163	.623	15.166	.000	2.146	2.784
grocery	2.877	.167	.602	17.248	.000	2.550	3.204
convenience Store Limited FS	1.917	.158	.637	12.097	.000	1.607	2.228
convenience Store Significant FS and/or packaged ice	2.266	.159	.700	14.218	.000	1.954	2.579
health Food Store w/FS	1.555	.188	.201	8.273	.000	1.186	1.923
retail bakery	2.548	.166	.545	15.333	.000	2.222	2.874
retail bakery w/FS	1.905	.181	.279	10.547	.000	1.551	2.259
bakery outlet store	1.325	.842	.022	1.574	.116	-.325	2.976
minor outlet with perishables	.797	.160	.234	4.979	.000	.483	1.111
minor outlet w/limited food service	1.215	.190	.152	6.392	.000	.842	1.588

minor outlet w/significant FS and/or Packaged	1.423	.219	.126	6.495	.000	.994	1.853
minor outlet/prepackaged/no PHF	.303	.162	.078	1.864	.062	-.016	.621
minor outlet	.181	.176	.029	1.028	.304	-.165	.527
flea market kiosk	.705	.256	.049	2.756	.006	.203	1.206
mobile vendor	.914	.205	.094	4.458	.000	.512	1.315

Cross-tabulation Analysis of Pass/Fail Rating

A crosstab analysis was performed to ascertain the inspection rate outcome on food establishment types. Based on the information in the table 8, it is easy to see that there is some relationship between the variables of interest in this case. Note that by looking at the percentages across the columns (categories of the dependent variable); I can see that there are differences in inspection rate outcome by food entity type. Of the food entity types, convenience store significant FS and/or packaged ice (22.2 %) has the highest percentage fail rate within inspection rate outcome, and bakery outlet store (0.3%) and mobile vendor (0.0%) have the lowest percentage fail rate within inspection rate outcome. Minor outlet w/significant food service and/or packaged ice (1.0 %) has the lowest pass rate within inspection rate outcome, and convenience store limited FS (21.2 %) has the highest pass rate within inspection rate outcome.

Table 8

Percentage of Food Establishment Type and Fail/Pass Crosstab

	Inspection Rate Outcome		
Food entity types	Pass	Fail	Total

Supermarket	Count	187	84	271
	% within food entity type	69.0%	31.0%	100.0%
	% within Inspection Rate Outcome	6.9%	14.6%	8.2%
	% of Total	5.7%	2.6%	8.2%
Grocery	Count	122	107	229
	% within food entity type	53.3%	46.7%	100.0%
	% within Inspection Rate Outcome	4.5%	18.6%	7.0%
	% of Total	3.7%	3.3%	7.0%
convenience store limited FS	Count	573	89	662
	% within food entity type	86.6%	13.4%	100.0%
	% within Inspection Rate Outcome	21.2%	15.5%	20.2%
	% of Total	17.4%	2.7%	20.2%
convenience store significant FS and/or packaged ice	Count	391	128	519
	% within food entity type	75.3%	24.7%	100.0%
	% within Inspection Rate Outcome	14.4%	22.2%	15.8%
	% of Total	11.9%	3.9%	15.8%
health food store w/FS	Count	79	4	83
	% within food entity type	95.2%	4.8%	100.0%
	% within Inspection Rate Outcome	2.9%	0.7%	2.5%
	% of Total	2.4%	0.1%	2.5%
retail bakery w/FS	Count	153	79	232
	% within food entity type	65.9%	34.1%	100.0%
	% within Inspection Rate Outcome	5.6%	13.7%	7.1%
	% of Total	4.7%	2.4%	7.1%
retail bakery	Count	87	12	99
	% within food entity type	87.9%	12.1%	100.0%
	% within Inspection Rate Outcome	3.2%	2.1%	3.0%
	% of Total	2.6%	0.4%	3.0%
	Count	30	2	32

	% within food entity type	93.8%	6.3%	100.0%
bakery outlet store	% within Inspection Rate Outcome	1.1%	0.3%	1.0%
	% of Total	0.9%	0.1%	1.0%
	Count	375	32	407
	% within food entity type	92.1%	7.9%	100.0%
minor outlet with perishables	% within Inspection Rate Outcome	13.8%	5.6%	12.4%
	% of Total	11.4%	1.0%	12.4%
	Count	57	4	61
minor outlet w/limited FS	% within food entity type	93.4%	6.6%	100.0%
	% within Inspection Rate Outcome	2.1%	0.7%	1.9%
	% of Total	1.7%	0.1%	1.9%
	Count	27	4	31
minor outlet w/significant FS and/or packaged ice	% within food entity type	87.1%	12.9%	100.0%
	% within Inspection Rate Outcome	1.0%	0.7%	0.9%
	% of Total	0.8%	0.1%	0.9%
	Count	295	21	316
minor outlet/prepackaged/no PHF	% within food entity type	93.4%	6.6%	100.0%
	% within Inspection Rate Outcome	10.9%	3.6%	9.6%
	% of Total	9.0%	0.6%	9.6%
	Count	102	5	107
	% within food entity type	95.3%	4.7%	100.0%
minor outlet	% within Inspection Rate Outcome	3.8%	0.9%	3.3%
	% of Total	3.1%	0.2%	3.3%
	Count	134	3	137
	% within food entity type	97.8%	2.2%	100.0%
flea market kiosk	% within Inspection Rate Outcome	4.9%	0.5%	4.2%
	% of Total	4.1%	0.1%	4.2%
	Count	40	0	40

	% within food entity type	100.0%	0.0%	100.0%
mobile vendor	% within Inspection Rate Outcome	1.5%	0.0%	1.2%
	% of Total	1.2%	0.0%	1.2%
others	Count	57	2	59
	% within food entity type	96.6%	3.4%	100.0%
	% within Inspection Rate Outcome	2.1%	0.3%	1.8%
	% of Total	1.7%	0.1%	1.8%
Total	Count	2709	576	3285
	% within food entity type	82.5%	17.5%	100.0%
	% within Inspection Rate Outcome	100.0%	100.0%	100.0%
	% of Total	82.5%	17.5%	100.0%

Chi-square is a test of statistical independence, which means if two variables are unrelated then they are independent of one another. In Table 9, the result shows that zero cell have an expected count less than 5, and the minimum expected count is 25.85. It also shows that the probability of the chi-square test statistic (chi-square = 48.33) is $p = 0.000$, less than the alpha level of significance of 0.05, which means that there is a 0% probability that any deviation from expected results is due to chance only. Pearson Chi-Square result shows that χ^2 (15) = 361.688, p = 0.000 ($p < 0.05$). This tells us that there is a statistically significant association between food entity types and inspection rate outcome. Phi and Cramer's V are both tests of the strength of association. Results of these tests show that the strength of association between the variables is moderate (Phi and Cramer's V = 0.332, $p < 0.001$).

Table 9

Food Establishment Type and Fail/Pass Rate

	Value	Df	Asymptotic Significance (2-sided)
Pearson Chi-Square	361.688[a]	15	0.000
Likelihood Ratio	359.220	15	0.000
Linear-by-Linear Association	23.378	1	0.000
N of Valid Cases	3285		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.44.

		Value	Approximate Significance
Nominal by Nominal	Phi	.332	0.000
	Cramer's V	.332	0.000
N of Valid Cases		3285	

Binary Logistic Regression of Pass/Fail Inspection

Binary logistic regression was used to estimate the probability of a pass/fail result occurring. Table 10 contains the Cox & Snell R Square and Nagelkerke R Square values, which are both methods of calculating the explained variation. Both are low, at 0.104 and 0.171. The overall -2 Log Likelihood for the model was 2690.949, which increased significantly, showing a poor fit of the model.

Table 10
Logistic Regression Model Summary for Dependent Variable (Pass/Fail Rate)

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
	2690.949	0.104	0.171

This table 11 provides important information about the binary logistic regression results. Overall percentage correct 82.5% value was predicted which means it did not improve the model. The base probability of simply guessing all cases were passes would have been correct 83 percent of the time.

Table 11
Logistic Regression *Classification for Dependent Variable (Pass/Fail Rate) Independent Variable (Food entity types)*

			Predicted		
			Rate outcome		
	Observed		Pass	Fail	Percentage Correct
Step 1	Rate outcome	Pass	2709	0	100.0
		Fail	576	0	.0
	Overall Percentage				82.5

Table 12 showed shows the contribution of each independent variables to the model. The result of this analysis presents an adjusted odds ratio, sig, and Exp (B) for each independent variable. The following categories were significantly different from the reference category (other food entities): supermarket (*B* = 2.043, *p* = 0.000), grocery (*B* = 2.946, *p* = 0.000), convenience store limited FS (*B* = 1.828, *p* = 0.013), and retail bakery w/FS (*B* = 2.347, *p* = 0.002) .The following variables were not significant: convenience Store Significant FS and/or packaged ice (B = 0.284, *p* = 0.751), health food store w/FS (B = 0.888, *p* = 0.232), retail bakery (*B* = 1.214, *p* = 0.13) , bakery outlet store (*B* = 18.596, *p* = 1.0) , minor outlet with perishables (*B* = 0.226, *p* = 0.766), minor outlet w/limited food service (B = -0.392, *p* = 0.702) , minor outlet w/significant food service and/or packaged ice (*B* = 1.061, *p* = 0.244) , minor outlet/prepackaged/no PHF(B = 0.314, *p* = 0.683), minor outlet (*B* = 0.308, *p* = 0.73) , flea market Kiosk (*B* = 0.015, *p* = 0.991), and mobile vendor (*B* = -18.492, *p* = 0.998).

The adjusted odds of pass fail rate were also significantly for civilian (age 16+) unemployed estimate (*B* = 0.001, *p* = 0.008), minority (all persons except white, non-Hispanic) estimate (*B* = .000, *p* = 0.014), and mobile homes estimate (*B* = 0.01, *p* = 0.014). Based on the logistic regression model, I can conclude that the overall logistic regression model was not a meaningful improvement over the pre-analysis classification table (percent correctly classified 0.83 vs 0.82).

Table 12

Logistic Regression Analysis of Fail Rate Independent Variable (Food Entity Types, and Demographic Area)

Measures	B	S.E.	Wald	df	Sig	Exp(B)
population estimate	-0.001	0	6.605	1	0.01	0.999
housing units' estimate	0	0	3.117	1	0.077	1
households estimate	0	0	0.203	1	0.652	1
persons below poverty estimate	0	0	0.422	1	0.516	1
civilian (age 16+) unemployed estimate	0.001	0	7.132	1	0.008	1.001
persons aged 65 and older estimate	0	0	0.007	1	0.935	1
persons aged 17 and younger estimate	0	0	0.789	1	0.374	1
percentage of civilian noninstitutionalized population with a disability estimate	0	0	1.346	1	0.246	1
single parent household with children under 18 estimate	0	0.001	0.01	1	0.92	1
Minority (all persons except white, non-Hispanic) estimate	0	0	6.048	1	0.014	1
persons (age 5+) who speak English "less than well" estimate	0	0	0.471	1	0.492	1
mobile homes estimate	0.001	0	6.069	1	0.014	1.001
households with no vehicle available estimate	-0.001	0.001	2.761	1	0.097	0.999
persons in institutionalized group quarters estimate	0	0	0.465	1	0.496	1
supermarket	2.043	0.743	7.556	1	0.006	7.712
grocery	2.946	0.748	15.523	1	0	19.038

convenience Store Limited FS	1.828	0.739	6.112	1	0.013	6.22
convenience Store Significant FS and/or packaged ice	0.284	0.896	0.1	1	0.751	1.328
health food store w/FS	0.888	0.743	1.428	1	0.232	2.43
retail bakery w/FS	2.347	0.749	9.825	1	0.002	10.452
retail bakery	1.214	0.802	2.293	1	0.13	3.368
bakery outlet store	-18.596	40193	0	1	1	0
minor outlet with perishables	0.226	0.76	0.089	1	0.766	1.254
minor outlet w/limited FS	-0.392	1.027	0.146	1	0.702	0.675
minor outlet w/significant FS and/or packaged ice	1.061	0.911	1.356	1	0.244	2.888
minor outlet/prepackaged/no PHF	0.314	0.769	0.167	1	0.683	1.369
minor outlet	-0.308	0.894	0.119	1	0.73	0.735
flea market kiosk	0.015	1.274	0	1	0.991	1.015
mobile vendor	-18.492	7390.04	0	1	0.998	0
constant	-2.863	0.753	14.446	1	0	0.057

Summary of Findings

Results for each of the alternate hypotheses are shown below.

H_a1**:** There is an association between the frequency of inspection rating failure and the poverty level of the area when controlling for food facility type, 2 years' period, race/ethnicity, age, and gender.

This hypothesis was tested using multiple logistic regression analysis. However, the logistic regression model results were disregarded because the overall logistic regression model was not a meaningful improvement over the pre-analysis classification table (percent correctly classified 0.83 vs 0.82). Therefore, I cannot reject the null hypothesis.

H_a2: The number of risk violations (employee health, preventing contamination by hands, approve source, protection from contamination, potentially hazardous food time/temperature, and chemical) is associated with the poverty level of the area when controlling for food facility type, 2 years' period, race/ethnicity, age, and gender.

This hypothesis was tested using multiple linear regression analysis in which demographic variables and food entity types were controlled. The only significant demographic variable was the number of single-parent households was significant (B = .001, p = 0.022). The poverty rate was not significant. Therefore, the null cannot be rejected.

H_a3: There is an association between the food entity types (supermarkets, grocery, convenience stores, meat market, minor outlet, and specialty stores) and the number of food violations cited when controlling for poverty level, 2 years' period, race/ethnicity, age, and gender.

Multiple linear regression analysis of the log of the number of violations was used to test this hypothesis. Results indicated that most of the food entities types are significant predictors of risk violations.

H_a4: There is an association between the food entity operation type (supermarkets, grocery, convenience stores, meat market, minor outlet, and specialty stores) and the number of inspection failures when controlling for when controlling for poverty level, year, race/ethnicity, 2 years' period, and gender.

A cross-tabulation table and multiple logistic regression analysis were used to test this hypothesis. The chi-square from the cross-tabulation revealed a significant association between food entity types and failing and inspection. ($p < 0.005$). However, the multiple logistic regression analysis performed poorly. Therefore, the significant association between food entity type and failure is not adjusted for demographic variables.

In the next chapter, I will present the interpretation of findings, implications for social change, recommendations for action, and further study.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

Due to more knowledgeable consumers and increased government legislation related to food safety, the overall incidences of foodborne illness outbreaks in the United States have decreased. Despite this fact, the CDC reported that there are still more than 48 million people in the United States who get sick and 3,000 who die each year from foodborne illness (CDC, 2017).

Potential outbreaks of foodborne illness can likely relate to public consumed contaminated products that have entered the food establishment at some point. Hospitalization rates reflect the seriousness of foodborne disease outbreaks; for example, 88% of patients with *Listeria* infections required hospitalization, compared with 36% for *Yersinia*, 37% for *E.* coli O157:H7, and 22% for Salmonella (Morton, 2002). One of the objectives of the FDACS is to protect and to reduce the number of foodborne illness cases by investigating the problematic areas and focusing on reducing violations in a team effort between state organizations, federal organizations, and the establishment providers (FDACS, n.d).

The purpose of this study was to conduct cross-sectional retrospective analysis of the food inspection data. I used a secondary design to analyze numerous variables by collecting statistical data to generate information about the safety food violation. The purpose of this research was to ascertain the relationship between the number of risk violations, food entity types, the frequency of inspection rating failure, and the poverty level of the area. Also, the purpose was to determine the correlation between the number of risk violations for each entity type and the region. The target population in this study was accessed through the FDACS database, which contained 3,436 risk violations from the year 2014 to 2016.

Interpretation of the Findings

During the 2-year study period, 3,435 food entity violations were inspected. Multiple logistic regression was not a meaningful improvement over the pre-analysis classification table; therefore, conclusions in Chapter 4 were based on a linear regression model and the cross-tabulation table tests. The results showed normal distribution of the number of violation among food entity types. A linear regression model of association presented a relationship between food entity types and risk violations. The research question addressed whether the number of food violations varies depending on the food entity types (grocery, supermarket, convenience store limited FS/convenience store significant FS and/or packaged ice, health food store w/FS, retail bakery/retail bakery w/FS, bakery outlet store, minor outlet with perishables/minor outlet w/limited food service/minor outlet w/significant food service and/or packaged ice, minor outlet/prepackaged/no PHF/ minor outlet, shopping center kiosk, flea market kiosk, mobile vendor, and others) after adjusting for differences in covariates. Overall, my prediction was that the number of food violations would be significantly different for food entity types. As predicted, multiple linear regression analysis indicated that most of the food entity types were significant predictors of risk violations, with grocery store (b = 2.877; $p < 0.001$) having a higher increase in violations than the other categories of food entities and convenience store significant FS and/or packaged ice (22.2 %) having the highest percentage fail rate within inspection rate outcome. Additionally, the only significant demographic variable was the number of single-parent households. The chi-square from the cross-tabulation indicated that food entity types had a significantly higher risk of failing inspection. However, the significant association between food entity type and failure was not adjusted for demographic variables.

Comparing Findings to Prior Research

I assessed the critical health code violations to fill in the knowledge gap of whether there was a link between risk for food illness and the socioeconomic level of an area. I expected this study to identify food illness risk food entity type and different demographic characteristics. These characteristics included population estimate, housing units estimate, households estimate, persons below poverty estimate, civilian (age 16+) unemployed estimate, persons aged 65 and older estimate, persons aged 17 and younger estimate, percentage of civilian non institutionalized population with a disability estimate, single parent household with children under 18 estimate, minority (all persons except White, non-Hispanic) estimate, persons (age 5+) who speak English "less than well" estimate, mobile homes estimate, households with no vehicle available estimate, and persons in institutionalized group quarters estimate.

Based on the analysis, the results in this study were different from that of a prior study by Darcey (2011), who demonstrated a significant interaction between poverty and the distribution of food markets, indicating that rates of all grocery stores, including corner markets, were highest in high poverty areas. Darcey indicated that rates of critical health violation (CHV) across poverty groups were significantly greater in the lowest poverty (highest income) group at 0.93 (0.04) compared to other groups. The author suggested the need to investigate different sources of data for food access research to confirm differential access to food for different populations (Darcey, 2011). In this study, I used a different population with a different data set to examine those variables, finding that poverty rate was not significant to reject the null hypothesis (the number of risk violations is associated with the poverty level of the area).

Contrary to the above-stated finding, results confirmed an association of increased access to chain food markets for low poverty areas and increased access to corner markets/groceries for high poverty (Darcey, 2011). The results from this present study revealed that grocery stores had more violations than the other types of entity. This study is important because it identified whether entity type could be associated with food violation risk.

Limitations of the Study

Limitations of the current study are that the data collection was not primary data and only involved data from 2 years (2015 and 2016) and did not compare the results with another county. Many other factors, such as employees' training and knowledge about their job, could contribute to violation outcomes, which could be a major limitation of that study. Including other factors could help improve the future model to further explore food safety violations. Also, poverty rate helps distinguish areas with different poverty levels, but the rate does not account for the actual population counts. The future model should consider the counts of potential customers who could be both commuters or nearby residents to better prioritize inspections. Another limitation of the study is that there were also missing data, which may have impacted the results.

Recommendation for Action

The costs associated with foodborne illness are substantial in terms of morbidity, mortality, and economic cost of health. According to the USDA, foodborne illness costs the United States economy between $10 to $83 billion United States dollars (USD) per year (McLinden et. al, 2014). The 10 states with the highest costs per case are Florida, Connecticut, Pennsylvania, South Carolina, the District of Columbia, Mississippi, New York, Massachusetts, and New Jersey (Walsh, 2011). The CDC (2016) estimated that approximately 76 million new cases of food-related illness, resulting in 5,000 deaths and 325,000 hospitalizations, occur in the United States each year.

To reduce the rates of morbidity, mortality, and economic spending, policymakers and stakeholders should target food entity types. Because food entity types are at higher risk for developing food violation, there is a need for operational assessment programs which will help in identifying and focusing on violations directly related to food safety. The operational assessment programs would review and measure performance based on regulatory requirements and industry best practices and standards, which will provide a complete picture of the state of operations.

Future researchers should investigate in more detail the issues of food safety risks associated with training, conformity, and following validation of certification to find out if these things could be factors that contribute to critical food safety violation. In addition, researchers could also look at inspector bias and lack of training to determine what role these factors play and if they make a difference in the number of food entity violations.

Social Change Implications

The purpose of this study was to investigate the number of food safety violations that frequently occurred in different types of food entities and the different demographic characteristics of the areas in which they occurred. Some researchers suggested that "small corner markets face unique challenges which may affect the quality and potential safety of perishable food" (Quilan, 2015).

Based on wide-ranging data from various sources, a significant part of this study is to draw attention to additional development of frameworks for food safety. Food violation causes foodborne illnesses commonly to occur in five categories: poor personal hygiene, contaminated equipment, failure to purchase and receive food from sage sources, improper holding temperature, and inadequate cooking (Medeiros et al., 2001). The results of the current study indicated that most food entity types, not the poverty level of the area, were significant predictors of risk violations. Therefore, the identified risk violations may allow various food entities to implement education and training programs, as well as hiring an infection preventionist to reduce the risk of foodborne illness. My results supported a need to better educate the public about the condition of the food entity type and the violation types, which can lead to social change and have an impact on people's day-to-day experiences.

Conclusion

Food safety and related foodborne illnesses are major public health challenge, which causes an estimated 48 million illnesses and 3,000 deaths each year in the United States (CDC, 2016). The food safety inspection program ensured that all facilities processed and served food in sanitary standards; however, the lack of consistency in the food establishment delivery challenged this goal. Brown et al. (2013) showed that many food service workers do not engage or follow food safety standard (Brown et al., 2013). This study used secondary data from the FDACS inspection database to investigate the predictors of food-borne illness and food safety risks from food entity establishments available to populations of different income levels and different racial compositions in Miami Dade County. The results from this study supported that food entity types are high predictors of food-borne illness risks (food safety violation risks), with grocery store being the highest. However, different neighborhood socio demographic characteristics were not predictive factors for food safety compliance. These results were congruent with the results presented by Darcey (2011) because the different population with a different data set may be influenced, and therefore people willing to perform or not perform adequate food safety practices may be hindered.

While the results presented here did not provide conclusive evidence that there are greater food safety risks at the retail level for any community, there is evidence to fill in a significant knowledge gap of risk factors causing the violation in food entity types. Hopefully, future research will shed more light using more detailed and descriptive primary data to generate conclusions on the violation and various entity type as a unit of analysis.

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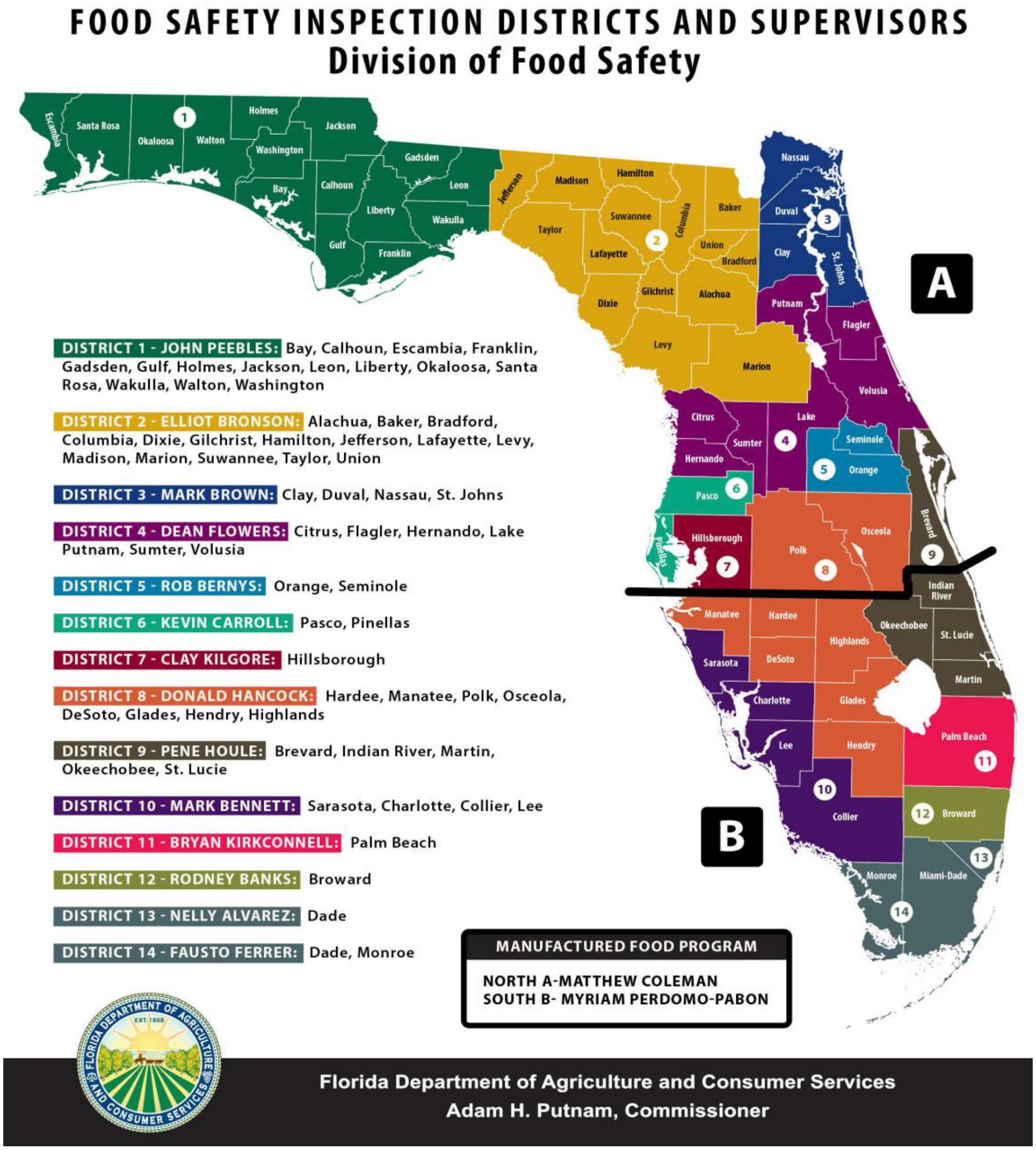
Figure A1: Food Safety Inspection Districts



Source: FDACS (n.d). Inspector Reference Files. Retrieved from https://freshfromflorida.sharepoint.com/fs/foodinspection/fieldinspection/SitePages/Home.aspx#ChecklistsRetail

Table A1: Most Common Violations and Information Collected on Food Safety Inspections Statewide

FOOD SAFETY INSPECTION REPORT

Chapter 500, Florida Statutes

Food Entity Number:
Food Entity Name:
Date of Visit:
Food Entity Address:
Food Entity Mailing Address:
Food Entity Type/Description:
Food Entity Owner:

INSPECTION SUMMARY

PERMIT APPLICATION INFORMATION

COMPLIANCE KEY

IN = In Compliance OUT = Not In Compliance N/O = Not Observed N/A = Not Applicable

FOODBORNE ILLNESS RISK FACTORS AND PUBLIC HEALTH INTERVENTIONS

Violation Number	Compliance Status	violation Description
1		Supervision: Person in Charge present, demonstrates knowledge, and
2		Employee Health: Management, food employee and conditional employee; knowledge, responsibilities, and reporting
3		Employee Health: Proper use of restriction and exclusion

4	Good Hygienic Practices: Proper eating, tasting, drinking, or tobacco use
5	Good Hygienic Practices: No discharge from eyes, nose, and mouth
6	Preventing Contamination by Hands: Hands clean and properly washed
7	Preventing Contamination by Hands: No bare hand contact with ready-to-eat foods or approved alternate method properly followed
8	Preventing Contamination by Hands: Adequate handwashing sinks, properly supplied and accessible
9	Approved Source: Food obtained from approved source
10	Approved Source: Food received at proper temperature
11	Approved Source: Food in good condition, safe and unadulterated
12	Approved Source: Required records available: shellstock tags, parasite destruction
13	Protection from Contamination: Food separated and protected
14	Protection from Contamination: Food-contact surfaces: cleaned and sanitized
15	Protection from Contamination: Proper disposition of returned, previously served, reconditioned, and unsafe food
16	Potentially Hazardous Food Time/Temperature: Proper cooking time and temperature
17	Potentially Hazardous Food Time/Temperature: Proper reheating procedures for hot holding
18	Potentially Hazardous Food Time/Temperature: Proper cooling time and temperatures
19	Potentially Hazardous Food Time/Temperature: Proper hot holding temperatures
20	Potentially Hazardous Food Time/Temperature: Proper cold holding temperatures
21	Potentially Hazardous Food Time/Temperature: Proper date marking and disposition
22	Potentially Hazardous Food Time/Temperature: Time as a public health control: procedures and records
23	Consumer Advisory: Consumer advisory provided for raw or undercooked foods
24	Highly Susceptible Populations: Pasteurized Foods, Prohibited Re-service, and Prohibited Foods*
25	Chemical: Food additives: approved and properly used
26	Chemical: Toxic substances properly identified, stored, and used

27	Conformance with Approved Procedures
	GOOD RETAIL PRACTICES
34	Food Temperature Control: Thermometers provided and accurate used
36	Prevention of Food Contamination: Insects, rodents, and animals not present
37	Prevention of Food Contamination: Contamination prevented during food preparation, storage & display
38	Prevention of Food Contamination: Wiping cloths: properly used and stored
39	Proper Use of Utensils: Utensils, equipment, and linens: properly stored, dried, handled
42	Proper Use of Utensils: Single-use/single-service articles: properly stored, and used
43	Proper Use of Utensils: Single-use/single-service articles: properly stored, and used
45	Utensils Equipment and Vending: Food and nonfood-contact surfaces cleanable, properly designed, constructed, and used
47	Utensils Equipment and Vending: Nonfood-contact surfaces clean
51	Physical Facilities: Toilet facilities: properly constructed, supplied, cleaned -
52	Physical Facilities: Garbage/refuse properly disposed; facilities maintained
53	Physical Facilities: Physical facilities installed, maintained, and clean

OBSERVATIONS AND CORRECTIVE ACTIONS

COS = Corrected on Site P = Priority Citation Pf = Priority Foundation Citation

Violation Number	Citation Description	Observation

Adopted from: FDACS (n.d). Inspector Reference Files. Retrieved from

https://freshfromflorida.sharepoint.com/fs/foodinspection/fieldinspection/SitePages/Home.aspx#ChecklistsRetail

Figure A2: Food Establishment Inspection Report

ADAM H. PUTNAM
COMMISSIONER

Florida Department of Agriculture and Consumer Services
Division of Food Safety

FOOD ESTABLISHMENT INSPECTION REPORT

Section 500.12, Florida Statutes

Bureau of Food Inspection
3125 Conner Boulevard C-26
Tallahassee, FL 32399-1650
1-800-HELP-FLA

Food Establishment Number | Food Establishment Type | Date
Inspector Name | Inspector Number
Food Establishment Name
Location Address | City | Zip
Mailing Address | City | Zip

Reason for Inspection

- ☐ Routine
- ☐ Re-inspection
- ☐ Check-Back
- ☐ Focused Inspection - Consumer Complaint
- ☐ Focused Inspection - Sample Collection
- ☐ Focused Inspection – Other

Food Establishment Status

- ☐ Active
- ☐ New / Permit Request
- ☐ Out of Business
- ☐ New/ Operating Without Permit
- ☐ Ancillary

Inspection Type

- ☐ Retail
- Manufacturing
  - ☐ GMP
  - ☐ LACF
  - ☐ Acidified Food
  - ☐ Juice HACCP
  - ☐ Juice HACCP
  - ☐ Seafood HACCP
  - ☐ Bottled Water
- ☐ Interdiction Station
- ☐ Vended Water/Vended Ice

Inspection Time Record

Time in: ______ Time out: ______

Re-inspection Date On or About

__/__/__

Inspection Summary

- ☐ Met Inspection Requirements
- ☐ Re-Inspection Required
- ☐ Met Inspection Requirements; Check-Back Needed

Supplements Issued	Total
Stop Sale Orders Issued	
Stop Use Orders Issued	
Release Notices Issued	
Destruction Reports Issued	
Movement Order Issued	

COMMENTS:

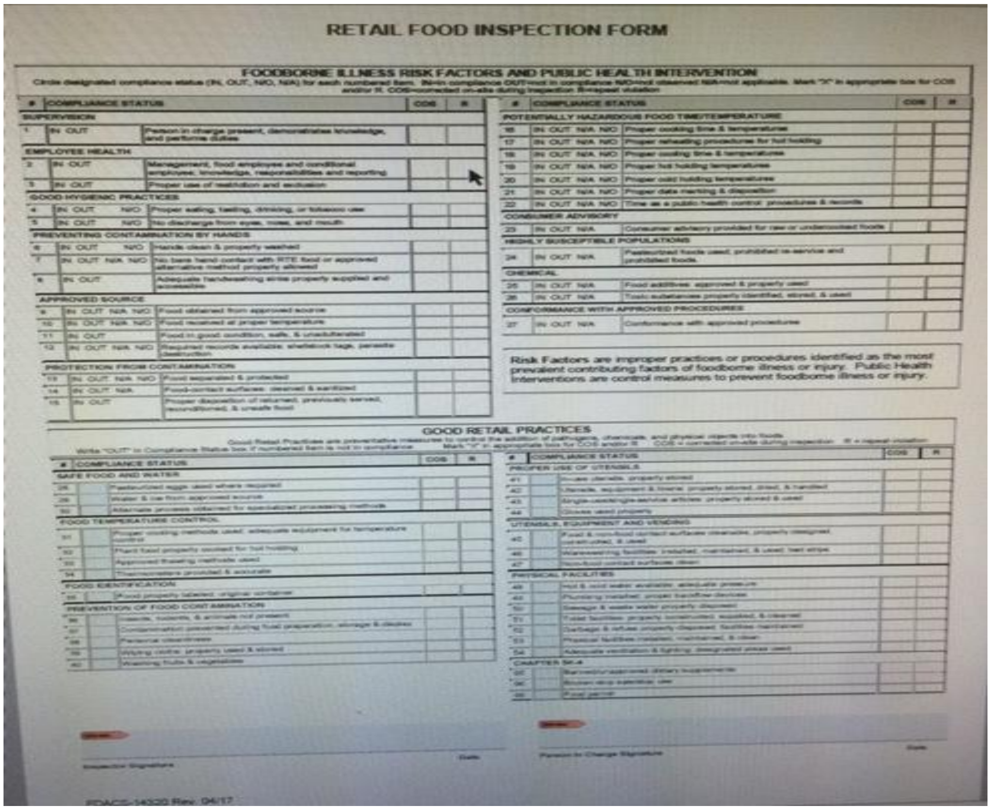
Inspector Name (print)

Person in Charge (print)

Inspector Signature | Date

Person in Charge Signature | Date

FDACS-14320 Rev. 04/17



RETAIL FOOD INSPECTION FORM

FOODBORNE ILLNESS RISK FACTORS AND PUBLIC HEALTH INTERVENTION

Circle designated compliance status (IN, OUT, N/O, N/A) for each numbered item. IN=in compliance OUT=not in compliance N/O=not observed N/A=not applicable. Mark "X" in appropriate box for COS and/or R. COS=corrected on-site during inspection R=repeat violation

#	COMPLIANCE STATUS		COS	R
SUPERVISION				
1	IN OUT	Person in charge present, demonstrates knowledge, and performs duties		
EMPLOYEE HEALTH				
2	IN OUT	Management, food employee and conditional employee; knowledge, responsibilities and reporting		
3	IN OUT	Proper use of restriction and exclusion		
GOOD HYGIENIC PRACTICES				
4	IN OUT N/O	Proper eating, tasting, drinking, or tobacco use		
5	IN OUT N/O	No discharge from eyes, nose, and mouth		
PREVENTING CONTAMINATION BY HANDS				
6	IN OUT N/O	Hands clean & properly washed		
7	IN OUT N/A N/O	No bare hand contact with RTE food or approved alternative method properly allowed		
8	IN OUT	Adequate handwashing sinks properly supplied and accessible		
APPROVED SOURCE				
9	IN OUT N/A N/O	Food obtained from approved source		
10	IN OUT N/A N/O	Food received at proper temperature		
11	IN OUT	Food in good condition, safe, & unadulterated		
12	IN OUT N/A N/O	Required records available: shellstock tags, parasite destruction		
PROTECTION FROM CONTAMINATION				
13	IN OUT N/A N/O	Food separated & protected		
14	IN OUT N/A	Food-contact surfaces: cleaned & sanitized		
15	IN OUT	Proper disposition of returned, previously served, reconditioned, & unsafe food		

#	COMPLIANCE STATUS		COS	R
POTENTIALLY HAZARDOUS FOOD TIME/TEMPERATURE				
16	IN OUT N/A N/O	Proper cooking time & temperatures		
17	IN OUT N/A N/O	Proper reheating procedures for hot holding		
18	IN OUT N/A N/O	Proper cooling time & temperatures		
19	IN OUT N/A N/O	Proper hot holding temperatures		
20	IN OUT N/A N/O	Proper cold holding temperatures		
21	IN OUT N/A N/O	Proper date marking & disposition		
22	IN OUT N/A N/O	Time as a public health control: procedures & records		
CONSUMER ADVISORY				
23	IN OUT N/A	Consumer advisory provided for raw or undercooked foods		
HIGHLY SUSCEPTIBLE POPULATIONS				
24	IN OUT N/A	Pasteurized foods used; prohibited re-service and prohibited foods		
CHEMICAL				
25	IN OUT N/A	Food additives: approved & properly used		
26	IN OUT N/A	Toxic substances properly identified, stored, & used		
CONFORMANCE WITH APPROVED PROCEDURES				
27	IN OUT N/A	Conformance with approved procedures		

Risk Factors are improper practices or procedures identified as the most prevalent contributing factors of foodborne illness or injury. Public Health Interventions are control measures to prevent foodborne illness or injury.

GOOD RETAIL PRACTICES

Good Retail Practices are preventative measures to control the addition of pathogens, chemicals, and physical objects into foods.

Write "OUT" in Compliance Status box if numbered item is not in compliance. Mark "X" in appropriate box for COS and/or R. COS = corrected on-site during inspection R = repeat violation

#	COMPLIANCE STATUS		COS	R
SAFE FOOD AND WATER				
28		Pasteurized eggs used where required		
29		Water & ice from approved source		
30		Alternate process obtained for specialized processing methods		
FOOD TEMPERATURE CONTROL				
31		Proper cooling methods used; adequate equipment for temperature control		
32		Plant food properly cooked for hot holding		
33		Approved thawing methods used		
34		Thermometers provided & accurate		
FOOD IDENTIFICATION				
35		Food properly labeled; original container		
PREVENTION OF FOOD CONTAMINATION				
36		Insects, rodents, & animals not present		
37		Contamination prevented during food preparation, storage & display		
38		Personal cleanliness		
39		Wiping cloths: properly used & stored		
40		Washing fruits & vegetables		

#	COMPLIANCE STATUS		COS	R
PROPER USE OF UTENSILS				
41		In-use utensils: properly stored		
42		Utensils, equipment & linens: properly stored, dried, & handled		
43		Single-use/single-service articles: properly stored & used		
44		Gloves used properly		
UTENSILS, EQUIPMENT AND VENDING				
45		Food & non-food contact surfaces cleanable, properly designed, constructed, & used		
46		Warewashing facilities: installed, maintained, & used; test strips		
47		Non-food contact surfaces clean		
PHYSICAL FACILITIES				
48		Hot & cold water available; adequate pressure		
49		Plumbing installed; proper backflow devices		
50		Sewage & waste water properly disposed		
51		Toilet facilities: properly constructed, supplied, & cleaned		
52		Garbage & refuse properly disposed; facilities maintained		
53		Physical facilities installed, maintained, & clean		
54		Adequate ventilation & lighting; designated areas used		
CHAPTER 5K-4				
[illegible]		Banned/unapproved dietary supplements		
[illegible]		[illegible]		
[illegible]		Food permit		

Inspector Signature   Date

Person in Charge Signature   Date

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Source: FDACS (n.d). Inspector Reference Files. Retrieved from https://freshfromflorida.sharepoint.com/fs/foodinspection/fieldinspection/SitePages/Home.aspx#ChecklistsRetail