

**USING THE HEALTH BELIEF MODEL TO DETERMINE DIFFERENCES IN  
UNIVERSITY FOODSERVICE EMPLOYEES' BELIEFS AND PERCEPTIONS ABOUT  
HANDWASHING AND FOODBORNE ILLNESS**

by

BECKY J BOLTE

B.A., WICHITA STATE UNIVERSITY, 1992

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Department of Hospitality Management and Dietetics  
College of Human Ecology

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Approved by:

Major Professor  
Dr. Elizabeth B. Barrett

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## **Abstract**

The Centers for Disease Control estimates that each year 48 million Americans become ill, 128,000 are hospitalized, and 3,000 die of foodborne diseases. In 2011, the CDC reported that Norovirus caused the majority of all foodborne diseases and can be eliminated with proper handwashing, which is the number one way to prevent the spread of foodborne disease. The purpose of this study was to use the Health Belief Model to determine differences in university foodservice employees' beliefs and perceptions about handwashing and foodborne illness. The constructs of perceived susceptibility, severity, barriers, benefits, and self-efficacy as they relate to handwashing were used to examine the differences in demographics.

Instrument development included a review of literature, focus group feedback, a pilot study and a review by industry experts. The final instrument was distributed to all foodservice employees at Kansas State University using Qualtrics and pen-and-paper surveys. Frequencies, means, t-tests, ANOVA, and regression were used for data analysis and to answer research questions.

Results indicated respondents who were older (above 23 years of age), full-time employees, had more than three years of experience, and were food safety certified had a higher perception of susceptibility, benefits, and self-efficacy of handwashing and its relationship to reducing foodborne illness. Perceived severity was highest among respondents with food safety certification and more than three years of experience. Supervisor/Manager category did not agree on barriers to handwashing in the workplace with other positions; however, most employees did not rate barriers as a problem. Non-white respondents showed a lower self-efficacy for ability to wash hands correctly. Results of this study highlight the need for self-efficacy focused handwashing training for first year and non-white employees.

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## **Dedication**

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## **Chapter 1 - Introduction**

The Center for Disease Control and Prevention (CDC) estimates each year approximately one in six Americans (or 48 million people) become ill, 128,000 are hospitalized, and 3,000 die of foodborne diseases from a combination of the major known pathogens and unspecified agents. The United States Department of Agriculture (USDA) defines a foodborne disease as an illness that occurs from eating a contaminated food and this contamination is usually caused by a bacteria or pathogen (USDA, 2011b). In the United States (U.S.) 58% of foodborne disease outbreaks are attributed to Norovirus with Salmonella second at 11% (CDC, 2011a).

The key factor in the spread of Norovirus is personal hygiene, specifically lack of handwashing. For more than a century, handwashing has been recognized as an essential component in the prevention of the spread of microbial infection (Fendler, Dolan, & Williams, 1998). The CDC (2011a) reports handwashing is the single most important means of preventing the widening of the infection. Additionally, Howes, McEwen, Griffiths, and Harris (1996) found food handler's malpractices contributed to 97% of foodborne illness in foodservice establishments. These findings indicate that improvement of foodservice employees' food preparation practices is needed to reduce the incidence of foodborne illness.

The Food Drug Administration (FDA) Food Code has focused on methods to prevent the transmission of foodborne diseases in foodservice facilities including effective hand hygiene, the use of gloves or other barriers with ready-to-eat foods, and the exclusion of ill foodservice employees from the workplace (FDA, 2009). This model code is a reference document that provides a scientifically sound technical and legal basis for regulating the retail and foodservice segment of the food industry (FDA, 2013). More specifically, it is a system of prevention and

safeguards designed to minimize foodborne illness on foodservice establishment premises and promote fair dealings with the consumer (FDA, 2013).

Knowledge alone does not persuade people to execute food safety accurately or dependably (Cates, 2009; Green & Selman, 2005; Roberts et al., 2008). Many of the leading causes of death and disease in the U.S. and globally are related to health behaviors (World Health Association, 2008). Subsequently, research and practice focusing on the role of behavior in the promotion of health and the prevention of disease is essential and holds promise for improving the health of populations (Pragle, Harding, & Mack, 2007). Along with barriers to following food safety, negative and positive consequences of food safety behaviors should also be considered when looking at the promotion of health and prevention of disease (Clayton, Griffith, Price, & Peters, 2002).

Health behavior theories focus on multiple determinants of behavior at the individual, interpersonal, group, organizational, and/or community levels (Glanz, Lewis, & Rimer, 1996). Determining what foodservice employees believe about food safety practices is important in understanding the best methods to train for food safety. With handwashing being the primary method to prevent the spread of foodborne disease, the focus on proper handwashing within a foodservice operation should be a priority. If a manager knows what an employee believes about the importance of handwashing, then he/she can focus on those beliefs to improve the employees' understanding.

The Health Belief Model (HBM) framework has been used to understand various types of health-seeking behaviors as well as reasons for non-compliance with medical recommendations (Rosenstock, Strecher, & Becker, 1998). The HBM proposes that health behaviors are influenced by an individual's beliefs and perceptions about disease, which

ultimately affect whether or not a person will seek out preventative services. This model can be used to study the perceptions and beliefs of university foodservice employees on handwashing behaviors.

The constructs of the HBM include perception of susceptibility to contracting the condition or the disease, perceived severity of the consequences of contracting the condition or the disease, perceived benefits of preventive behavior, perceived barriers that stop appropriate health behavior by the person, confidence in their ability to perform the behavior, and cues to action. The model is concerned primarily with the readiness and initiative of the individual to pursue a health action as well as their perception that such an action would be beneficial minus barriers. Susceptibility and severity are hypothesized to provide the energy force to act, whereas, diminishment of barriers is thought to provide an accessible path for action (Strecher & Rosenstock, 1997).

The environmental health specialists network (EHS-net) found 65% of the most common causes of foodborne illness outbreaks were infected foodservice employees and 35 % were employees touching food with their bare hands. EHS-net study found 89% of the food indicated in foodborne illness outbreaks in restaurants was contaminated by foodservice employees; thus, understanding the beliefs and perceptions of foodservice employees is essential in eliminating the spread of germs from hands to food (2011). Nearly 20% of foodservice employees reported working at least one shift while experiencing foodborne illness symptoms of diarrhea and vomiting (Sumner et al., 2011). The EHS-net study (2011) found restaurant employees washed their hands in only 27% of the expected times and when wearing gloves were less likely to wash their hands than were employees who were not wearing gloves. The need to understand the

beliefs and perceptions of foodservice employees regarding handwashing is vital to improving compliance with food safety guidelines.

### **Statement of the Problem**

The importance of hand hygiene has been noted in numerous studies such as the current 2009 FDA Food Code regulations and in food safety training. Research reported that training foodservice employees' increased knowledge of food safety, but did not improve compliance with food safety guidelines (Howes, McEwen, Griffiths, & Harris, 1996). Studies have explored foodservice employees' perceived barriers to food safety, specifically that of handwashing. Those barriers include time constraints, inadequate resources, inconvenient location of resources, dry skin, and having a bad attitude regarding food safety (Howells et al., 2008). A wide range of thoughts exist about how a person perceives his or her susceptibility or seriousness to an illness (Rosenstock, 1966). One person may believe they have zero chances of contracting an illness as another believes they are in imminent danger of contracting an illness. The problem is that perceived susceptibility and severity does not mean individuals will have increased positive health behaviors and in the current study, handwashing to prevent a foodborne illness. Since employee behaviors - especially a lack of handwashing - has been linked to many foodborne illnesses outbreaks, it is important to understand their beliefs and perceptions about handwashing and foodborne illness. However, no studies have been found that have a connection between beliefs and perceptions of foodservice employees with handwashing and foodborne illness.

### **Justification**

Current research has revealed the majority of foodborne illness outbreaks can be controlled through proper hand hygiene (CDC, 2012a). Yet, foodservice employees have not

fully adapted the elementary skill of hand hygiene as a habit (Hardy, 1999). Many of the leading sources of death and disease in the U.S. and globally are related to health behaviors (World Health Association, 2008). In addition, it has been found individuals were most likely to use food safety information if the information is easy to understand, followed by having scientific facts causing feelings of a health threat (Lum, 2010). Jenkins-McLean, Skilton, and Sellers (2004) found changing behaviors in foodservice operations is achievable when behavior-change theories are used to design and implement a program. The HBM is centered on the idea that general health motivation is the tendency that health behaviors are influenced by an individual's beliefs and perceptions about disease. These beliefs and perceptions affect whether or not an individual will take specific health related actions toward positive change if they feel a negative health condition can be avoided through healthful behavior (Finfgeld, Wongvatunyu, Conn, Grando, & Russell, 2003). Subsequently, research and practice focusing on the role of behavior in the promotion of health and the prevention of disease is essential and holds promise for improving the health of populations (Pragle, Harding, & Mack, 2007). Determining what foodservice employees believe about food safety practices is important in understanding the best methods to train for food safety. Because handwashing is the primary method to prevent the spread of foodborne disease, the focus on proper handwashing within a foodservice operation should be a priority. There is little research about university foodservice employees' beliefs and perceptions of handwashing in relation to foodborne illness. In knowing what barriers and perception of hand hygiene exists, managers will be better equipped to overcome barriers and increase positive hand hygiene habits among employees.

## **Purpose**

The purpose of this study was to use the Health Belief Model to determine differences in university foodservice employees' beliefs and perceptions about handwashing and foodborne illness.

## **Objectives**

1. Develop an instrument using the HBM constructs of perceived susceptibility, perceived severity, perceived barriers, perceived benefits, and self-efficacy to identify differences in university foodservice employees' beliefs and perceptions about handwashing.
2. Determine if demographics and knowledge of proper handwashing of employees impact beliefs and perceptions of handwashing and foodborne illness.
3. Ascertain if demographics and knowledge of proper handwashing and foodborne illness of university foodservice employees affect handwashing self-efficacy.

## **Research Questions**

The central research question that this study aimed to answer was to use the HBM to determine if demographics and knowledge of proper handwashing impacted perceptions and beliefs about handwashing and foodborne illness among university foodservice employees. This study also addressed the following research sub-questions:

1. Is there a difference among demographics and food safety knowledge and certification of university foodservice employees about the perceived susceptibility of foodborne illness and handwashing?



2. Is there a difference among demographics and food safety knowledge and certification of university foodservice employees about the perceived severity of foodborne illness and handwashing?
3. Is there a difference among demographics and food safety knowledge and certification of university foodservice employees about the perceived barriers of foodborne illness and handwashing?
4. Is there a difference among demographics and food safety knowledge and certification of university foodservice employees about the perceived benefits of foodborne illness and handwashing?
5. Is there a difference among demographics and food safety knowledge and certification of university foodservice employees about the perceived susceptibility of foodborne illness and handwashing?
6. Is self-efficacy affected by any of the HBM constructs of perceived susceptibility, severity, barriers, and benefits?

### **Limitations**

This study was limited to a convenience sample of Kansas State University residential dining foodservice employees including: student employees, full-time employees, and managers. Future researchers could approach a larger sample of university foodservice employees in order to generalize results to a larger population. It should also be noted this sample works closely with the Department of Hospitality Management and Dietetics on campus; therefore, food safety training is a priority because students use the facilities and complete internships.

All employees were contacted via e-mail with access to the Qualtrics online survey. Students and managers were the primary users of the online survey, while full-time employees

were contacted by the researcher and managers through flyers and weekly meetings. Response bias is possible due to the voluntary nature of this survey. In addition, the study used a self-reported questionnaire where responses could be susceptible to social desirability bias because respondents may have felt the data was not confidential and reported more positive answers.

Even with a 30.3% response rate and efforts made to increase participation by providing multiple opportunities to complete pen-and-paper surveys, the total numbers (n = 195) were skewed towards student employees (n = 138) versus full-time employees (n = 55). This same issue was seen within the diversity of the population. The sample consisted of predominately white, non-Hispanic employees (n = 141) with fewer non-white respondents (n = 52).

Due to the timing of the survey at the end of the academic year, employees may not have been aware of the study, had no interest, or lacked the time to complete before leaving for the summer break. In addition employees may not have chosen to participate in this study for personal concern of being identified as a participant.

## **Definition of Terminology**

**2009 FDA Food Code:** A system of prevention and overlapping safeguards designed to minimize foodborne illness; ensure employee health, industry manager knowledge, safe food, nontoxic and cleanable equipment, and acceptable levels of sanitation on food establishment premises; and promote fair dealings with the consumer (FDA, 2009).

**Cues to action:** Strategies to activate willingness to change like education, symptoms, media information (Glanz, Rimer, & Lewis, 2002).

**Foodborne Illness:** An illness that occurs from eating a contaminated food. The contamination is usually caused by a bacteria or pathogen (USDA, 2011a).

**Handwashing:** The act of cleansing the hands with water or other liquid, with or without the inclusion of soap or other detergent, for the purpose of removing soil or microorganisms (Webster's Online Dictionary, 2008).

**Health Belief Model (HBM):** A psychological model that attempts to explain and predict health behaviors by focusing on the attitudes and beliefs of individuals as an expression of health beliefs (Mosby's Medical Dictionary, 8<sup>th</sup> edition, 2009).

**Known Foodborne Pathogens:** 31 tracked known pathogens to cause foodborne illness (CDC, 2011a).

**Perceived Barriers:** The individual's own thoughts of the hurdles in the way of adopting a new behavior and consequences of continuing old behaviors (Rosenstock, 1966).

**Perceived Benefits:** An individual's assessment of the value of alternative behaviors is how they see the benefit of the health action (Rosenstock, 1966).

**Perceived Severity:** An individual's perception of the seriousness of an illness (Rosenstock, 1966).

**Perceived Susceptibility:** Refers to an individual's belief of his chance of acquiring an illness or ill-effects of an illness (Weissfield et al., 1987).

**Self-Efficacy:** Belief in being able to successfully execute the behavior required to produce the desired outcomes (Bandura, 1977).

## **Chapter 2 - Review of Literature**

This chapter summarizes relevant literature related to the objectives and concepts of this study. The purpose of this study was to use the Health Belief Model to determine differences in university foodservice employees' beliefs and perceptions about handwashing and foodborne illness. This review of literature discusses history of handwashing and foodborne illness, current FDA Food Code guidelines about hand hygiene, the Health Belief Model, and foodservice employee beliefs and perceptions about handwashing.

### **History of Handwashing**

Handwashing is the act of cleansing the hands with water or other liquid, with or without the inclusion of soap or other detergent, for the purpose of removing soil or microorganisms (Webster's Online Dictionary, 2008). As early as 1822, A.J. Labaraque, a French chemist and pharmacist, demonstrated that solutions containing chlorides of lime or soda could eradicate the foul odors associated with human corpses and these solutions could be used as disinfectants and antiseptics. In 1825, Labaraque stated that physicians and other persons attending patients with contagious diseases should moisten their hands with a liquid chloride solution to reduce the spread of disease (Boyce & Pittet, 2002).

A Hungarian physician named Ignaz Philipp Semmelweis found in the 1840's the spread of disease was occurring more in the hospital maternity ward at his hospital than in the midwives ward. Women and their babies were dying at an alarming rate because physicians were coming from autopsies into the delivery room without washing their hands between patients. Dr. Semmelweis asked the physicians to wash their hands with a chlorine solution between patients and an immediate drop from 18% to 1% in mortality occurred. (Semmelweis Society

International, 2009). Unfortunately, this practice was not widely accepted until years later when Louis Pasteur confirmed the germ theory and Joseph Lister was successful using hygienic methods in his medical practice and operations (Semmelweis Society International, 2009). This is when the importance of hygiene for public health began.

After returning from the Crimean War and setting up a school for nurses, Florence Nightingale wrote in “Notes on Nursing for the Labouring Classes” (1861) the following excerpt from her chapter on “Personal Hygiene”.

***“...when it is cold without soap, cold with soap, hot with soap. You will find the first has hardly removed dirt at all,...the third a great deal more... What I mean is that by simply washing or sponging with water you do not really clean your skin. Take a rough towel dip one corner in very hot water... it will be more effectual and then rub as if you were rubbing the towel into your skin with your finger...”*** (pg. 65)

In 1910, Josephine Baker, M.D, helped to discover Typhoid Mary after a cook in several New York households, Mary Mallon, inadvertently caused a small typhoid epidemic and paved the way for public health programs to improve standards of personal hygiene (Hardy, 1999). Mallon was the first “healthy carrier” of typhoid fever discovered. Through a period of 15 years, it is believed she infected as many as 53 people (truly unknown how many total) in her cooking career and caused three deaths through contaminated food and water. She was quarantined twice and eventually passed away from pneumonia in 1938 (Rosenberg, 2013). Mallon was the first carrier found, but not the only carrier. In New York City alone, 4,500 new cases of typhoid fever were reported and an estimated 3% of those who had typhoid fever became carriers (Rosenberg, 2013). Preventative measures included carriers washing hands before preparing food as well as

everyone eating only cooked food helped to reduce typhoid fever. Eventually typhoid fever was controlled through disinfection of the drinking water supply, sewage treatment, milk sanitation and pasteurization, as well as shellfish bed sanitation. With the emergence of foodborne illness related to the wars, the awareness of the need for handwashing to control this spread of disease was beginning to increase. In 1920's, one in a thousand washed their hands after visiting the latrine. Of course, some of this was due to the lack of wash basins in the latrines, but handwashing remains one of the most neglected elementary precautions against bacterial food infections (Hardy, 1999).

Both World War I (WWI) and World War II (WWII) brought new issues of proper personal hygiene to light. Even though specific measures through a manual of military training and "policing" of sanitation standards were taken to ensure proper personal hygiene including when to wash hands was achieved in the camps, several commanders observed a relaxed attitude in the troops when away from the base. This relaxed attitude contributed to diarrheal diseases among the three common issues causing more hospital admissions than all battle casualties (U.S. Medical Department, 1955). The Army notes, outbreaks of foodborne illness were the exception. This was due to the way the Army was able to handle many of these outbreaks by identifying carriers and ensuring they were not handling food in the field. This was made possible by laboratories for bacteriologic examination. Fecal specimens of food handlers were consistently tested to identify carriers and ensure they were no longer handling food. This was not possible in the general public due to laws and public facilities, but the close evaluation of soldiers made the U.S. Army maintain a close follow-up of carriers (Khuns, 2009).

In 1961, the U. S. Public Health Service produced a training film that demonstrated handwashing techniques recommended for use by healthcare workers. Formal guidelines on

handwashing practices in hospitals were published by the CDC in 1975 and 1985 (Boyce & Pittet, 2002). The techniques have been revised several times since first published in 1975 and include using hand sanitizers when soap and water are not available. The steps of handwashing often include the following:

1. Wet your hands with clean running water (warm or cold) and apply soap.
2. Rub your hands together to make lather and scrub them well; be sure to scrub the backs of your hands, between your fingers, and under your nails.
3. Continue rubbing your hands for at least 20 seconds. .
4. Rinse your hands well under running water.
5. Dry your hands using a clean towel or air dry. (CDC, 2013)

When the Acquired Immunodeficiency Syndrome (AIDS) epidemic hit in the early 1980's, preventing healthcare workers exposure to bloodborne pathogens became important. In 1987, the CDC created universal precautions which included washing hands before and after each medical procedure to be used consistently among health care workers. The Occupational Safety and Health Administration (OSHA) mandated the use of the universal precautions in 1990 after the discovery Human Immunodeficiency Virus (HIV) was transmitted through blood and other bodily fluids (Boskey, 2010). Epidemiological outbreak data repeatedly identifies five major risk factors related to employee behaviors and preparation practices in retail and food service establishments as contributing to foodborne illness. Of these five major risks poor hand hygiene is listed as number one (Mann, 2007).

While the knowledge of pathogens and diseases transmitted by lack of proper hand hygiene has grown, compliance with handwashing is still an issue in healthcare and foodservice. In 1997, a survey at the London School of Hygiene and Tropical Medicine revealed 44% of toilet



users either did not wash their hands or did not use soap. The researchers concluded from the survey, even within staff promoting good hygiene, a disconnection in relation to personal practices was evident (Hardy, 1999). Dr. Robert Weinstein, chairman of the Division of Infectious Disease at Cook County Hospital, reported 85% of healthcare providers stated they washed their hands according to infection control recommendations in 2000. When asked about their peers, 50% believed their peers followed recommendations. After true observation of behaviors, only 26% were following proper handwashing procedures (Twomey, 2006). Green et al. (2005) found that approximately 5% of surveyed food workers admitted having worked during the previous year while suffering vomiting or diarrhea, and Sumner et al. (2011) found 12% of study participants reported they had worked two or more shifts with symptoms. Ill workers pose a severe foodborne illness risk and especially those who do not follow proper handwashing procedures.

### **History of Foodborne Illness**

In June 1880, a discovery in the understanding of foodborne illness occurred in the English Midlands. An estate sale at the Walbeck Abby attributed to an outbreak where 2,000 people were in attendance. Refreshments served included imported American hams and other cold meat platters. The caterers used the hotel's underground storage for this event, which had a long exposed sewer trough that flowed through the room. After attending this event, 72 cases and four deaths were reported with "gripping pains in the belly", chills, headache, diarrhea and vomiting. The suspected exported American hams were sent to microbiologist Edward Klein, for examination. He found in the thicker, less cooked portion of the ham a "living parasitic thing capable of spreading by its growth and reproduction through the material in which it was found". The Walbeck outbreak marked the beginning of the growing concern for hygienic preparation

and storage of food along with the creation of “food poisoning” as a public health concern (Hardy, 1999).

The discovery of Salmonella enteritis by Gustav Gaertner in 1888 was the next most important landmark in the history of bacterial food poisoning and later foodborne illness. Gaertner was positively able to link the bacillus found in a slaughtered cow to the gastro-enteritis experienced by those who ate the meat (Hardy, 1999). In 1898, Herbert Durham an English bacteriologist attempted to resolve some of the confusion of bacilli, which he divided into three separate groups, on a spectrum from typhoid and the paratyphoid (highly pathogenic), through the salmonellas (less pathogenic) to the Escherichia coli group (Hardy, 1999). Even after knowing the existing food and drug legislation only focused on chemical adulteration, some were investigating bacterial organisms. For example in 1910, bacteriologists working at the Lister Institute reported a lethal salmonella outbreak among their stock of guinea pigs. The survivors were still excreting bacteria intermittently five months later. This recognition of animal reservoirs of salmonella infection reinforced the complex public health aspects of the food poisoning problem. In 1913, Arthur Newsholme, then Chief Medical Officer in the United Kingdom, made a statement that emphasized the importance of inspection of meat, adequate control of the places where food was prepared and stored, and cleanliness in all stages of food preparation (Hardy, 1999).

From a public health perspective the food poisoning problem had several elements: 1) the animal health aspect, with veterinary, slaughterhouse, and culinary factors to consider; 2) the personal hygiene aspect, which involved toilet and handwashing habits; 3) the question of legislation; and 4) the bacteriological aspect, which indicated the need for more extensive laboratory provisions to assist in unraveling evidence from the field (Hardy, 1999). By the

1920s, it was recognized that most cases of food poisoning were associated with meat, especially with beef and pork (Hardy, 1999). Unless there were one or more deaths involved, or the outbreak was on a considerable local scale, incidents of gastro-enteritis rarely were reported to the authorities (Hardy, 1999). Common stomach illness was not severe enough to merit the expense of medical attention so an epidemic would go undetected by authorities.

Exposure was one hazard; handling was another with potential for the transfer of pathogenic bacteria of human and animal origin. Issues of personal hygiene began to receive closer attention, but the practice of hygiene proved difficult. In 1930, Dr. W. M. Scott was the first to demonstrate that eggs were a vehicle for salmonella transmission which increased public health concern about the wider environmental sources of food poisoning organisms (Hardy, 1999). The 1938 Food and Drug Act made food poisoning notifiable by including clean working conditions, provision of adequate washing facilities and the practice of handling, wrapping, and the delivery of food (Hardy, 1999).

As mentioned previously the wars brought on new incidence of disease. In World War II one example of 76 outbreaks of staphylococcal food poisoning involving 14,214 men stressed the growing importance of food safety (U.S Medical Department, 1955). The cause was related to the time and temperature abuse of several different types of foods. Food poisoning became more prevalent with the addition of new behaviors such as mass catering, mass production, reheating of food and international trade which contributed to new food poisoning events. Reporting of incidences of foodborne illness followed due to public knowledge and availability of medical care (Hardy, 1999).

Today there are over 31 major known pathogens transmitted through food (Scallan, 2011). Food handling by infected employees in restaurants contributes to two-thirds of the

foodborne illness outbreaks caused by these known pathogens. Out of these 31 pathogens there are five; Norovirus, Salmonella, Shigella, Enterohemorrhagic or Shiga-toxin producing E. coli, and the Hepatitis A virus which are considered the “big 5” that cause the most illnesses due to easy transmission through food. The greatest risk of contracting these five pathogens to consumers occurs when foodservice employees’ work with food while infected (FDA, 2007). Of the Big 5, poor personal hygiene is a major contributor to the spread of foodborne illness by viruses Hepatitis A and Norovirus and bacteria Shigellosis. Salmonella and Escherichia coli 0157:H7 are found in food sources, but can be spread by cross contamination due to lack of handwashing. It should be noted that both Norovirus and Salmonella are currently represented in estimates of the top five pathogens responsible for the most illnesses, hospitalizations, and deaths recorded each year from foodborne illnesses (CDC, 2011a).

### *Hepatitis A*

Hepatitis A is a liver disease caused by the hepatitis A virus. The disease causes inflammation and eventual failure of the liver if untreated (CDC, 2011c). During the 19<sup>th</sup> century the disease was known as acute catarrhal jaundice and was considered a mild illness (Melnick, 1995). Up through 1950, person to person transmission of hepatitis was undetected. Studies in the 1970s and 1980s showed transmissions of Hepatitis A were more frequently detected in those with a history of hepatitis (FDA, 2000).

Half of the individuals with Hepatitis A are unaware they are carrying the disease (Fiore, 2004). Incidence of Hepatitis A has decreased by 53% since 2006 with exposure from common-source foodborne or waterborne outbreak at 10.4% of those reported, second to 14.1 percent from those who were exposed during travel outside of the United States (CDC, 2010b).

Transmission is primarily the fecal-oral route, by either person-to-person contact or consumption of contaminated food or water (CDC, 2010a). The source of most reported foodborne Hepatitis A outbreaks has been from infected foodservice employees. A single infected foodservice employee can transmit Hepatitis A to dozens or even hundreds of persons by bare hand contact to food that is served directly to customers (Fiore, 2004). Proper hand hygiene practices within foodservice operations are imperative in reducing outbreaks (CDC, 2010a).

### *Norovirus*

Norovirus, the most common cause of foodborne illness outbreaks in the United States, is a contagious virus that commonly causes acute gastroenteritis (CDC, 2012c). The virus is contracted from an infected person, contaminated food or water, or by touching contaminated surfaces (CDC, 2012c). In 1929, epidemic nonbacterial gastroenteritis was described for the first time and was termed “winter vomiting disease” due to the primary onset during September through March. The epidemic was described with sudden onset of nausea and vomiting with a mild fever spread from a common source or infected individual (Adler & Zickl, 1969). The viral agent was later identified in 1972 as Norwalk virus from an outbreak in 1968 in two elementary schools in Norwalk and Columbus, Ohio (Wright, Gould, Mahon, Sotir, & Tauxe, 2010). The exposure was caused by person-to-person transmission (Adler & Zickl, 1969). Outbreaks of the virus are most known today in facilities where food is prepared for mass numbers including hospitals, nursing homes, schools, and the more prevalent cruise ships (CDC2012c).

Each year Norovirus causes about 21 million illnesses and contributes to about 70,000 hospitalizations and 800 deaths. Norovirus is identified as 49 percent of the known foodborne illness outbreaks reported from 2006 to 2010 (CDC, 2012c).

Norovirus has an extreme infectious nature in low doses; therefore, high risk of human infection from exposure occurs frequently with greater than a 30 percent increase in person to food to person exposure (Rutala & Weber, n.d.). Transmission is by fecal-oral route usually through eating food or drinking liquids that are contaminated, touching contaminated surfaces or objects then putting in mouth, or having close contact with someone who is infected by sharing food or utensils. The most effective means of preventing of Norovirus is to practice proper hand hygiene.

### ***Shigellosis (Shigella)***

Shigellosis is an infectious disease caused by Shigella bacteria. The bacteria was discovered 100 years ago by Dr. Kiyoshi Shiga, a Japanese scientist, who examined a dysentery outbreak in 1897 and isolated the bacillus then named Bacillus dysenteriae (Tropha, Ueno-Olsen, Oiwa, & Yoshikawa, 1999). Outbreaks were more common in the military during WWI and WWII due to the bacteria's existence in areas of poor sanitation and overcrowding (Hardy, 1999).

An estimated 450,000 cases occur in the U. S. each year (CDC, 2009). Incidence of Shigella foodborne illness has shown a 43% decrease since 2006 (CDC, 2011a). Shigellosis is the most communicable of the bacterial enteric diseases with small dose symptoms (Tropha et al., 1999). Transmission is mainly through fecal-oral route (CDC, 2009). Developing countries see much higher number of cases than the U.S., with substantially higher numbers of deaths. Epidemics in Central America in the late 1960's and early 1970's; and in central Africa in the 1990's have shown the importance of person-to-person spread. The association of Shigella with foods sold by vendors and the risk from water vessels that permitted hand dipping was documented during this same time (Wright et al., 2010). Reduction of the spread of the disease

is solved rather easily with proper handwashing. This poses a challenge to developing countries as clean water supplies are difficult to find and personal hygiene is poor, hence the higher number of cases observed in those countries versus the U.S.

### *Salmonella*

Salmonella infection is produced by bacteria which affects the gastrointestinal track causing diarrheal illness in humans and death without prompt treatment (CDC, 2012d). Salmonella is thought to date back to 323 B.C. to Alexander the Great's cause of death (University of Maryland Medical Center, 1998). Nontyphoidal salmonella strains were discovered after WWII and have increased decade by decade (Tauxe, 1997).

According to the USDA, salmonella is the leading reported foodborne illness in the United States (2011a). Incidence of reported cases of salmonella each year is an astounding 42,000 cases and is suspected there are twenty nine times more cases actually occurring (CDC, 2012d). In the United States, an estimated 2 million to 3 million people suffer from nontyphoidal salmonella serotype foodborne illnesses each year and 500 to 2,000 die which has increased by 6 percent since 2006 (CDC, 2011a).

Salmonella lives in the intestines of humans and animals and is caused by ingesting contaminated food that is either already containing salmonella in the animal source or through contamination from an infected employee (USDA, 2011a). From 1985 through 1999, 62 percent of the salmonella enteritidis infections were due to fecal-oral route from infected foodservice employees in food preparation (Patrick et al., 2004). The best means of prevention is proper cooking of food and elimination of cross contamination through proper hand hygiene and surface cleaning (CDC, 2010c).

### ***Escherichia coli (E. coli)***

Enterohemorrhagic *Escherichia coli* are bacterium that makes a shiga toxin; the commonly identified strain is *E. coli* 0157:H7, which is most likely to be associated with an outbreak. *E. coli* was first recognized as a human pathogen in 1982 and was identified as a cause of bloody diarrhea from the consumption of undercooked hamburgers from a fast food restaurant (Riley et al., 1983). At this point, only food seemed to be the transmitter for *E. coli*.

CDC reports in 2011 over 265,000 cases of *E. coli* each year with 36% from 0157:H7 strain. Of those 265,000 cases, 46% are hospitalized (CDC, 2012a). The United States saw a decrease of 25% in reported cases since 2006 (CDC, 2012a).

The national food safety system was transformed when, in 1993, an *E. coli* outbreak on the West Coast from adulteration of ground beef caused the focus on Hazard Analysis Critical Control Points (HACCP) method of prevention for meat packing plants (Food Safety Inspection Service [FSIS], 2002). Pathogenic *E. coli* can be transmitted via fecal-oral route through contaminated water or food, or through contact with animals or humans (CDC, 2012b). Best prevention methods are to ensure food is cooked properly, avoid cross contamination, and practice hand hygiene in foodservice establishments or production as well as after contact with animals and their environment (CDC, 2012b).

### **FDA Food Code & Handwashing**

The FDA Food Code is a model code and reference document that provides a scientifically sound technical and legal basis for regulating the retail and foodservice segment of the food industry (FDA, 2013). Originating from the Pure Drug and Food Act of 1906, the code began in 1993 to address prevention of foodborne illnesses through guidelines for time, temperature and humidity of cooking foods, recommendations on health and hygiene among



foodservice employees, and warning consumers of potential health problems of undercooked foods (Rugless, 1994). This code was meant as a best advice model of uniform regulation for those who prepare food commercially or in institutional settings ensuring that food in retail operations is safe and properly protected. This was a breakthrough for the industry, but again just as handwashing in the medical field in the 1800's, was not accepted as good practice. Requiring employees to wash hands twice using a nail brush, and wearing gloves to protect hands from touching ready-to-eat items was beyond what operators believed could be possible (Rugless, 1994). Research on the prevalence of handwashing and glove use in foodservice establishments is vast and many indicate hand hygiene practices do not occur as often as they should. Foodservice employees have reported that they sometimes or often do not wash their hands and/or wear gloves when they should (Green et al., 2005). The EHS study (2011) found restaurant employees washed their hands in only 27% of the expected times and when wearing gloves were less likely to wash their hands than were employees who were not wearing gloves (EHS-net, 2011).

The food code was updated every two years from 1993 to 2001 with major changes established in the 1997 code. The significance of the 1997 changes were unprecedented due to the transformation of inspecting “floors, walls, and ceiling superficial cleanliness” to the emphasis on proper handling of food products (Robin & Zuber, 1998). After 2001, the food code has been updated every four years with supplemental information published as needed (FDA, 2013).

FDA's purpose today is maintaining an updated model food code to assist food control jurisdictions at all levels of government for regulating the retail segment (FDA, 2009).

*“Accordingly, the provisions of the Food Code provide a system of prevention and overlapping safeguards designed to minimize foodborne illness; ensure employee health, industry manager knowledge, safe food, nontoxic and cleanable equipment, and acceptable levels of sanitation on food establishment premises; and promote fair dealings with the consumer.” (FDA, 2009)*

This code embraces the concept that our quality of life, state of health, and the public welfare is directly affected by how we provide and protect our food (FDA, 2009). The EHS-net (2011) found the most common causes of foodborne illness outbreaks were infected foodservice workers (65%) and workers touching food with their bare hands (35%). With 89% of foodborne outbreaks in restaurants caused by food which was contaminated by foodservice workers, eliminating the spread of germs from hands to food is an important focus (EHS-net, 2011).

The most recent FDA Food Code (2009) addresses many areas where food safety is critical as it relates to hand hygiene. Focus is on three interventions to prevent foodborne illness transmission in food: (i) the removal of pathogens from the hands of foodservice employees through effective hand hygiene, (ii) the use of barriers (ex. gloves, utensils, etc...) to prevent bare-hand contact with ready-to-eat foods, and (iii) the exclusion of ill foodservice employees from the workplace (FDA, 2009).

Specifically in Chapter 2 of the FDA food code, Management and Personnel, the areas of employee health, personal cleanliness, and hygiene practices are of concern in relation to foodborne illness. The code is specific about compliance requirements which include supervision, employee health, personal cleanliness, and hygienic practices for both the employee and manager. The supervisor and/or manager must have knowledge of the food code to ensure

the compliance of preventing foodborne illness. Section 2-103.11 of the food code, states the responsibility of the person in charge includes properly training the employees in food safety and informing employees of their responsibility to report information about their personal health and activities relating to transmissible diseases, ensuring employees are effectively cleaning their hands by monitoring handwashing, preventing cross contamination of ready-to-eat food by using single-use gloves and utensils instead of bare hands because handwashing may not always be sufficient to prevent the transmission of pathogens from hands to other items, such as food (FDA, 2009). The follow-through of this outline of expectations and responsibilities are dependent on the supervisor and/or manager of the operation (FDA, 2009).

Guzewich and Ross (1999) found 89% of foodborne illness outbreaks are contributed to pathogens transferred to food from foodservice employees' hands. This percent shows proper hygiene practice by foodservice employees is imperative in the reduction of foodborne illness outbreaks. The code refers to this issue in section 2-3, regarding personal cleanliness where foodservice employees are to keep their hands and arms clean by following the procedures as stated this section (FDA, 2009).

### **Health Belief Model (HBM)**

Knowledge alone does not persuade people to execute food safety activities accurately or dependably (Cates, 2009; Green & Selman, 2005; Roberts et al., 2008). Jenkins-McLean, Skilton, and Sellers (2004) found changing behaviors in foodservice operations is achievable when behavior-change theories are used to design and implement a program. In addition, it was found individuals were most likely to use food safety information if the information is easy to understand, followed by having scientific facts causing feelings of a health threat (Lum, 2010). These findings show the importance of looking at the Health Belief Model (HBM) in relation to

how foodservice employees believe the importance of handwashing is to reducing, contracting, or causing a foodborne illness.

The HBM is a psychological model that attempts to explain and predict health behaviors by focusing on the attitudes and beliefs of individuals through the following constructs:

1. Perception of susceptibility to contracting the condition or the illness
2. Perceived severity of the consequences of contracting the condition or the illness
3. Perceived benefits of preventive behavior
4. Perceived barriers that stop appropriate health behavior by the person
5. Confidence in their ability to perform the behavior

(Mosby's Medical Dictionary, 8<sup>th</sup> edition, 2009; Athearn et al., 2004).

The model was created in the 1950s by U.S. Public Health Service researchers Hochbaum, Rosenstock, and Kegels in order to find reasons why subjects were not taking advantage of low cost health care services (Finfgeld, Wongvatunyu, Conn, Grando, & Russell, 2003). Specifically the HBM was centered on the idea that general health motivation is the tendency that health behaviors are influenced by an individual's beliefs and perceptions about disease. These beliefs and perceptions affect whether or not an individual will take specific health related actions toward positive change if they feel a negative health condition can be avoided through healthful behavior. The original model only included the first four variables mentioned above and Rosenstock (1966) found in his original works the HBM defines an individual's readiness to pursue an action as well as their perception that such an action will be a benefit to them.

The perception of susceptibility refers to an individual's estimate of his chance of acquiring an illness or of suffering the ill-effects of an illness (Weissfield, Brock, Kirscht, & Hawthorne, 1987). A wide range of degrees exist with respect to the manner in which a person

perceives his or her susceptibility to an illness (Rosenstock, 1966). One person may believe they have zero chances of contracting an illness as another believes they are in imminent danger of contracting an illness at all times. The problem is increased perceived susceptibility alone does not mean individuals will have increased positive health behaviors. For instance, Courtney (1998) found college students perception of susceptibility is rarely linked to healthier behaviors.

Perceived severity refers to an individual's perception of the seriousness of a given illness or of an illness in general. The way the severity is framed by the individual could vary by context (Rosenstock, 1966). For example, an individual could associate the severity with medical consequences, as bodily harm or death. While another could associate with the financial burden contracting such an illness could cause (Hinojosa, 2011). Rosenstock (1988) believed together perceived susceptibility and severity constitute an individual's perception of the overall threat of an illness. In a study of colon cancer survivors, the chance of having a reoccurrence of an illness was extremely high and therefore the survivors' perceived threat was high. This resulted in increased healthy behaviors in the study subjects (Mullens, McCaul, Erickson, Sandgren, 2003).

An individual's assessment of the value or weight of the benefits of alternative behaviors is how they see the benefit of the health action and how that will guide the decision the individual will take (Rosenstock, Strecher, & Becker, 1988; Weissfield et al., 1987). Assuming that a person has at least one available health action to take, the degree to which that action limits or decreases the perceived threat of an illness determines how beneficial the action is perceived to be by the individual and then the individual has to believe there is a benefit before they will adopt the behavior (Glanz, Rimer, Viswanath, 2008; Rosenstock, Strecher, & Becker, 1988). For

a new behavior to be adopted, a person needs to believe the benefits of the new behavior outweigh the consequences of continuing the old behavior (CDC, 2004).

Change is not easy for most individuals, and to sustain long-term change they must be self-motivated and positive (Harvard Health, 2007). The last of the original four constructs is the perceived barriers to change. This is the individual's own thoughts of the hurdles in the way of adopting a new behavior and the consequences of continuing old behaviors. Difficulty starting a new behavior or developing a new habit, fear of not being able to perform the behavior correctly, and having to give up something in order to do the behavior are all examples of barriers to change (Umeh & Rogan-Gibson, 2001). The perceived barriers are the most significant construct because they determine behavior change (Janz & Becker, 1984).

Connor and Norman (2005) found choices affecting health are dependent on self-efficacy. Belief in being able to successfully execute the behavior required to produce the desired outcomes, otherwise known as self-efficacy, was added to the model by Bandura (1977). The fear of not being able to correctly perform a behavior stops many individuals from trying the new behavior. People with a strong sense of self-efficacy view challenging problems as tasks to be mastered, develop deeper interest in the activities in which they participate, form a stronger sense of commitment to their interests and activities, and lastly recover quickly from setbacks and disappointments. People with a weak sense of self-efficacy avoid challenging tasks, believe that difficult tasks and situations are beyond their capabilities, focus on personal failings and negative outcomes, and quickly lose confidence in personal abilities. Bandura (1977) noted, "It is not the sheer intensity of emotional and physical reactions that is important, but rather how they are perceived and interpreted".

Rosenstock along with researchers Strecher and Becker (1988) came back to the HBM and added cues to action motivation and modifying variables to the model which affect the individual perceptions and likelihood of action. The cues to action motivation involve how the media (news, research papers, magazines, internet, etc...), illness of a friend or family member, or training that contributes positively to the perceived threat of contracting an illness causing a change in behavior. Hearing television or radio news stories about foodborne illness or reading the safe handling instructions on a potentially hazardous food are examples of cues to action associated with safer food handling behaviors. The modifying variables or individual characteristics influencing personal perceptions have been added to the model throughout the years. These variables include demographic factors (age, sex, culture, etc...) education level, past experiences, skill, and knowledge of the illness (Glanz, Rimer & Viswanath, 2008; Strecher & Rosenstock, 1997). Cues to action and modifying behaviors both could influence the motivations of the individual with regard to health behavior action.

### *Criticisms of HBM*

With regards to the predictive ability of the constructs of the model, early findings were inconsistent. A meta-analysis of twenty four studies using the HBM showed the construct of perceived barriers exerted the most predictive ability (Janz & Becker, 1984). These results were contradicted in another meta-analysis that same year which showed the predictive power of the individual constructs differed based on type of outcomes being studied.

A second criticism is the original model does not account for external factors that may influence health behaviors because the main focus was more on cognitive influences (Hinojosa, 2011). These external factors include socioeconomic status, demographics, education level, and

past experiences. With the addition of the cues to action by Rosenstock, Strecher, and Becker (1988), these have been addressed.

## **Beliefs, Perceptions, and Behaviors of Hand Hygiene by Foodservice Employees**

Evidence suggests individual characteristics like age, gender, attitudes, and beliefs influence food safety behavior as well as food safety knowledge. Clayton and Griffith (2008) identified attitudes, subjective norms (perceived social pressure or cues to action), and perceived behavioral control, and intention as significant predictors of hand hygiene malpractices among caterers using constructs from the Theory of Planned Behavior (TPB) and the Health Belief Model (HBM). Results from Cho et al. (2010), who studied food safety in relation to the HBM, indicated that food safety knowledge predicts perceived severity, perceived susceptibility, and perceived barriers; while perceived benefits and cues to action predict food safety behavior. Patil, Cates, and Morales found (2005) gender shows a difference in foodservice employees with males being more likely to engage in unsafe food handling behaviors than females.

Foodservice employees aged 21 to 30 years and 31 to 40 years were more likely to have worked while experiencing vomiting and diarrhea than were employees aged greater than 40 years (Sumner et al., 2011). After a foodborne illness outbreak of 340 students at the University of Guelph (Canada), a study was conducted of college students within the residence population of the university regarding hand hygiene beliefs and behaviors. The study found 83% indicated they adhered to hand hygiene during the outbreak and only 37% indicated they were motivated to improve their practice. This same study involved observations of hand hygiene as well as the self-reporting of behaviors which found less than 20% were in actual compliance with hand hygiene (Surgeoner, Chapman, & Powell, 2009). Even with results showing employees



engaging in malpractices regarding handwashing, their concern for customers' health and concern for personal health were seen as factors for positively influencing handwashing practice (Pragle, Harding, & Mack, 2007).

Foodservice employees who are knowledgeable about food safety actions are sometimes unable to implement these practices because of perceived barriers in their work environment (Clayton & Griffith, 2004; Green et al., 2005). Previous studies have shown how time constraints, inconvenience, inadequate training, and inadequate resources are perceived barriers to foodservice employees participating and achieving full food safety compliance (Green & Selman, 2005; Howells et al., 2008). In addition, high volume of business, stress, attitude of employees, lack of accountability, and type of establishment were also found to be barriers mentioned most frequently by foodservice employees (Pragle, Harding, & Mack, 2007). Howells et al. (2008) found four common perceived barriers to personal hygiene (specifically handwashing) among their study subjects which included time constraints, resources in inconvenient locations, inadequate resources, and dry skin. From these studies educating employees about the consequences of improper food handling and management making all a priority with accountability might improve attitudes toward food safety (Howells, et al.2008; Pragle, Harding, & Mack, 2007; Sneed, Strohbehn, & Gilmore, 2007).

The role of management is a key component in the attitudes of the foodservice employees. The prevailing attitudes, standards and morale within a business form part of the organizational culture, which has an influence on the motivation of employees and behavioral change (Sneed, Strohbehn, & Gilmore, 2007; Worsford & Griffith, 2003). The absence of a culture of food safety in an operation instills a negative attitude and therefore a lack of food safety practices (Pragle, Harding, & Mack, 2007). Participants outlined several ways in which

managers can successfully promote handwashing. These recommendations included explaining goals and expectations, paying for training such as the food handlers' training, having strict rules in place about handwashing, and educating new workers about handwashing (Pragle, Harding, & Mack, 2007). Cho et al. (2010) found among Latino foodservice employees that concern about management and customer satisfaction is more of a motivating factor than the perceptions of severity or susceptibility of the HBM to foodborne illness. Developing an understanding of how these beliefs and perception could be incorporated into handwashing training would facilitate development of behavioral interventions to encourage handwashing in foodservice operations. Concern for customers' health, concern for personal health, and taking pride in providing a quality product were factors which influenced handwashing practices (Pragle, Harding, & Mack, 2007).

## **Chapter 3 - Methodology**

The purpose of this study was to use the Health Belief Model to determine differences in university foodservice employees' beliefs and perceptions about handwashing and foodborne illness. This chapter focuses on the methodology which includes a discussion of the study sample, research design, and development of the research instrument.

### **Institutional Review Board (IRB)**

Approval was obtained from the IRB (Appendix A) for this research prior to data collection. The researcher completed all mandated training required by the Kansas State University Research Compliance Office and all individuals who assisted with the research completed training.

### **Study Sample**

The target population for this study was Kansas State University (KSU) residential dining foodservice employees. The population consisted of 643 employees. To achieve a 95% confidence level with 5% sampling error, 169 - 197 useable surveys were needed (Dillman, 2007). Employees from three dining halls, two retail operations, and one restaurant were sampled. Efforts were made to obtain a high response rate by holding meetings at each location to request participation and by offering a \$75 gift card raffle for those who completed the survey.

### **Research Design**

A quantitative cross-sectional research approach was used in this study. The cross-sectional research used the Qualtrics online survey system and pen-and-paper surveys. The survey was designed to determine if there were relationships between perceptions and beliefs of handwashing among foodservice employees and foodborne illness.

## **Focus Group**

A focused discussion with a random selection of KSU residential dining foodservice employees determined thoughts about foodborne illness awareness, knowledge of proper handwashing practices, and understanding of their relationship. The discussion group included 10 representatives of the population (gender, age, experience, and years of service). Participants were recruited via flyers posted by the time clocks and email. A raffle for a McDonald's \$25 gift card was offered to encourage participation.

The primary researcher, using one assistant, moderated the discussion. All participants were asked to sign an Informed Consent Form (Appendix B) and complete an information sheet (Appendix C) to collect demographic information about the participants and their previous food safety education and/or training experiences.

The format was based on guidelines suggested by Edmunds (1999) and included participants responding to prewritten questions (Appendix C) presented orally and on paper. Open discussions that deviated from the prewritten questions were allowed, but were related to food safety. The sessions lasted approximately 30 minutes.

## **Pilot Survey**

A pilot survey was then developed based on the research, focus group discussions, and feedback from industry experts including KSU faculty from the colleges of Agriculture and Human Ecology. The instrument (Appendix E) consisted of questions constructed from the literature review, focus group discussions, and adapted Health Belief Model (HBM) food safety questions developed by Riggins (2006), knowledge and belief questions by Yarrow (2006), handwashing knowledge from Roberts et al. (2008), and demographic information. The pilot

survey was used to determine reliability, content validity, ease of answering questions, and survey response time which was measured through the online Qualtrics system.

The first section of the pilot instrument included foodborne illness and handwashing knowledge questions to help the researcher assess any deficiencies in knowledge and to compare knowledge to beliefs and perceptions of handwashing. The second section explored respondents' beliefs and perceptions about handwashing as they related to the specific constructs: perceived susceptibility, perceived severity, perceived barriers, and perceived benefits. The third section gathered perceptions of respondents about their behavior as it relates to self-efficacy of proper handwashing. The last section asked respondents about demographics, question clarity and applicability, as well as additional comments or concerns regarding the survey instrument.

Pilot study participants were recruited using a random selection of undergraduate students enrolled in the College of Human Ecology at Kansas State University. These students were selected because of their possible knowledge or familiarity of foodborne illness and proper personal hygiene in foodservice establishments. A drawing of \$15 Starbucks gift card was used as an incentive to increase response rate. There were 33 useable surveys collected from the pilot and responses resulted in a minor change to online survey directions.

Statistical analysis was conducted using the Statistical Package for Social Science v. 20.0 (SPSS) to measure the reliability of the instrument. A Cronbach's Alpha of  $\alpha > .70$  was desired. Two constructs were found to have a less than 0.70 Cronbach's Alpha (Table 3.1). One item in each of the perceived susceptibility and self-efficacy constructs was revised into two questions to add clarity. The reliability of these scales reached the desired reliability outcome of  $\alpha > 0.70$ .

**Table 3.1. Pilot Study Cronbach’s Alpha Results**

<b>Construct</b>	<b>Number of Items</b>	<b>Cronbach’s Alpha</b>	<b>Corrected After Changes</b>
Overall	NA	0.731	0.862
Perceived Susceptibility	6	0.587**	0.864
Perceived Severity	6	0.781	
Perceived Barriers	10	0.903	
Perceived Benefits	4	0.866	
Self-efficacy	3	0.534**	0.898

\*\*Denotes items changed in final instrument

### **Final Research Instrument**

Feedback from pilot study participants and the results of the Cronbach’s Alpha tests of reliability resulted in minor revisions to the directions of the final instrument. Internal validity was addressed by collecting data in a short period of time (two weeks) and ensuring each respondent was only surveyed once. A letter and description page (Appendix D) was attached to the survey to explain the purpose, confidentiality, and contacts for questions.

The first section of the final survey (Appendix F) included foodborne illness and proper handwashing knowledge questions. A total of six questions were included in the survey. Participants were asked to circle all that apply or pick one, depending on the question. A correct

answer was coded as 1 and an incorrect answer was coded as 0 for a total of 26 possible correct responses.

The second section explored participants' beliefs and perceptions about handwashing and foodborne illness. Perceived susceptibility focused on six items about the susceptibility of contracting or causing a foodborne illness because of improper handwashing and asked respondents to rate their agreement to statements such as "If I follow proper handwashing practices at work, my chances of causing a foodborne illness outbreak would decrease". The perceived severity construct which was measured with six questions, addressed the severity if a foodborne disease were to occur as a result of improper handwashing in their operation and included items such as "I could lose my job if I did not wash my hands and caused a foodborne illness outbreak". Ten questions asked about perceived barriers (location of sinks, missing paper towels or soap, water too hot, irritation of skin, time, inconvenience, and lack of knowledge of food safety). A sample item is "I do not wash my hands because the handwashing sinks are not located close enough to my work station". Perceived benefits focused on four items regarding the benefits of reduction of foodborne illness, control spread of disease, and satisfaction of work when proper handwashing occurred in the workplace. A sample item is, "If I wash my hands properly at work I can control the spread of disease and illness". The final construct asked respondents to rate their self-efficacy about confidence, skills, and knowledge of properly wash hands at work. A sample item was, "I have the skills to wash my hands properly at work". The answers to the HBM construct questions were measured using a five-point Likert type scale with responses ranging from strongly disagree (1) to strongly agree (5).

Modifying variables or individual characteristics influencing personal perceptions and likelihood of action have been added to the HBM throughout the years. These variables include

demographic factors (age, sex, culture, etc...) education level, past experiences, skill, and knowledge of the illness (Strecher & Rosenstock, 1997; Glanz, Rimer & Viswanath, 2008). The last section targeted respondent demographic data, measured with open-ended or multiple-choice items. These questions included gender, age, ethnicity, years of work experience, education level, job classification (whether student or full-time employee), current position held within food services (service, sanitation, production, supervisor/manager) and if they had a food safety certification as research suggests. See final survey in Appendix F

### **Data Collection**

Data was collected two ways, through the KSU email system using the Qualtrics survey system and with in-person pen-and-paper surveys. Foodservice employees were alerted to the survey via email, flyers posted by time clocks, and during announcements from managers. An email invitation to participate was sent with a link to the Qualtrics survey. Participants who agreed to participate had two weeks to complete the survey. Reminders about the survey were sent after one week. In addition to the Qualtrics online survey, three meetings were conducted for respondents who wished to complete the survey via in-person pen-and-paper at different locations to achieve a higher response rate. Respondents took an average of 10 minutes to complete for both the online and by pen-and-paper surveys. Data from those who used the Qualtrics system was then downloaded and transferred to SPSS (v. 20.0). Data from the pen-and-paper surveys was entered into SPSS (v. 20.0) manually by the researcher.

### **Data Analysis**

SPSS (v. 20.0) was used to analyze data collected. Reliability coefficients were computed using Cronbach's alpha with the recommended value of 0.70 as the threshold to demonstrate consistency. Frequencies and percentages were used to gather information about



handwashing knowledge among the sample. ANOVA or t-tests were used to analyze if there were significant differences among the HBM constructs, handwashing knowledge and demographics of the sample. Linear multiple regression results were used to determine if self-efficacy was impacted by any of the HBM constructs.

# **Chapter 4 - USING THE HEALTH BELIEF MODEL TO DETERMINE DIFFERENCES IN UNIVERSITY FOODSERVICE EMPLOYEES' BELIEFS AND PERCEPTIONS ABOUT HANDWASHING AND FOODBORNE ILLNESS**

## **Introduction**

The Center for Disease Control and Prevention (CDC) estimates each year roughly one in six Americans (or 48 million people) become ill, 128,000 are hospitalized, and 3,000 die of foodborne diseases from a combination of the major known pathogens and unspecified agents. The United States Department of Agriculture (USDA) defines a foodborne disease as an illness that occurs from eating a contaminated food. The contamination is usually caused by a bacteria or pathogen (USDA, 2011b).

In the United States (U.S.) 58% of foodborne disease outbreaks are attributed to Norovirus, while Salmonella is second at 11% (CDC, 2011a). Howes, McEwen, Griffiths, and Harris (1996) found food handler's malpractice (specifically personal hygiene and handwashing) contributed to 97% of foodborne illness in foodservice establishments, and is the key factor in the spread of Norovirus. For more than a century, handwashing has been recognized as an essential component in the prevention of microbial infections (Fendler, Dolan, & Williams, 1998). The CDC (2011a) reports handwashing is the single most important means of preventing the spread of infection.

Knowledge alone does not persuade people to execute food safety accurately or dependably (Cates, 2009; Green & Selman, 2005; Roberts et al., 2008). Jenkins-McLean,

Skilton, and Sellers (2004) found changing behaviors in foodservice operations is achievable when behavior-change theories are used to design and implement a program. In addition, it was found individuals were most likely to use food safety information if the information is easy to understand, followed with scientific facts that could cause feelings of a health threat (Lum, 2010).

Many of the leading sources of death and disease in the U.S. and globally are related to health behaviors (World Health Association, 2008). Subsequently, research and practice focusing on the role of behavior in the promotion of health and the prevention of disease is essential and holds promise for improving the health of populations (Pragle, Harding, & Mack, 2007). Along with barriers to following food safety, negative and positive consequences of food safety behaviors should also be considered when looking at the promotion of health and prevention of disease (Clayton, Griffith, Price, & Peters, 2002). Health behavior theories focus on multiple determinants of behavior at the individual, interpersonal, group, organizational, and/or community levels (Glanz, Lewis, & Rimer, 1996). Determining what foodservice employees believe about food safety practices is important in understanding the best methods to train for food safety. Because handwashing is the primary method to prevent the spread of foodborne disease, the focus on proper handwashing within a foodservice operation should be a priority. If a manager knows what an employee believes about the importance of handwashing, then he/she can focus on those beliefs to improve the employees' understanding.

The Health Belief Model (HBM) framework has been used to understand various types of health-seeking behaviors and reasons for non-compliance with medical recommendations (Rosenstock, Strecher, & Becker, 1998). The HBM proposes health behaviors are influenced by an individual's beliefs and perceptions about disease, which ultimately affect whether or not a

person will seek out preventative services. This model can be used to study the perceptions and beliefs of university foodservice employees on handwashing behaviors.

The constructs of the HBM include perception of susceptibility to contracting the condition or the disease, perceived severity of the consequences of contracting the condition or the disease, perceived benefits of preventive behavior, perceived barriers that stop appropriate health behavior by the person, confidence in their ability to perform the behavior, and cues to action. The model is concerned primarily with the readiness and initiative of the individual to pursue a health action as well as their perception that such an action would be beneficial to them minus barriers. Susceptibility and severity are hypothesized to provide the energy force to act, whereas, diminishment of barriers is thought to provide an accessible path for action (Strecher & Rosenstock, 1997).

The environmental health specialists network (EHS-net) found 65% of the most common causes of foodborne illness outbreaks were infected foodservice employees and 35 % were employees touching food with their bare hands. EHS-net study found 89% of the food indicated in foodborne illness outbreaks in restaurants were caused by food contaminated by foodservice employees; thus, understanding the beliefs and perceptions of foodservice employees is essential in eliminating the spread of germs from hands to food (2011). Nearly 20% of foodservice employees reported working at least one shift while experiencing symptoms of diarrhea and vomiting (Sumner et al., 2011). The EHS-net study (2011) found restaurant employees washed their hands in only 27% of the expected times and when wearing gloves were less likely to wash their hands than were employees who were not wearing gloves. The need to understand the beliefs and perceptions of foodservice employees regarding handwashing is vital to improving compliance with food safety guidelines.

The purpose of this study was to use the Health Belief Model to determine differences in university foodservice employees' beliefs and perceptions about handwashing and foodborne illness. The objectives included developing an instrument to identify employees' beliefs and perceptions about handwashing and foodborne illness. A second objective was to determine if differences of university foodservice employee demographics and knowledge of proper handwashing of employees impacted handwashing and foodborne illness beliefs and perceptions. The final objective was to ascertain if demographics and knowledge of proper handwashing and foodborne illness of university foodservice employees affect handwashing self-efficacy. The following research questions were addressed:

1. Is there a difference among demographics and food safety knowledge and certification of university foodservice employees about the perceived susceptibility of foodborne illness and handwashing?
2. Is there a difference among demographics and food safety knowledge and certification of university foodservice employees about the perceived severity of foodborne illness and handwashing?
3. Is there a difference among demographics and food safety knowledge and certification of university foodservice employees about the perceived barriers of foodborne illness and handwashing?
4. Is there a difference among demographics and food safety knowledge and certification of university foodservice employees about the perceived benefits of foodborne illness and handwashing?

5. Is there a difference among demographics and food safety knowledge and certification of university foodservice employees about the perceived susceptibility of foodborne illness and handwashing?
6. Is self-efficacy affected by any of the HBM constructs of perceived susceptibility, severity, barriers, and benefits?

## **Methodology**

### ***Institutional Review Board (IRB)***

The questionnaire and research protocol were reviewed and approved by the Human Subjects Committee for the Institutional Review Board (Kansas State University, Manhattan)

### ***Sample***

The target population for this study was Kansas State University (KSU) residential dining foodservice employees. The population was estimated at 643. To achieve a 95% confidence level with 5% sampling error, 169 - 197 useable surveys were needed (Dillman, 2007).

Employees from three dining halls, two retail operations, and one restaurant were sampled.

Efforts were made to obtain a high response rate by holding meetings at each location to request participation and by offering a \$75 gift card raffle for those who completed the survey.

### ***Instrument Development***

Instrument development began by reviewing the literature of previous belief and perception questionnaires used in HBM and food safety research. Focus groups with selected KSU residential dining foodservice employees were held to ascertain their thoughts about foodborne illness awareness, knowledge of proper handwashing practices, and understanding of the relationship between the two were used to improve the instrument. The discussion group

included 10 representatives of the population (gender, age, experience, and years of service). A raffle for a McDonald's \$25 gift card was offered to encourage participation.

After the focus group discussions, a pilot instrument was developed to confirm reliability, content validity, ease of answering questions, and survey response time. The pilot survey consisted of questions constructed from the literature review, focus group discussions, and previous HBM food safety related questions developed by Riggins (2006), knowledge and belief questions by Yarrow (2006), handwashing knowledge from Roberts et al. (2008), and demographic information. Content validity was confirmed by industry experts including KSU faculty members from the Colleges of Agriculture and Human Ecology and a pilot study. Internal validity was addressed by collecting data in a short period of time (less than one week) and ensuring each respondent was only surveyed once. Reliability was determined through Cronbach's Alpha for each factor within the HBM constructs.

The pilot test was conducted using a random selection of undergraduate students enrolled in the College of Human Ecology at Kansas State University. These students were selected due to their possible knowledge or familiarity of foodborne illness and proper personal hygiene in foodservice establishments. A drawing of \$15 Starbucks gift card was used as an incentive to increase response rate. Responses of 33 useable surveys were collected from the pilot test.

Reliability was determined by running Cronbach's Alpha for each of the HBM constructs. Two constructs were found to have a less than 0.70 Cronbach's Alpha. One item in each of the perceived susceptibility and self-efficacy constructs was revised into two questions to add clarity. Pilot study participants were asked about question clarity and applicability, and to provide additional comments or concerns about the survey instrument. Pilot study responses resulted in minor changes to the online survey directions.

The final instrument included three sections. The first section consisted of six knowledge questions about foodborne illness and proper handwashing knowledge. A sample item is “If you are not feeling well (fever, vomiting, or diarrhea), is it okay to prepare and serve food for others if you properly wash your hands”. Participants were asked to circle all that apply or pick one, depending on the question. A correct answer was coded as 1 and an incorrect answer was coded as 0 for a total of 26 possible correct answers.

The second section explored participants’ beliefs and perceptions pertaining to the HBM. Perceived susceptibility focused on six items about the susceptibility of contracting or causing a foodborne illness because of improper handwashing and asked respondents to rate their agreement to statements such as “If I follow proper handwashing practices at work, my chances of causing a foodborne illness outbreak would decrease”. The perceived severity construct which was measured with six questions addressed the severity if a foodborne disease were to occur as a result of improper handwashing in their operation and included items such as “I could lose my job if I did not wash my hands and caused a foodborne illness outbreak”. Ten questions asked about perceived barriers (location of sinks, missing paper towels or soap, water too hot, irritation of skin, time, inconvenience, and lack of knowledge of food safety). A sample item is “I do not wash my hands because the handwashing sinks are not located close enough to my work station”. Perceived benefits (n=4) focused on the benefits of reduction of foodborne illness, control spread of disease, and satisfaction of work when proper handwashing occurred in the workplace. A sample item was, “If I wash my hands properly at work I can control the spread of disease and illness”. The final construct gathered perceptions of respondents about their confidence, skills, and knowledge as it related to their self- efficacy to properly wash hands at work. A sample item was, “I have the skills to wash my hands properly at work”. The



answers to the HBM construct questions were measured using a five-point Likert type scale with responses ranging from strongly disagree (1) to strongly agree (5).

Modifying variables or individual characteristics influencing personal perceptions and likelihood of action have been added to the HBM throughout the years. These variables include demographic factors (age, sex, culture, etc...) education level, past experiences, skill, and knowledge of the illness (Strecher & Rosenstock, 1997; Glanz, Rimer & Viswanath, 2008). The last section focused on respondent demographic data, measured with open-ended or multiple-choice items. These questions included gender, age, ethnicity, years of work experience, education level, job classification (whether student or full-time employee), current position held within food services (service, sanitation, production, supervisor/manager) and if they had a food safety certification as research suggests. See final survey in Appendix F.

### ***Data Collection***

Data was collected two ways, through the KSU email system using the Qualtrics survey system and with in-person pen-and-paper surveys. Foodservice employees were alerted to the survey via email, flyers posted by time clocks, and during announcements from managers. An email invitation to participate was sent with a link to the Qualtrics survey. Participants who agreed to participate had two weeks to complete the survey. Reminders about the survey were sent after one week. In addition to the Qualtrics online survey, three meetings were conducted for respondents who wished to complete the survey via in-person pen-and-paper at different locations to achieve a higher response rate. Respondents took an average of 10 minutes to complete for both the online and by pen-and-paper surveys. Data from those who used the Qualtrics system was then downloaded and transferred to SPSS (v. 20.0). Data from the pen-and paper surveys was entered into SPSS (v. 20.0) manually by the researcher.

### ***Statistical Analysis***

Reliability coefficients were computed using Cronbach's alpha with the recommended value of  $\alpha > 0.70$  as the threshold to demonstrate consistency. Frequencies, means, and percentages were used to gather information about handwashing knowledge among the sample. ANOVA or t-tests were used to analyze if there were significant differences among the HBM constructs, handwashing knowledge, and demographics of the sample. Linear regression results were used to determine significance if self-efficacy and was impacted by any of the HBM constructs.

## **Results**

### ***Response Rate***

A total of 237 respondents started the survey, 212 were completed, and 195 surveys were deemed usable due to incomplete and missing data. This achieved the 95% confidence level with 5% sampling error as discussed by Dillman (2007) in the methodology. Of the 237 respondents who started the survey 198 were received via Qualtrics online and 39 as pen-and-paper survey. This yielded a response rate of 30.3%.

### ***Instrument Development Results***

One of the objectives of this research was to develop an instrument using the HBM constructs of perceived susceptibility, perceived severity, perceived barriers, perceived benefits and self-efficacy to identify differences in university foodservice employees' beliefs and perceptions about handwashing. This was accomplished by computing Cronbach's alpha for each HBM construct. In the final instrument, all scales had  $\alpha > 0.70$  (overall  $\alpha = 0.896$ ,

perceived susceptibility  $\alpha = 0.864$ , severity  $\alpha = 0.762$ , barriers  $\alpha = 0.866$ , benefits  $\alpha = 0.849$ , and self-efficacy  $\alpha = 0.897$ )

### ***Demographic Results***

Table 4-1 provides results of the respondent's demographic characteristics. Demographic variables included were gender; age which was categorized into two groups (under 23 years of age and 23+ years); ethnicity which was divided from nine categories (White non-Hispanic, Hispanic, African American, Asian, Native Hawaiian, Pacific Islander, American Indian, Alaskan Native, or other) into two (white and non-white); education which included two categories (college degree and no college degree); and job classification categorized into two groups (full-time and students). Length of work experience was split into three categories (less than one year, 1-3 years of experience, and greater than 3 years of experience). Current job positions included the categories of service, sanitation, production, and supervisor/manager. The respondents were female (68.7%), under age 22 (64.1%), white (72.3%), did not hold a food safety certification (71.3%), had worked for the foodservice less than a year (47.2%), had not completed a college degree (71.3%), were classified as a student (70.8%), and in a service position (49.2%). The sample was representative of the population demographics.

### ***Handwashing and Foodborne Illness Knowledge Overall Results***

The overall score for handwashing and foodborne illness knowledge was a mean of 21.83  $\pm 2.51$  (84%) out of a possible 26. In response to specific questions, handwashing was found to have a higher percent (83%) of correct answers among respondents than for foodborne illness (80%). Before independent sample t-tests were conducted to determine differences in HBM construct items with handwashing and foodborne illness knowledge, a knowledge variable was

created to include two items; those with scores less than (1) and greater than or equal (2) the mean value. (T-test specific mean, t, and significant values are found in Appendix N)

For perceived susceptibility, a significant difference was found in two items with those with better knowledge scores rating higher means. The items were: “*the chances of my customers getting a foodborne illness are great if I do not wash my hands at work*” and “*following proper handwashing practices at work decreases my chance of causing a foodborne illness outbreak*”.

For perceived severity, the only significant difference found was for the statement “*if I do not wash my hands at work and cause a foodborne illness outbreak, the operation could get sued*” with those with greater knowledge having the higher mean. There was only one significant difference for perceived benefits with those with greater knowledge having a higher mean for “*proper handwashing at work is important for reducing the chances of a foodborne illness outbreak*”.

Two of the ten items for perceived barriers reported significance for knowledge. Item, “*there is not enough time at work to wash my hands properly*” and item “*when I am in a hurry at work I do not wash my hands*” showed a greater mean for those with higher knowledge scores.

### ***Health Belief Model Constructs Overall Results***

#### ***Perceived Susceptibility***

For the six items developed to measure the construct perceived susceptibility, most respondents agreed with the items “*if they followed proper handwashing practices at work their chances of causing a foodborne illness outbreak*” and “*the chances of customers contracting a foodborne illness would decrease*”. The lowest mean was the items, “*chance of contracting a*

*foodborne illness at work*” and *“worrying about contracting a foodborne illness if I do not wash hands at work”*. (See Table 4.2)

### ***Perceived Severity***

Responses for the six items related to perceived severity had similar results. Most respondents agreed with the items *“if employees do not wash their hands and a foodborne illness outbreak occurs customers could get sick*, *“customers would get upset and stop eating at the operation”*, *“the operation could get sued”*, and *“the employee could lose their job”*. However, respondents were less in agreement with the items *“relationships changing with fellow employee”* and *“fear of the possibility of a foodborne illness occurring in their operation”*. (See Table 4.2)

### ***Perceived Barriers***

Respondents indicated that perceived barriers (lack of food safety knowledge, irritating skin, water was too hot, too busy at work, inconvenience, no paper towels or soap, or hand sinks not located close to work stations) were not rated high in their operations. The highest mean was reported for item *“knowing more about food safety would cause them to wash their hands properly at work”*. The lowest was reported for *“not washing hands properly at work because there is no soap”*. (See Table 4.2)

### ***Perceived Benefits***

Most respondents rated perceived benefits of handwashing to prevent foodborne illness as high with means above 3.90. The item *“the importance of proper handwashing at work in reducing foodborne illness outbreaks”* had the most agreement while the item, *“being more satisfied with their work when they wash their hands properly”*, the least. (See Table 4.3)

### ***Self-efficacy***

All three items for self-efficacy had means at 4.60 or above. The item “*confidence to wash my hands properly at work*” was the highest, “*having the skills to wash my hands properly at work*” next, and “*the confidence of knowing when to wash my hands at work*” was the lowest of the three. (See Table 4.2)

### ***T-tests and ANOVA’s of Demographic Categories and HBM Constructs***

Independent sample t-tests and a one-way between subjects analysis of variance (ANOVA) with post hoc comparison using the Tukey HSD were conducted to determine differences in HBM construct item responses based on demographic variables and food safety certification. Individual mean and standard deviation values are listed in table 4-2, 4-3, and 4-4. (T-test and ANOVA specific mean, t, F, and significant values are found in Appendix G-M)

### ***Perceived Susceptibility***

For gender the one significant difference at  $p < 0.05$  was that females had a greater concern of a foodborne illness occurring at work than males. For age, five of the six items were found to be significant with the 23+ group showing a higher mean than those who were 22 or less. Those items were: “*when I think about a foodborne illness occurring at work, I feel concerned*”, “*I worry a lot about getting a foodborne illness if I do not wash my hands at work*”, “*the chances of my customers getting a foodborne illness is great if I do not wash my hands at work*”, “*I worry a lot about my customers getting a foodborne illness if I do not wash my hands at work*”, and “*my chances of getting a foodborne illness is great if I do not wash my hands at work*”.

For food safety certification and job classification, significance was found in all six items indicating those who were certified and those who were full-time employees had higher means than those who were not certified and those who were student employees. T-tests for ethnicity and education did not find significant differences for any of the perceived susceptibility items.

For work experience, significance was shown in five of the six items at  $p < 0.05$ . Post hoc comparisons using the Tukey indicated that the significant differences for each of the statements were between the less than one year of experience and the greater than three years of experience. Those items were: “*chances of customers getting a foodborne illness is great if respondents do not wash hands at work*”; “*when I think about a foodborne illness occurring at work, I feel concerned*”; “*I worry a lot about my customers getting a foodborne illness if I do not wash my hands at work*”; “*chances of getting a foodborne illness are great if they do not wash their hands at work*” and; “*I worry a lot about getting a foodborne illness if I do not wash my hand*”.

Current position showed significance in two items for perceived susceptibility. These were: “*if I follow proper handwashing practices at work, my chances of causing a foodborne illness sanitation employees and supervisors/managers*”. The item “*chances of customers getting a foodborne illness is great if I do not wash my hands at work*” was found to be significant but did not show significance when the Tukey comparison was run.

### ***Perceived Severity***

T-tests for age found a significant difference for the item “*I could lose my job if I did not wash my hands and caused a foodborne illness outbreak*” with the 22 or less group showing a higher mean than the 23+ age group. For food safety certification, significance was found in

four of the six items of perceived severity. Those who were food safety certified had higher means than those who were not for: *“customers could get very sick”*, *“customer would get upset and stop eating at our operation”*, *“the operation could get sued if a foodborne illness were to occur in the operation”*, and *“their relationship with fellow employees would change if they caused a foodborne illness outbreak”*.

T-tests for job classification found significance in four of the six items. Full-time employees had higher means than student employees in three of the four items: *“customers could get very sick if a foodborne illness were to occur in the operation”*, *“their relationship with fellow employees would change if they caused a foodborne illness outbreak”*, and *“fear of the possibility of an outbreak occurring in the operation”*. The item *“losing their job if they did not wash their hands and caused a foodborne illness outbreak”* showed a higher mean for the student employees. T-tests for gender, ethnicity, and education were not significant.

ANOVA comparisons found significant differences in three of the six items for years of work experience at the  $p < 0.05$ . Specific items are: *“our customers could get very sick if I do not wash my hands at work”* with Tukey comparison indicating significant difference between less than one year of experience and greater than three years of experience; *“if I do not wash my hands at work and cause a foodborne illness outbreak, the operation could get sued”* with Tukey comparison indicating significant difference between less than one year experience and 1-3 years' work experience and; *“I could lose my job if I did not wash my hands and caused a foodborne illness outbreak”* with post hoc comparison indicating those with less than one year of experience and those with 1-3 years of experience had significant difference in means from those who had worked greater than three years.



Only one item was significant for current position at the  $p < 0.05$ , “*I am afraid to think about the possibility of a foodborne illness outbreak at my operation*”. Tukey post hoc comparison indicated significant differences between service and production employees having higher means than supervisors/managers.

### ***Perceived Barriers***

The barrier item “*handwashing sinks not being located close to their work station*” showed a significant difference between the full-time employees and students. Full time employees rated this higher. No significance was found in perceived barriers for gender, age, ethnicity, or education.

Four items showed significant differences for job position. These items were: “*enough time at work to wash hands properly*” and “*not washing hands properly at work because there are no paper towels*” with Tukey comparison indicating significant differences between service employees and supervisors/managers with sanitation employees having the higher means; “*location of handwashing sinks not being close to work station*” and “*not washing hands because there is no soap*” with post hoc tests indicating significant differences between supervisors/managers and sanitation employees with sanitation showing the higher mean. No significant differences were found for work experience for perceived barriers.

### ***Perceived Benefits***

Independent sample t-tests for age only showed significant difference for the item, “*I can control the spread of disease and illness if I wash my hands properly at work*” where the group 23+ had a significantly higher mean. T-tests for food safety certification found significance for three of the four items. Those who were certified had significantly higher means than those without certification for the items: “*proper handwashing is important for reducing the chances*

*of a foodborne illness outbreak*”, *“I can control the spread of disease and illness if I wash my hands properly”*, and *“less people will get a foodborne illness if I wash my hands properly”*. For employee classification, significance was found in three of four items. Full-time employees showed higher means than student employees for the items: *“proper handwashing is important for reducing the chances of a foodborne illness outbreak”*, *“I can control the spread of disease and illness if I wash my hands properly”*, and *“less people will get a foodborne illness if I wash my hands properly”*. No significance was found in perceived benefits for gender, ethnicity, and education.

ANOVA comparisons for years of work experience found significant differences in three out of four items. These items were: *“proper handwashing at work being important for reducing the chances of a foodborne illness outbreak”* and *“if I wash my hands properly at work I can control the spread of disease and illness”* with Tukey comparison indicating significant difference between 1-3 years of experience and greater than 3 years of experience with less than one year experience and; *“less people will get a foodborne illness if I wash my hands properly at work”*. The Tukey comparison indicated a difference between less than one year experience and 1-3 years. There were no significant differences found for current job position.

### ***Self-efficacy***

Independent sample t-test showed significance for ethnicity in all three items, *“I am confident I can wash my hands properly”*, *“I have the skills to wash my hands properly”*, and *“I am confident I know when to wash my hands at work”*; with the white, non-Hispanic group showing a higher mean than the non-white group. For age and food safety certification, t-test comparison showed a significant difference in only one item, *“I am confident I know when to*

*wash my hands at work*” with the 23+ group and those with food safety certification showing higher means.

After t-test results for self-efficacy showed significance in all items for ethnicity, an additional t-test was computed with a new variable of ethnicity and student classification (only nine individuals reported in the non-white group for full-time employees and they were excluded). For this variable there were 98 white and 40 non-white students who completed the survey. The independent samples t-test showed significance in all three self-efficacy items with the white students having a higher mean than the non-white (Appendix O).

ANOVA comparisons found only one item significant for work experience, “*I am confident I know when to wash my hands at work*”. The Tukey comparison indicated significant difference for less than one year work experience and 1-3 years of work experience with greater than 3 years of work experience. No significant differences were found in the ANOVA for current job position

### ***Regression for Self-efficacy and Health Belief Model Constructs***

To determine if the HBM constructs affected self-efficacy, a multiple linear regression was run (Table 4-5). Self-efficacy items were recoded into one dependent variable while the HBM constructs of perceived susceptibility, severity, barriers, and benefits were recoded into the independent variables.

$$\text{Self-efficacy} = (I1+I2+I3)/3$$

$$\text{PSusceptibility} = (I1+I2+I3+I4+I5+I6)/6$$

$$\text{PSeverity} = (I1+I2+I3+I4+I5+I6)/6$$

$$\text{PBarriers} = (I1+I2+I3+I4+I5+I6+I7+I8+I9+I10)/10$$

$$\text{PBenefits} = (I1+I2+I3+I4)/4$$

The model was significant and perceived barriers and benefits had an independent influence on self-efficacy.

## **Discussion**

The aim of this study was to explore differences of beliefs and perceptions about foodborne illness and handwashing among university foodservice employees. The objectives included developing an instrument using the HBM to identify differences in university foodservice employees' beliefs and perceptions about handwashing. A second objective was to determine if differences of employee demographics and food safety knowledge impact handwashing and foodborne illness beliefs and perceptions. The final objective was to ascertain if demographics and knowledge of handwashing and foodborne illness affect beliefs and perceptions of handwashing self-efficacy of university foodservice employees.

The first objective of instrument development was achieved as Cronbach's alpha scales were greater than 0.70 for all HBM constructs. Based on the results of this study, this instrument has the potential to measure beliefs and perceptions of proper handwashing in relation to foodborne illness in future studies.

This study measured proper handwashing and foodborne illness knowledge of university foodservice employees. Overall results found employees have a thorough understanding of proper handwashing and foodborne illness with a score of 84% (21.83 out of 26). With the majority of the respondents without food safety certification (71.3%), this is a surprising but positive result. Those respondents who had higher knowledge scores understood that not washing their hands would cause a foodborne illness outbreak, the benefits of washing hands would reduce the opportunity of foodborne illness outbreaks and the operation could get sued if a foodborne illness were to occur if hands were not washed properly. The high knowledge group

also agreed that when they are busy and there is a lack of time, they do not properly wash their hands at work even though they know they should. This contradictory gap shows they know how to wash their hands and understand what could happen in relation to foodborne illness; however, the reality that a foodborne illness could occur is not a concern if the work needs to be done quickly.

The perception of susceptibility refers to an individual's estimate of his chance of acquiring an illness or of suffering the ill-effects of an illness (Weissfield, Brock, Kirscht, & Hawthorne, 1987). This study showed females, 23+ years of age, full-time employees, with more than a year of experience, and those who were certified had a greater perception of susceptibility indicating they realized that a foodborne illness could occur in the operation if hands are not properly washed. In addition, supervisor/manager, supervisors, and production positions indicated a higher degree of perceived susceptibility than either the service or sanitation positions. These employees have had more training on prevention of foodborne illness and have a closer relationship with the food during production, so these results are not unexpected and findings are consistent with results from Cho et al. (2010), as their study indicated that food safety knowledge predicts higher perceived susceptibility. Patil, Cates, and Morales found (2005) gender shows a difference in foodservice employees with males being more likely to engage in unsafe food handling behaviors than females. With this study only finding one item with a significant difference between males and females, there is not enough data to say these results are similar.

For perceived severity, results indicated that those with a food safety certification and more than one year of experience had a greater perception of severity that not washing hands could cause a foodborne illness. For the statement "I could lose my job if I did not wash my

hands and caused a foodborne illness outbreak”, respondents who were students, under 23 years old, and had less than one year of work experience had significantly higher means. Similar to knowledge findings this could be based on the uncertainty of what a foodborne illness could cause. Without food safety certification, media may be the only exposure to the severity of a foodborne illness outbreak occurring in a foodservice operation. Another reason could be the majority of these employees are students and have not worked in the operation long; therefore, job security may lead to the perception their job might be at risk if they were to cause an outbreak. In addition, supervisors and managers rated “I am afraid to think about the possibility of a foodborne illness outbreak at my operation” significantly lower than the other positions. This indicates the possibility that supervisors and managers have less perceived severity related to foodborne illness outbreaks due to their training, knowledge, experience, and managing of food safety in the operation.

A statistically significant difference between positions and perceived barriers was observed in four items. Supervisors and managers did not view location of sinks, missing paper towels and soap, or time as barriers to handwashing but sanitation employees did. With 17 students and nine full-time respondents being sanitation workers, the representation is a small percentage of the sample. Sanitation employees often perform multiple tasks and may find stopping to walk to a hand sink and wash their hands after each task more of an inconvenience because of the time it takes. However, sanitation employees replenish the paper towels and soap, so for them to find this as a barrier is puzzling. Overall, most employees did not rate barriers as a high concern in their operations. With previous studies showing multiple barriers to safe food handling (Green & Selman, 2005; Howells et al., 2008); it is encouraging to note that in this study there were minimal barriers to proper handwashing.

As seen with perceived susceptibility, perceived benefits showed that the demographic variables directly related to those 23 or older, full-time employees, food-safety certified employees, and those with more than a year of experience had a higher perception of the benefits of handwashing and its relationship to reducing foodborne illness outbreaks. This could be a result of food safety training. Previous studies have shown that food safety certification has a positive impact on foodservice employees' knowledge of food safety (Hertzman, et al., 2011; Lin and Sneed, 2005; Yarrow, 2006).

For self-efficacy, those with a food safety certification, were 23 or older, and had more work experience rated their ability to wash their hands correctly significantly higher. For those who were non-white, results showed a lower self-efficacy for confidence and skill of how and when to wash their hands properly and most of these (40 out of 49) of the non-white respondents were students, under 23 and had less than one year of work experience. Therefore, a comparison was made using t-tests between white and non-white students to determine if there was a difference in their self-efficacy. The results showed that white students rated self-efficacy for handwashing significantly higher than the non-white group. These results indicate that non-white students may have less understanding of proper handwashing or their experience with washing their hands properly is lower. Cho, et al. (2010) found cultural characteristics were a motivating factor other than the perceptions of susceptibility and severity to foodborne illness to food safety behavior, therefore, the lower self-efficacy of the non-white respondents may be due to their cultural differences. This finding could pose an additional practical implication that further handwashing/foodborne illness training is needed with non-white student employees.

To explain how the HBM constructs affected self-efficacy, a multiple linear regression indicated that barriers and benefits, but not susceptibility and severity effect self-efficacy. This

is consistent with Rosenstock's (1990) argument that a person must believe in his or her ability to overcome the perceived barriers in order to address the problem. A meta-analysis of twenty four studies using the HBM showed the construct of perceived barriers exerted the most predictive ability (Janz & Becker, 1984). These results were contradicted in another meta-analysis that same year which showed the predictive power of the individual constructs differed based on type of outcomes being studied. The results from this study showed the respondents did not rate barriers as a high concern; in addition, there was not a high perception of benefit of proper handwashing among those found to have low self-efficacy.

## **Conclusions and Recommendations**

This study was able to show, through the use of the Health Belief Model, differences in university foodservice employees' beliefs and perceptions about proper handwashing and foodborne illness. Specifically, those who are younger, less experienced, not food safety certified, have less food safety knowledge, and who are of non-white ethnicity have less concern about perceived susceptibility and severity a foodborne illness could occur in the operation if hands are not properly washed. This same group did not see the benefit of proper handwashing or any perceived barriers.

As stated previously in the review of literature, food safety knowledge does not always improve food safety behaviors (Cates, 2009; Green & Selman, 2005; Roberts et al., 2008), based on this study's results, those operations that employ the young, inexperienced, and diverse work force may need to focus on training that emphasizes the reasons why proper handwashing is needed to enhance the benefits of not causing a foodborne illness outbreak. The results of Cho et al. (2010) revealed that when employees were exposed to current foodborne illness incidents, they tend to perform more proper food safety behavior. In addition, results of Lum's study



(2010) found individuals were most likely to use food safety information if the information is easy to understand, followed by having scientific facts causing feelings of a health threat. While York et al. (2009) showed specific use of signage with persuasive messages stressing serious consequences and incentives enhanced proper handwashing understanding of employees. Therefore, combining these studies' findings to improve university foodservice employees understanding of the susceptibility, severity, and benefit of proper handwashing in relation to foodborne illness is recommended. With self-efficacy shown by Haapala and Probart (2004) to be positively correlated to food safety behavior and this study's results showing significantly lower self-efficacy among the young non-white employees, management should use self-efficacy as a focus for future training and practice for specific employees to improve confidence.

Additionally, the regression analysis results showed barriers and benefits affecting self-efficacy. Training should include concentration on the reduction of barriers to handwashing within foodservice employees together with increasing the understanding of the benefits of handwashing in order to improve the self-efficacy of foodservice employees. High volume of business, stress, attitude of employees, lack of accountability, and type of establishment were also found to be barriers mentioned most frequently by foodservice employees (Pragle, Harding, & Mack, 2007). Howells et al. (2008) found four common perceived barriers to personal hygiene (specifically handwashing) among their study subjects which included time constraints, resources in inconvenient locations, inadequate resources, and dry skin. From these studies educating employees about the consequences of improper food handling and management making all a priority with accountability might improve attitudes toward food safety (Howells, et al. 2008; Pragle, Harding, & Mack, 2007; Sneed, Strohbehn, & Gilmore, 2007). With these results along with these participants not seeing the benefit of proper handwashing, foodservice

operations should use training techniques to increase the understanding of the benefits of handwashing, establish accountability and eliminate barriers in order to improve the self-efficacy of foodservice employees.

Based on results of this study, the following recommendations for managers of university foodservice operations include:

1. Use this instrument to conduct assessments of employees to find areas of concern about proper handwashing in relation to foodborne illness.
2. Use the results to tailor additional or enhanced trainings towards those specific demographics in need.
3. Use self-efficacy training techniques to improve the confidence, understanding, and connection between proper handwashing and foodborne illness of employees.
4. Try intervention training techniques to enhance the knowledge, understanding, and connection between benefits of proper handwashing and foodborne illness outbreak consequences. Focus on the benefit through use of persuasive signage with current foodborne illness incidents stressing serious consequences.
5. Repeat training throughout the year to enhance the self-efficacy of current employees, improve memory of training, and capture new employees throughout the hiring stages.
6. Remove barriers to handwashing.

## **Future Research**

Recommendations for future research include repeating this study with a larger population and more locations to obtain data on a wider scope of demographics that were not as well represented (full-time employees and ethnicity). Additional research would be to conduct this study in other non-commercial or commercial settings specifically identifying handwashing and its relationship to foodborne illness. A third study would be to conduct a behavior analysis with an intervention of foodborne illness and handwashing multidimensional training followed by another behavior analysis. This would provide insight about beliefs, perceptions, and behaviors of proper handwashing and multidimensional training techniques. Another project would be to look at the self-efficacy of food safety behaviors with a younger and ethnically diverse population. With a final look at conducting new research on barriers and benefits effect on self-efficacy of food safety to see how barriers may be eliminated and benefits emphasized to increase self-efficacy of proper handwashing.

## **Limitations**

This study was limited to a convenience sample of Kansas State University residential dining foodservice employees including: student employees, full-time employees, and managers. Future researchers could approach a larger sample of university foodservice employees in order to generalize results to a larger population. It should also be noted this sample works closely with the Department of Hospitality Management and Dietetics on campus; therefore, food safety training is a priority because students use the facilities and complete internships.

All employees were contacted via e-mail with access to the Qualtrics online survey. Students and managers were the primary users of the online survey, while full-time employees were contacted by the researcher and managers through flyers and weekly meetings. Response

bias is possible due to the voluntary nature of this survey. In addition, the study used a self-reported questionnaire where responses could be susceptible to social desirability bias because respondents may have felt the data was not confidential and reported more positive answers.

Even with a 30.3% response rate and efforts made to increase participation by providing multiple opportunities to complete pen-and-paper surveys, the total numbers (n = 195) were skewed towards student employees (n = 138) versus full-time employees (n = 55). This same issue was seen within the diversity of the population. The sample consisted of predominately white, non-Hispanic employees (n = 141) with fewer non-white respondents (n = 52).

Due to the timing of the survey at the end of the academic year, employees may not have been aware of the study, had no interest, or lacked the time to complete before leaving for the summer break. In addition employees may not have chosen to participate in this study for personal concern of being identified as a participant.

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## Tables

**Table 4.1. Demographic Results of Respondents (N=195)**

Characteristic	N	% <sup>a</sup>
<b>Gender</b>		
Male	58	29.7
Female	134	68.7
No response	3	1.5
<b>Age Ranges</b>		
22 or less	125	64.1
22 +	64	32.8
No response	6	3.1
<b>Ethnicity</b>		
White, non-Hispanic	141	72.3
Non-white	52	26.7
no response	2	1.0
<b>Food Safety Certification</b>		
Yes	52	26.7
No	139	71.3
No response	4	2.1
<b>Years of work experience</b>		
Less than 1 year	92	47.2
1-3 years	70	35.9
Greater than 3 years	31	15.9
No response	2	1.0
<b>Education</b>		
No College	139	71.3
College (Associates, Bachelors, Masters)	54	27.7
No response	2	1.0
<b>Classification</b>		
Student	138	70.8
Full-time	55	28.2
No response	2	1.0
<b>Position</b>		
Service	96	49.2
Sanitation	26	13.3
Production	34	17.4
Supervisor/Manager	37	19.0
No response	2	1.0

<sup>a</sup>Numbers may not total 100% due to rounding error

**Table 4.2. Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Gender, Age, and Food Safety Certification – T-test**

Item <sup>3</sup>	Statement <sup>1,2</sup>	Overall	Male	Female	Under 23	23+	Not Certified	Certified
		(n=195)	(n=58)	(n=134)	(n=125)	(n=64)	(n=139)	(n=52)
		Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD
1.	If I follow proper handwashing practices at work, my chances of causing a foodborne illness outbreak would decrease.	4.42 0.82	4.24 0.96	4.49 0.75	4.32 0.89	4.58 0.66	4.27* 0.88	4.81* 0.45
2.	The chances of my customers getting a foodborne illness are great if I do not wash my hands at work.	4.06 0.96	3.95 1.00	4.11 0.95	3.88* 0.97	4.34* 0.88	3.91* 1.01	4.40* 0.72
3.	When I think about a foodborne illness occurring at work, I feel concerned.	3.94 1.09	3.94* 1.09	4.07* 0.99	3.70 1.13	4.36 0.88	3.76* 1.12	4.40* 0.80
4.	I worry a lot about my customers getting a foodborne illness if I do not wash my hands at work.	3.89 1.03	3.84 1.09	3.9 1.02	3.23* 1.08	4.3* 0.83	3.76* 1.05	4.19* 0.91
5.	My chances of getting a foodborne illness are great if I do not wash my hands at work.	3.7 1.04	3.52 1.01	3.81 1.04	3.48* 1.04	4.11* 0.91	3.53* 1.03	4.17* 0.90
6.	I worry a lot about getting a foodborne illness if I do not wash my hands at work.	3.49 1.12	3.41 1.26	3.51 1.05	3.65* 1.07	3.92* 0.98	3.34* 1.12	3.81* 1.03
7.	Our customers could get very sick if I do not wash my hands at work.	4.14 0.75	4.02 0.81	4.19 0.72	4.06 0.76	4.27 0.72	4.04* 0.76	4.40* 0.63
8.	If I do not wash my hands at work and a foodborne illness outbreak occurs, our customers would get upset and stop eating at our operations.	4.11 0.83	3.98 0.85	4.15 0.82	4.06 0.89	4.14 0.69	4.01* 0.87	4.33* 0.65
9.	If I do not wash my hands at work and cause a foodborne illness outbreak, the operation could get sued.	4.05 0.83	4.16 0.83	4.01 0.83	4.02 0.84	4.09 0.83	3.97* 0.87	4.25* 0.68
10.	I could lose my job if I did not wash my hands and caused a foodborne illness outbreak.	4.03 0.92	4.03 0.90	4.05 0.93	4.16* 0.82	3.78* 1.05	4.074 0.90	3.92 0.98

**Table 4.2. Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Gender, Age and Food Safety Certification – T-test (cont.)**

Item <sup>3</sup>	Statement <sup>1,2</sup>	Overall	Male	Female	Under 23	23 +	Not Certified	Certified
		(n=195)	(n=58)	(n=134)	(n=125)	(n=64)	(n=139)	(n=52)
		Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD
11.	My relationship with my fellow employees would change if I caused a foodborne illness outbreak at work because I did not wash my hands.	3.86	3.67	3.93	3.76	4.02	3.77	4.08
		0.96	1.02	0.92	0.99	0.88	0.97	0.88
12.	I am afraid to think about the possibility of a foodborne illness outbreak at my operation.	3.31	3.11	3.38	3.16	3.52	3.23	3.44
		1.21	1.26	1.20	1.15	1.29	1.17	1.33
13.	I would wash my hands properly at work if I knew more about food safety.	2.81	2.76	2.84	2.90	2.70	2.81	2.83
		1.22	1.23	1.20	1.12	1.35	1.15	1.40
14.	Washing my hands irritates my skin.	2.30	2.07	2.39	2.29	2.35	2.23	2.50
		1.19	1.17	1.18	1.15	1.24	1.17	1.26
15.	The water is too hot to wash my hands properly at work.	2.00	1.93	2.02	2.02	1.98	1.95	2.10
		1.12	1.09	1.14	1.11	1.13	1.06	1.27
16.	When I am in a hurry at work I do not wash my hands.	1.71	1.84	1.63	1.69	1.75	1.73	1.65
		0.87	0.97	0.78	0.86	0.87	0.84	0.97
17.	Washing my hands properly at work is an inconvenience.	1.69	1.75	1.64	1.65	1.78	1.65	1.69
		0.95	1.06	0.90	0.92	1.03	0.89	1.06
18.	There is not enough time at work to wash my hands properly.	1.63	1.64	1.61	1.61	1.66	1.67	1.46
		0.88	0.95	0.84	0.83	0.93	0.86	0.87
19.	I do not wash my hands properly at work because there are no paper towels.	1.62	1.72	1.58	1.59	1.69	1.64	1.56
		0.92	1.06	0.86	0.89	0.96	0.89	1.02
20.	I do not wash my hands because the handwashing sinks are not located close enough to my work station.	1.56	1.59	1.54	1.54	1.61	1.53	1.58
		0.86	0.95	0.80	0.80	0.88	0.75	1.00
21.	I do not make an effort to wash my hands properly at work.	1.53	1.62	1.49	1.50	1.59	1.53	1.44
		0.82	0.91	0.78	0.77	0.92	0.72	0.94

**Table 4.2. Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Gender, Age, and Food Safety Certification – T-test (cont.)**

Item <sup>3</sup>	Statement <sup>1,2</sup>	Overall	Male	Female	Under 23	23 +	Not Certified	Certified
		(n=195)	(n=58)	(n=134)	(n=125)	(n=64)	(n=139)	(n=52)
		Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD
22.	I do not wash my hands properly at work because there is no soap.	1.52 0.79	1.65 0.97	1.46 0.69	1.49 0.75	1.61 0.88	1.52 0.71	1.48 0.98
23.	Proper handwashing at work is important for reducing the chances of a foodborne illness outbreak.	4.40 0.64	4.31 0.71	4.44 0.69	4.34 0.61	4.48 0.69	4.30* 0.63	4.65* 0.56
24.	If I wash my hands properly at work I can control the spread of disease and illness.	4.23 0.71	4.17 0.68	4.28 0.69	4.11* 0.66	4.45* 0.69	4.18* 0.64	4.40* 0.77
25.	Less people will get a foodborne illness if I wash my hands properly at work.	4.21 0.72	4.10 0.69	4.25 0.72	4.13 0.72	4.33 0.71	4.10* 0.71	4.48* 0.67
26.	I am more satisfied with my work when I wash my hands properly.	3.91 0.97	3.79 1.01	3.96 0.95	3.84 0.95	3.98 1.00	3.83 0.95	4.08 1.01
27.	I am confident I can wash my hands properly at work.	4.63 0.56	4.6 0.59	4.65 0.54	4.61 0.59	4.66 0.51	4.60 0.56	4.69 0.54
28.	I have the skills to wash my hands properly at work.	4.62 0.61	4.53 0.78	4.66 0.52	4.58 0.66	4.69 0.50	4.58 0.64	4.75 0.48
29.	I am confident I know when to wash my hands at work.	4.60 0.59	4.59 0.62	4.6 0.59	4.52* 0.66	4.73* 0.445	4.54* 0.62	4.77* 0.469

<sup>1</sup>All statements were preceded by the instructions to “Choose the response that corresponds to the way you feel.”

<sup>2</sup>All statements were measured on a 5-point Likert scale with 1=strongly disagree, 2=disagree, 3=neither agree or disagree, 4=agree, 5=strongly agree

<sup>3</sup>Items number 1-6 measured Perceived Susceptibility, 7-12 Perceived Severity, 13-22 Perceived Barriers, 23-26 Perceived Benefits, 27-29 and Self-efficacy

\*p-value <0.05

**Table 4.3. Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Ethnicity, Job Classification, Student White, Non-Hispanic, and Student Non-White – T-test**

Item <sup>3</sup>	Statement <sup>1,2</sup>	Overall (n=195)	White, Non- Hispanic (n=141)	Non-white (n=52)	Student (n=138)	Full- time (n=55)	Student White, (n=98)	Student, Non- White (n=40)
		Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD
1.	If I follow proper handwashing practices at work, my chances of causing a foodborne illness outbreak would decrease.	4.42 0.82	4.43 0.79	4.35 0.93	4.32* 0.88	4.64* 0.62	NA	NA
2.	The chances of my customers getting a foodborne illness are great if I do not wash my hands at work.	4.06 0.96	4.03 0.98	4.13 0.93	3.86* 0.98	4.55* 0.72	NA	NA
3.	When I think about a foodborne illness occurring at work, I feel concerned.	3.94 1.09	3.89 1.07	4.04 1.14	3.72* 1.12	4.47* 0.79	NA	NA
4.	I worry a lot about my customers getting a foodborne illness if I do not wash my hands at work.	3.89 1.03	3.83 1.02	4.04 1.07	3.67* 1.06	4.44* 0.74	NA	NA
5.	My chances of getting a foodborne illness are great if I do not wash my hands at work.	3.70 1.04	3.65 1.03	3.9 1.05	3.48* 1.05	4.31* 0.74	NA	NA
6.	I worry a lot about getting a foodborne illness if I do not wash my hands at work.	3.49 1.12	3.33 1.05	3.9 1.18	3.25* 1.13	4.09* 0.82	NA	NA
7.	Our customers could get very sick if I do not wash my hands at work.	4.14 0.75	4.18 0.71	4.02 0.83	4.05* 0.79	4.36* 0.59	NA	NA
8.	If I do not wash my hands at work and a foodborne illness outbreak occurs, our customers would get upset and stop eating at our operations.	4.11 0.83	4.13 0.78	4.02 0.94	4.07 0.89	4.18 0.64	NA	NA
9.	If I do not wash my hands at work and cause a foodborne illness outbreak, the operation could get sued.	4.05 0.83	4.12 0.76	3.87 0.99	4.01 0.85	4.15 0.78	NA	NA

**Table 4.3. Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Ethnicity, Job Classification, Student White Non-Hispanic, and Student Non-White – T-test (cont.)**

Item <sup>3</sup>	Statement <sup>1,2</sup>	Overall (n=195)	White, Non- Hispanic (n=141)	Non-white (n=52)	Student (n=138)	Full- time (n=55)	Student White, (n=98)	Student, Non- White (n=40)
		Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD
10.	I could lose my job if I did not wash my hands and caused a foodborne illness outbreak.	4.03 0.92	4.06 0.94	3.96 0.87	4.13* 0.83	3.80* 1.09	NA	NA
11.	My relationship with my fellow employees would change if I caused a foodborne illness outbreak at work because I did not wash my hands.	3.86 0.96	3.87 0.96	3.81 0.97	3.77* 0.99	4.07* 0.84	NA	NA
12.	I am afraid to think about the possibility of a foodborne illness outbreak at my operation.	3.31 1.21	3.27 1.24	3.38 1.7	3.16* 1.17	3.66* 1.27	NA	NA
13.	I would wash my hands properly at work if I knew more about food safety.	2.81 1.22	2.77 1.16	2.83 1.30	2.88 1.20	2.67 1.33	NA	NA
14.	Washing my hands irritates my skin.	2.30 1.19	2.36 1.21	2.14 1.11	2.29 1.16	2.32 1.25	NA	NA
15.	The water is too hot to wash my hands properly at work.	2.00 1.12	1.94 1.09	2.18 1.20	2.01 1.10	1.98 1.19	NA	NA
16.	When I am in a hurry at work I do not wash my hands.	1.71 0.87	1.70 0.83	1.73 0.95	1.69 0.83	1.75 0.95	NA	NA
17.	Washing my hands properly at work is an inconvenience.	1.69 0.95	1.66 0.97	1.73 0.91	1.63 0.88	1.81 1.12	NA	NA
18.	There is not enough time at work to wash my hands properly.	1.63 0.88	1.62 0.88	1.65 0.88	1.59 0.79	1.73 1.06	NA	NA

**Table 4.3. Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Ethnicity, Job Classification, Student White Non-Hispanic, and Student Non-White – T-test (cont.)**

Item <sup>3</sup>	Statement <sup>1,2</sup>	Overall (n=195)	White, Non- Hispanic (n=141)	Non-white (n=52)	Student (n=138)	Full- time (n=55)	Student White, (n=98)	Student, Non- White (n=40)
		Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD
19.	I do not wash my hands properly at work because there are no paper towels.	1.62 0.92	1.60 0.94	1.69 0.88	1.57 0.82	1.78 1.13	NA	NA
20.	I do not wash my hands because the handwashing sinks are not located close enough to my work station.	1.56 0.86	1.55 0.88	1.60 0.80	1.49* 0.70	1.76* 1.15	NA	NA
21.	I do not make an effort to wash my hands properly at work.	1.53 0.82	1.52 0.85	1.56 0.75	1.47 0.70	1.69 1.07	NA	NA
22.	I do not wash my hands properly at work because there is no soap.	1.52 0.79	1.5 0.80	1.58 0.78	1.46 0.67	1.69 1.07	NA	NA
23.	Proper handwashing at work is important for reducing the chances of a foodborne illness outbreak.	4.40 0.64	4.44 0.59	4.27 0.74	4.33* 0.64	4.56* 0.60	NA	NA
24.	If I wash my hands properly at work I can control the spread of disease and illness.	4.23 0.71	4.29 0.67	4.1 0.75	4.12* 0.68	4.53* 0.63	NA	NA
25.	Less people will get a foodborne illness if I wash my hands properly at work.	4.21 0.72	4.23 0.69	4.12 0.78	4.13* 0.73	4.38* 0.65	NA	NA
26.	I am more satisfied with my work when I wash my hands properly.	3.91 0.97	3.9 1.00	3.92 0.88	3.83 0.93	4.09 1.04	NA	NA
27.	I am confident I can wash my hands properly at work.	4.63 0.56	4.70* 0.49	4.42* 0.74	4.62 0.60	4.65 0.48	4.71* 0.50	4.38* 0.74

**Table 4.3. Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Ethnicity, Job Classification, Student White Non-Hispanic, and Student Non-White – T-test (cont.)**

Item <sup>3</sup>	Statement <sup>1,2</sup>	Overall (n=195)	White, Non- Hispanic (n=141)	Non-white (n=52)	Student (n=138)	Full- time (n=55)	Student White, (n=98)	Student, Non- White (n=40)
		Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD
28.	I have the skills to wash my hands properly at work.	4.62 0.61	4.74* 0.44	4.29* 0.85	4.61 0.64	4.64 0.52	4.77* 0.43	4.23* 0.89
29.	I am confident I know when to wash my hands at work.	4.60 0.59	4.67* 0.54	4.4* 0.69	4.55 0.64	4.47 0.46	4.64* 0.58	4.33* 0.73

<sup>1</sup>All statements were preceded by the instructions to “Choose the response that corresponds to the way you feel.”

<sup>2</sup>All statements were measured on a 5-point Likert scale with 1=strongly disagree, 2=disagree, 3=neither agree or disagree, 4=agree, 5=strongly agree

<sup>3</sup>Items number 1-6 measured Perceived Susceptibility, 7-12 Perceived Severity, 13-22 Perceived Barriers, 23-26 Perceived Benefits, 27-29 and Self-efficacy

\*p-value <0.05



**Table 4.4. Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Work Experience and Current Job Position - ANOVA**

Item <sup>3</sup>	Statement <sup>1,2</sup>	Overall (n=195)	Work Experience			Current Job Position			
			<1 Year (n=92)	1-3 years (n=70)	>3 years (n=31)	Service (n=96)	Sanitation (n=26)	Production (n=34)	Supervisor/ Manager (n=37)
		Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD
1.	If I follow proper handwashing practices at work, my chances of causing a foodborne illness outbreak would decrease.	4.42 0.82	4.26 0.81	4.51 0.86	4.61 0.72	4.37* 0.79	4.08* 1.16	4.59* 0.78	4.65* 0.54
2.	The chances of my customers getting a foodborne illness are great if I do not wash my hands at work.	4.06 0.96	3.84* 0.94	4.09* 0.96	4.65* 0.80	3.84* 1.03	4.08* 0.94	4.32* 0.95	4.30* 0.70
3.	When I think about a foodborne illness occurring at work, I feel concerned.	3.94 1.09	3.77* 1.12	3.87* 1.08	4.55* 0.81	3.88 1.02	3.62 1.30	4.06 1.21	4.16 0.96
4.	I worry a lot about my customers getting a foodborne illness if I do not wash my hands at work.	3.89 1.03	3.33* 1.05	3.83* 1.05	4.48* 0.89	3.75 0.96	4.31 0.74	4.00 1.10	3.81 1.24
5.	My chances of getting a foodborne illness are great if I do not wash my hands at work.	3.70 1.04	3.49* 1.04	3.66* 0.99	4.52* 0.72	3.55 1.00	3.77 1.07	3.97 1.06	3.81 1.05
6.	I worry a lot about getting a foodborne illness if I do not wash my hands at work.	3.49 1.12	3.73* 1.01	3.34* 1.13	4.29* 0.94	3.34 1.06	3.77 1.11	3.74 1.11	3.35 1.23
7.	Our customers could get very sick if I do not wash my hands at work.	4.14 0.75	3.98* 0.74	4.23* 0.77	4.42* 0.62	4.05 0.88	4.12 0.65	4.29 0.63	4.22 0.85
8.	If I do not wash my hands at work and a foodborne illness outbreak occurs, our customers would get upset and stop eating at our operations.	4.11 0.83	3.97 0.83	4.23 0.84	4.19 0.75	4.05 0.88	4.12 0.65	4.32 0.64	4.00 0.94
9.	If I do not wash my hands at work and cause a foodborne illness outbreak, the operation could get sued.	4.05 0.83	3.89* 0.85	4.23* 0.78	4.13 0.85	3.93 0.80	4.19 0.85	4.18 0.90	4.14 0.82
10.	I could lose my job if I did not wash my hands and caused a foodborne illness outbreak.	4.03 0.92	4.14* 0.78	4.11* 0.89	3.53* 1.20	4.07 0.85	4.04 1.11	4.12 0.77	3.84 1.07

**Table 4.4. Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Work Experience and Current Job Position - ANOVA (cont.)**

Item <sup>3</sup>	Statement <sup>1,2</sup>	Overall (n=195)	Work Experience			Current Job Position			
			<1 Year (n=92)	1-3 years (n=70)	>3 years (n=31)	Service (n=96)	Sanitation (n=26)	Production (n=34)	Supervisor/ Manager (n=37)
			Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD
11.	My relationship with my fellow employees would change if I caused a foodborne illness outbreak at work because I did not wash my hands.	3.86 0.96	3.83 0.92	3.8 1.00	4.06 0.96	3.83 0.93	4.12 0.77	3.88 1.04	3.70 1.08
12.	I am afraid to think about the possibility of a foodborne illness outbreak at my operation.	3.31 1.21	3.25 1.11	3.17 1.23	3.76 1.46	3.40* <sup>x</sup> 1.13	3.20* <sup>y</sup> 1.16	3.67* <sup>z</sup> 1.24	2.76* <sup>x</sup> 1.3
13.	I would wash my hands properly at work if I knew more about food safety.	2.81 1.22	2.84 1.14	2.74 1.19	2.97 1.45	2.93 1.21	3.00 1.30	2.50 1.13	2.65 1.21
14.	Washing my hands irritates my skin.	2.30 1.19	2.30 1.16	2.28 1.20	2.33 1.27	2.19 1.13	2.38 2.04	2.64 1.25	2.27 1.26
15.	The water is too hot to wash my hands properly at work.	2.00 1.12	2.03 1.11	1.94 1.07	2.03 1.28	2.00 1.07	3.96 1.11	2.24 1.35	1.73 0.99
16.	When I am in a hurry at work I do not wash my hands.	1.71 0.87	1.73 0.87	1.69 0.84	1.68 0.91	1.64 0.81	1.96 1.04	1.71 0.84	1.76 0.96
17.	Washing my hands properly at work is an inconvenience.	1.69 0.95	1.77 0.96	1.51 0.78	1.80 1.24	1.56 0.83	2.04 1.21	1.79 0.88	1.62 1.04
18.	There is not enough time at work to wash my hands properly.	1.63 0.88	1.67 0.85	1.56 0.83	1.65 1.05	1.60* <sup>x</sup> 0.84	2.12* <sup>xy</sup> 1.14	1.65 0.81	1.30* <sup>y</sup> 0.57
19.	I do not wash my hands properly at work because there are no paper towels.	1.62 0.92	1.67 0.93	1.47 0.72	1.84 1.24	1.57* <sup>x</sup> 0.83	2.19* <sup>xya</sup> 1.30	1.56* <sup>y</sup> 0.71	1.43* <sup>xa</sup> 0.90
20.	I do not wash my hands because the handwashing sinks are not located close enough to my work station.	1.56 0.86	1.63 0.82	1.39 0.64	1.77 1.26	1.52* <sup>y</sup> 0.73	1.96* <sup>x</sup> 1.15	1.5* <sup>z</sup> 0.75	1.38* <sup>x</sup> 0.79

**Table 4.4. Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Work Experience and Current Job Position – ANOVA (cont.)**

Item <sup>3</sup>	Statement <sup>1,2</sup>	Work Experience			Current Job Position				
		Overall (n=195)	<1 Year (n=92)	1-3 years (n=70)	>3 years (n=31)	Service (n=96)	Sanitation (n=26)	Production (n=34)	Supervisor/ Manager (n=37)
		Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD	Mean SD
21.	I do not make an effort to wash my hands properly at work.	1.53 0.82	1.57 0.79	1.41 0.63	1.71 1.22	1.47 0.68	1.81 1.10	1.50 0.75	1.46 0.80
22.	I do not wash my hands properly at work because there is no soap.	1.52 0.79	1.57 0.76	1.39 0.62	1.7 1.15	1.47 0.66	1.92 1.19	1.56 0.71	1.35 0.79
23.	Proper handwashing at work is important for reducing the chances of a foodborne illness outbreak.	4.40 0.64	4.21 <sup>*xy</sup> 0.64	4.53 <sup>*x</sup> 0.56	4.65 <sup>*y</sup> 0.66	4.32 0.59	4.23 0.82	4.53 0.62	4.57 0.60
24.	If I wash my hands properly at work I can control the spread of disease and illness.	4.23 0.71	4.05 <sup>*xy</sup> 0.64	4.33 <sup>*x</sup> 0.68	4.58 <sup>*y</sup> 0.72	4.16 0.64	4.15 0.73	4.44 0.71	4.32 0.75
25.	Less people will get a foodborne illness if I wash my hands properly at work.	4.21 0.72	4.05 <sup>*x</sup> 0.69	4.33 <sup>*x</sup> 0.72	4.35 <sup>*</sup> 0.76	4.14 0.69	4.00 0.75	4.38 0.74	4.35 0.72
26.	I am more satisfied with my work when I wash my hands properly.	3.91 0.97	3.85 0.89	4.00 0.92	3.87 1.28	3.91 0.90	3.77 1.03	4.06 0.98	3.84 1.09
27.	I am confident I can wash my hands properly at work.	4.63 0.56	4.53 0.64	4.70 0.49	4.74 0.45	4.64 0.56	4.54 0.58	4.56 0.61	4.70 0.52
28.	I have the skills to wash my hands properly at work.	4.62 0.61	4.52 0.62	4.69 0.63	4.74 0.51	4.64 0.55	4.50 0.65	4.59 0.61	4.68 0.75
29.	I am confident I know when to wash my hands at work.	4.60 0.59	4.42 <sup>*xy</sup> 0.70	4.73 <sup>*x</sup> 0.45	4.81 <sup>*y</sup> 0.40	4.56 0.63	4.46 0.65	4.56 0.61	4.81 0.40

<sup>1</sup>All statements were preceded by the instructions to “Choose the response that corresponds to the way you feel.”

<sup>2</sup>All statements were measured on a 5-point Likert scale with 1=strongly disagree, 2=disagree, 3=neither agree or disagree, 4=agree, 5=strongly agree

<sup>3</sup>Items number 1-6 measured Perceived Susceptibility, 7-12 Perceived Severity, 13-22 Perceived Barriers, 23-26 Perceived Benefits, 27-29 and Self-efficacy

\*p-value <0.05 ANOVA using the Tukey and LSD post hoc test, x = significant, y = significant

**Table 4.5. Linear Regression of Self-efficacy and Health Belief Model Constructs**

<b>Variable</b>	<b>B</b>	<b>Std. Error</b>	<b>Beta</b>	<b>t</b>	<b>Sig</b>
(Constant)	10.232	0.778	-	13.157	0.000
Perceived Susceptibility	0.023	0.032	0.058	.0718	0.474
Perceived Severity	0.055	0.042	0.113	1.320	0.189
Perceived Barriers	-0.084	0.018	-0.291	-4.633	0.000*
Perceived Benefits	0.250	0.060	0.338	4.143	0.000*

\*p-value <0.05

## **Chapter 5 – Summary and Conclusion**

This final chapter includes the major findings of the study. Practical implications for university foodservice operations are discussed along with future research and study limitations.

### **Summary of Study**

The Center for Disease Control and Prevention (CDC) estimates each year roughly 1 in 6 Americans (or 48 million people) gets sick, 128,000 are hospitalized, and 3,000 die of foodborne diseases from a combination of the major known pathogens and unspecified agents (CDC, 2011a). For more than a century, handwashing has been recognized as an essential component in the prevention of the spread of microbial infection (Fendler, Dolan, & Williams, 1998). Food safety, handwashing, and foodborne illness have been studied extensively; however, little research of the relationship between these concepts and belief and perceptions as they relate to the demographics of the employees has been conducted in a university dining center setting. Therefore, the purpose of this study was to use the Health Belief Model and its constructs of perceived susceptibility, perceived severity, perceived barriers, perceived benefits and self-efficacy to determine differences in university foodservice employees' beliefs and perceptions about handwashing and foodborne illness.

A total of 237 respondents started the survey, 212 were completed, and 195 surveys were deemed usable due to incomplete and missing data; 198 were received via Qualtrics online and 39 as pen-and-paper survey. This yielded a response rate of 30.3%. The majority of the respondents were female (68.7%), under age 22 (64.1%), white (72.3%), did not hold a food safety certification (71.3%), had worked for the foodservice less than a year (47.2%), had not completed a college degree (71.3%), were classified as a student (70.8%), and in a service position (49.2%). The sample was representative of the population.

## Summary of Major Findings

***RQ1. Is there a difference among demographics and food safety knowledge and certification of university foodservice employees about the perceived susceptibility of foodborne illness and handwashing?***

The significant results showed that those who were female, older, had more work experience, were full-time, were in a manager/supervisor/production position, were food safety certified, and received an 84% or above on their knowledge score had a greater perceived susceptibility that a foodborne illness could occur in the operation if hands were not properly washed. No differences were found in education level and ethnicity.

***RQ2. Is there a difference among demographics and food safety knowledge and certification of university foodservice employees about the perceived severity of foodborne illness and handwashing?***

Results indicated those who had a knowledge score of 84% and above, held a food safety certification, and had more than one year of experience had a greater perception of severity that not washing hands could cause a foodborne illness. Those under age 23, classified as a student, and with less than one year of work experience showed significantly greater belief that they would lose their job if they caused a foodborne illness. Supervisor/manager had the lowest rating for a foodborne illness would occur in their operation. No significant differences were found in gender, ethnicity, or education level of respondents.

***RQ3. Is there a difference among demographics and food safety knowledge and certification of university foodservice employees about the perceived barriers of foodborne illness and handwashing?***

Perceived barriers were found statistically significant among time (included those with knowledge score of 84% and above), location of sinks (included students), and lack of paper towels and soap in regards to sanitation employees versus those reported as supervisors and managers who showed the lowest concern. Overall, most employees did not rate barriers with a high importance in their operations.

***RQ4. Is there a difference among demographics and food safety knowledge and certification of university foodservice employees about the perceived benefits of foodborne illness and handwashing?***

Significant differences in perceived benefits showed that the demographic variables directly related to older (above 23), full-time employees, food-safety certified employees, and those with more than a year of experience had a higher perception of the benefits of handwashing and its relationship to reducing foodborne illness outbreaks.

***RQ5. Is there a difference among demographics and food safety knowledge and certification of university foodservice employees about the perceived susceptibility of foodborne illness and handwashing?***

Based on this study's responses, those with food safety certification, 23+, and more than a year of experience all showed a higher confidence in when to wash their hands at work. For those in the non-white category (Hispanic, African American, Asian, Native Hawaiian, Pacific Islander, American Indian, Alaskan Native, or other) results showed a lower self-efficacy for confidence, skill, and knowledge of when to wash hands properly. This was most significant between student employees (n=138) showing white, non-Hispanic students having a higher self-efficacy than those of non-white ethnicity.

***RQ6. Is self-efficacy affected by any of the HBM constructs of perceived susceptibility, severity, barriers, and benefits?***

The results of this study indicated that both barriers and benefits, not susceptibility and severity, had an independent influence on self-efficacy.

## **Future Research**

Recommendations for future research include;

1. Repeat this study with a larger population and more locations to obtain data on a wider scope of demographics that were not as well represented (full-time employees and ethnicity).
2. Conduct this study in other non-commercial or commercial settings specifically identifying handwashing and its relationship to foodborne illness.
3. Carry out a behavior analysis study with an intervention of foodborne illness and handwashing multidimensional training followed by another behavior analysis. This would provide insight about beliefs, perceptions, and behaviors of proper handwashing and multidimensional training techniques.
4. More research on the self-efficacy of food safety behaviors with a younger and ethnically diverse population.
5. Research on barriers and benefits effect on self-efficacy of food safety to see how barriers may be eliminated and benefits emphasized to increase self-efficacy of proper handwashing.



## **Limitations**

This study was limited to a convenience sample of Kansas State University residential dining foodservice employees including: student employees, full-time employees, and managers. Future researchers could approach a larger sample of university foodservice employees in order to generalize results to a larger population. It should also be noted this sample works closely with the Department of Hospitality Management and Dietetics on campus; therefore, food safety training is a priority because students use the facilities and complete internships.

All employees were contacted via e-mail with access to the Qualtrics online survey. Students and managers were the primary users of the online survey, while full-time employees were contacted by the researcher and managers through flyers and weekly meetings. Response bias is possible due to the voluntary nature of this survey. In addition, the study used a self-reported questionnaire where responses could be susceptible to social desirability bias because respondents may have felt the data was not confidential and reported more positive answers.

Even with a 30.3% response rate and efforts made to increase participation by providing multiple opportunities to complete pen-and-paper surveys, the total numbers (n = 195) were skewed towards student employees (n = 138) versus full-time employees (n = 55). This same issue was seen within the diversity of the population. The sample consisted of predominately white, non-Hispanic employees (n = 141) with fewer non-white respondents (n = 52).

Due to the timing of the survey at the end of the academic year, employees may not have been aware of the study, had no interest, or lacked the time to complete before leaving for the summer break. In addition employees may not have chosen to participate in this study for personal concern of being identified as a participant.

## **Conclusions and Recommendations**

This study was able to show, through the use of the Health Belief Model, differences in university foodservice employees' beliefs and perceptions about proper handwashing and foodborne illness. Specifically, those who are younger, less experienced, not food safety certified, have less food safety knowledge, and who are of non-white ethnicity have less concern about perceived susceptibility and severity a foodborne illness could occur in the operation if hands are not properly washed. This same group did not see the benefit of proper handwashing or any perceived barriers.

As stated previously in the review of literature, food safety knowledge does not always improve food safety behaviors (Cates, 2009; Green & Selman, 2005; Roberts et al., 2008), based on this study's results, those operations that employ the young, inexperienced, and diverse work force may need to focus on training that emphasizes the reasons why proper handwashing is needed to enhance the benefits of not causing a foodborne illness outbreak. The results of Cho et al. (2010) revealed that when employees were exposed to current foodborne illness incidents, they tend to perform more proper food safety behavior. In addition, results of Lum's study (2010) found individuals were most likely to use food safety information if the information is easy to understand, followed by having scientific facts causing feelings of a health threat. While York et al. (2009) showed specific use of signage with persuasive messages stressing serious consequences and incentives enhanced proper handwashing understanding of employees. Therefore, combining these studies' findings to improve university foodservice employees understanding of the susceptibility, severity, and benefit of proper handwashing in relation to foodborne illness is recommended. With self-efficacy shown by Haapala and Probart (2004) to be positively correlated to food safety behavior and this study's results showing significantly

lower self-efficacy among the young non-white employees, management should use self-efficacy as a focus for future training and practice for specific employees to improve confidence.

Additionally, the regression analysis results showed barriers and benefits affecting self-efficacy. Training should include concentration on the reduction of barriers to handwashing within foodservice employees together with increasing the understanding of the benefits of handwashing in order to improve the self-efficacy of foodservice employees. High volume of business, stress, attitude of employees, lack of accountability, and type of establishment were also found to be barriers mentioned most frequently by foodservice employees (Pragle, Harding, & Mack, 2007). Howells et al. (2008) found four common perceived barriers to personal hygiene (specifically handwashing) among their study subjects which included time constraints, resources in inconvenient locations, inadequate resources, and dry skin. From these studies educating employees about the consequences of improper food handling and management making all a priority with accountability might improve attitudes toward food safety (Howells, et al. 2008; Pragle, Harding, & Mack, 2007; Sneed, Strohbehn, & Gilmore, 2007). With these results along with these participants not seeing the benefit of proper handwashing, foodservice operations should use training techniques to increase the understanding of the benefits of handwashing, establish accountability and eliminate barriers in order to improve the self-efficacy of foodservice employees.

Based on results of this study, the following recommendations for managers of university foodservice operations include:

1. Use this instrument to conduct assessments of employees to find areas of concern about proper handwashing in relation to foodborne illness.

2. Use the results to tailor additional or enhanced trainings towards those specific demographics in need.
3. Use self-efficacy training techniques to improve the confidence, understanding, and connection between proper handwashing and foodborne illness of employees.
4. Try intervention training techniques to enhance the knowledge, understanding, and connection between benefits of proper handwashing and foodborne illness outbreak consequences. Focus on the benefit through use of persuasive signage with current foodborne illness incidents stressing serious consequences.
5. Repeat training throughout the year to enhance the self-efficacy of current employees, improve memory of training, and capture new employees throughout the hiring stages.
6. Remove barriers to handwashing.

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


# Appendix A - IRB Approval



TO: Elizabeth Barrett  
HMD  
107 Justin

Proposal Number: 6601

FROM: Rick Scheidt, Chair   
Committee on Research Involving Human Subjects

DATE: 03/14/2013

RE: Approval of Proposal Entitled, "THE POSSIBILITY OF CONTRACTING OR CAUSING A FOODBORNE ILLNESS: THE IMPACT ON PERCEPTIONS AND BELIEFS OF HANDWASHING AMONG THE DIVERSE WORKFORCE REPRESENTED IN A COLLEGE DINING SERVICE FACILITY."

The Committee on Research Involving Human Subjects has reviewed your proposal and has granted full approval. This proposal is **approved for one year from the date of this correspondence, pending "continuing review."**

APPROVAL DATE: 03/14/2013

EXPIRATION DATE: 03/14/2014

Several months prior to the expiration date listed, the IRB will solicit information from you for federally mandated "continuing review" of the research. Based on the review, the IRB may approve the activity for another year. **If continuing IRB approval is not granted, or the IRB fails to perform the continuing review before the expiration date noted above, the project will expire and the activity involving human subjects must be terminated on that date. Consequently, it is critical that you are responsive to the IRB request for information for continuing review if you want your project to continue.**

In giving its approval, the Committee has determined that:

- There is no more than minimal risk to the subjects.
- There is greater than minimal risk to the subjects.

This approval applies only to the proposal currently on file as written. Any change or modification affecting human subjects must be approved by the IRB prior to implementation. All approved proposals are subject to continuing review at least annually, which may include the examination of records connected with the project. Announced post-approval monitoring may be performed during the course of this approval period by URCO staff. Injuries, unanticipated problems or adverse events involving risk to subjects or to others must be reported immediately to the Chair of the IRB and / or the URCO.

# Appendix B - Informed Consent Form

## KANSAS STATE UNIVERSITY

### INFORMED CONSENT FOCUS GROUPS

**PROJECT TITLE:** EXPLORING THE RELATIONSHIP BETWEEN CONTRACTING OR CAUSING A  
FOODBORNE ILLNESS AND PERCEPTIONS AND BELIEFS OF HANDWASHING AMONG THE DIVERSE  
WORKFORCE REPRESENTED IN A COLLEGE DINING SERVICE FACILITY

**APPROVAL DATE OF PROJECT:**

**EXPIRATION DATE OF PROJECT:**

**PRINCIPAL INVESTIGATOR:** Elizabeth B. Barrett, PhD

**CO-INVESTIGATOR(S):** N/A

**CONTACT NAME AND PHONE FOR ANY PROBLEMS/QUESTIONS:**

Becky J. Bolte; [jojobolt@ksu.edu](mailto:jojobolt@ksu.edu); (785) 341-2307

**IRB CHAIR CONTACT/PHONE INFORMATION:**

- Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224.
- Jerry Jaax, Associate Vice President for Research Compliance and University Veterinarian, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224.

**SPONSOR OF PROJECT:** N/A

**PURPOSE OF THE RESEARCH:** Foodborne illness is a major threat in the United States. Very little is known about what the opinions of foodservice workers have about handwashing and foodborne illness. The purpose of this research project is to determine the possibility of contracting or causing a foodborne illness and personal predictors' impact on perceptions and beliefs about handwashing among campus dining service employees. The purpose of the Focus Group is not on the particular responses, but rather to help me to determine what factors I should include in my survey..

**PROCEDURES OR METHODS TO BE USED:** Focus groups, lasting approximately 30 minutes, will be conducted in the spring of 2013. Focus groups are small groups of 6-10 individuals from two dining centers where informal discussions will be used to gather information about opinions regarding handwashing and foodborne illness. Focus group sessions will be audio taped and transcribed. Focus group participants will receive bakery goods as refreshments as well as a raffle ticket for a Wal-Mart gift card.

**LENGTH OF STUDY:** Focus group participation: 30 minutes.

**RISKS OR DISCOMFORTS ANTICIPATED:** There could be a risk that someone might go outside of the group and share the information or names of participants related in the session and that they should respond accordingly before they begin discussion. In addition the questions are not targeting misbehavior but rather more general knowledge and attitudes. My goal is just to get your opinions to help me determine the areas I should include in the survey. These results will only be shared as collective data not individual.

**BENEFITS ANTICIPATED:** The results of this study could help the future development of industry training instruments to reduce brand damage and expenses due to preventable foodborne illness outbreaks.

**EXTENT OF CONFIDENTIALITY:** The confidentiality of the research subjects will be of the utmost concern in this study. Any and all focus group and pilot study paperwork will be stored in a secure location within the department of HMD.

**TERMS OF PARTICIPATION:** I understand this project is research, and that my participation is completely *voluntary*. I also understand that if I decide to participate in this study, I may withdraw my consent at any time, and stop participating at any time without explanation, penalty, or loss of benefits, or academic standing to which I may otherwise be entitled.

**I verify that my signature below indicates that I have read and understand this consent form, and willingly agree to participate in this study under the terms described, and that my signature acknowledges that I have received a signed and dated copy of this consent form.**

**Participant Name:** \_\_\_\_\_

**Participant Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Witness to Signature: (project staff)** \_\_\_\_\_

**Date:** \_\_\_\_\_

## Appendix C - Information Sheet and Focus Group Questions

### Focus Group Information Sheet

Name: \_\_\_\_\_

Phone#: \_\_\_\_\_

Email: \_\_\_\_\_

Age: \_\_\_\_\_

Gender (please circle one): Male Female

Ethnicity (please circle one): White/Non-Hispanic Hispanic Black or African  
American Asian Native Hawaiian or Pacific Islander American Indian or Alaskan  
Native Other \_\_\_\_\_

What is your position within your facility (please circle one): Server Cook Supervisor  
Production Sanitation Other \_\_\_\_\_

Years of work experience with dining services: \_\_\_\_\_

Are you ServSafe certified? (Please circle one) Yes No

## Focus Group Discussion Guide with Comments from Participants

1. What is a foodborne illness?
  - a. Disease you get from eating food with high levels of bacteria, virus, pathogens
  - b. Salmonella, bacteria
  - c. An illness caused by food
  - d. Don't know
  - e. From not washing hands
  - f. Bacteria on food caused by poor hygiene or cross contamination
  
2. How does foodborne illness relate to handwashing?
  - a. Wash hands to not spread germs and not get on food
  - b. To remove bacteria
  - c. You don't wash your hands you get the pathogens on the food
  - d. More washing, less bacteria, positive correlation
  
3. Do you know the proper handwashing procedures and when to wash your hands at work?  
Can you tell me what they are?
  - a. When you are handling one item and move on to another need to wash your hands.
  - b. Every time you change your gloves
  - c. When you touch your face, apron, anything
  - d. Wash all the time
  - e. After bathroom, sneeze, dirty
  - f. Before you handle food
  - g. Whenever you change what kind of food you are handling, after restroom.
  - h. Wash with soap, 20 to 30 seconds with warm water
  - i. Use paper towel to turn off water and open doors
  - j. Hot water, soap, for 20 secs, nails and wrists
  - k. 20 sec, sing "eat um up, eat um up, KSU" 6 times,
  
4. Can you describe some good things that come from proper handwashing at work?
  - a. Less illness
  - b. Sanitary
  - c. Cleaner people
  - d. Control the spread of disease
  - e. Clean food
  - f. Sanitary work environment

- g. Cleanliness is next to godliness
  - h. No one gets sick
  - i. Feel better about yourself when clean
  - j. Satisfied work experience
5. What could result from you not washing your hands at work?
- a. Sick people
  - b. Sued
  - c. Less illness
  - d. Get customers sick
  - e. Get yourself sick
  - f. Fail a health inspection
  - g. Upset customers if they find out
  - h. You are not being sanitary
6. Do you think you and your customers can get a foodborne illness if you do not wash your hands at work?
- a. Yes
  - b. No – if they or you have a good immune system
  - c. If someone is allergic to something it could be on your hands and cause a reaction
7. What is the worst thing that could happen if you do not wash your hands at work?
- a. Get sick and sued
  - b. Dry hands
  - c. Friends would hate you
  - d. Customers get sick
  - e. You could get fired
  - f. Fail a health inspection
  - g. Make the company look bad
  - h. Get sued
  - i. If someone is allergic to something it could be on your hands and cause a reaction
  - j. Death
  - k. Sickness – could be lots of people
  - l. You get sick
  - m. Fired
  - n. Sued
  - o. Employer is liable



- 8.** What causes you or other people to not wash their hands at work?
- a. Hurried
  - b. Busy
  - c. Want to serve people fast
  - d. Can't physically feel the dirt when you have gloves on
  - e. No supplies so just rinse under water
  - f. Laziness
  - g. Too busy
  - h. Inconvenient
  - i. In a hurry
  - j. Wet hands makes it hard to put on gloves
  - k. People don't know when they need to wash their hands
  - l. Don't wash them long enough
  - m. Don't use soap
  - n. Out of paper towels
  - o. Terrorism
  - p. No soap – use sanitizer that is enough
  - q. Water is too hot
  - r. Hurry/busy
  - s. Always have time no excuse
- 9.** Do you think if you do not wash your hands at work you could be responsible for a foodborne illness outbreak?
- a.** Yes, worry about germs and what other people do
  - b.** No, if you are more cautious you are more apt to get it
  - c.** Washing hands can remove the good bacteria so too much prevention is bad
  - d.** Possible but not probable

## **Appendix D - Survey letter and Description**

The purpose of this survey is to collect your opinion about handwashing and foodborne illness. Identifying the differences in employee beliefs and perceptions about handwashing can assist dining service managers in training development. You will be asked to respond to questions about your experiences with and knowledge of foodborne illness as well as handwashing behaviors within your workplace. Please carefully read each question and do not leave any items blank. You may notice there are some statements that sound similar, please try to answer all the questions. There is no right or wrong answers. Your honest and thoughtful replies will help my research. Most people are able to complete the survey in less than (TBD). This project is research and your participation is completely voluntary. If you decide to participate, you may withdraw and stop participating at any time without explanation or penalty. There is no risk to your employment by taking this survey.

By completing this survey, you indicate to the researcher your willingness to participate in this research. All information from the completed survey will be kept confidential and reported in summary form. If you have any questions regarding this research, you may contact Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224. For further information about this study, contact Becky Bolte, 785-532-2213 or [jojobolt@ksu.edu](mailto:jojobolt@ksu.edu). You may also contact my major professor, Dr. Elizabeth B. Barrett, PhD at 785-532-2208.

May 2013

Dear Dining Service Employee,

You are invited to participate in food safety research being conducted at Kansas State University (KSU). This study will help determine the opinions of foodservice workers about handwashing. You were selected to participate because you are an employee of KSU Dining Services.

Your participation in this research is completely voluntary. If you decide to participate, you may withdraw and stop without explanation or penalty. There is no risk to your employment for participating in this study. Your participation and all information from the completed survey will be kept confidential and only reported in summary form. If you have any questions about this research, you may contact Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224.

Please complete the entire enclosed survey. Your honest and thoughtful replies will help my research. Most people are able to complete the survey in less than 10 minutes. Your response and any comments will be treated with utmost confidentiality. After the results are tabulated and compiled, I will issue a report which you may receive by sending a request via email to [jojobolt@ksu.edu](mailto:jojobolt@ksu.edu).

Please complete survey by May 24, 2013.

Thanks again for your help!

Sincerely,

Becky J Bolte

Masters Student

Department of Hospitality Management and Dietetics

Elizabeth B. Barrett, PhD

Associate Professor, Department of Hospitality Management and Dietetics

## Appendix E - Pilot Survey

### Food Safety

Q26 Do you have food service experience?

- Yes (1)
- No (2)

If No Is Selected, Then Skip To End of Survey

Q1 Which of the following cause foodborne illness? Choose all that apply

- E. coli (1)
- Poor personal hygiene (2)
- Eating food that has been contaminated by a sick employee (3)
- Not using soap when washing hands at work (4)
- Salmonella (5)
- Cold food kept at 35 degrees (6)

Q2 The majority of foodborne illness can be prevented by which of the following?

- Eliminating cross-contamination at work (1)
- Proper hand hygiene at work (2)
- Covering your mouth when you sneeze or cough at work (3)
- Cooking food to the proper temperature at work (4)
- I am not sure (5)

Q3 If you are not feeling well (fever, vomiting, or diarrhea), is it okay to prepare and serve food for others if you properly wash your hands?

- Yes (1)
- No (2)
- I am not sure (3)

Q4 Hands should be washed in which of the following circumstances: Choose all that apply

- Before work (1)
- When switching food preparation tasks (2)
- After touching body parts (3)
- Before going to the bathroom (4)
- Before putting on gloves (5)
- After going to the bathroom (6)
- I am not sure (7)

Q5 Which of the following are necessary for proper handwashing? Choose all that apply

- Hot water (1)
- Hand sanitizer (2)
- Soap (3)
- Wash for 20 seconds (4)
- Warm water (5)
- Wash for 10 seconds (6)
- I am not sure (7)

Q6 After handwashing, hands should be dried by which of the following? Choose all that apply

- With a towel (1)
- With my apron (2)
- With a single use paper towel (3)
- With an air dryer (4)
- By shaking off the water (5)
- On my uniform (6)
- I am not sure (7)

Q7 Please choose the response that corresponds to the way you feel. There are no right or wrong answers.

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
When I think about a foodborne illness occurring at work, I feel concerned. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I worry a lot about myself and my customers getting a foodborne illness if I do not wash my hands at work. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The chances of my customers and myself getting a foodborne illness is great if I do not wash my hands at work. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I follow proper handwashing practices at work, my chances of causing a foodborne illness outbreak would decrease. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q8 Please choose the response that corresponds to the way you feel. There are no right or wrong answers.

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
I am afraid to think about the possibility of a foodborne illness outbreak at my operation. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I do not wash my hands at work and cause a foodborne illness outbreak, the operation could get sued. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I do not wash my hands at work and a foodborne illness outbreak occurs, our customers would get upset and stop eating at our operations. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our customers could get very sick if I do not wash my hands at work. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My relationship with my fellow employees would change if I caused a foodborne illness outbreak at work because I did not wash my hands. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I could lose my job if I did not wash my hands and caused a foodborne illness outbreak. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q9 Please choose the response that corresponds to the way you feel. There are no right or wrong answers.

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
There is not enough time at work to wash my hands properly. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Washing my hands irritates my skin. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I am in a hurry at work I do not wash my hands. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would wash my hands properly at work if I knew more about food safety. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do not wash my hands properly at work because there is no soap. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do not wash my hands properly at work because there are no paper towels. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am really just too lazy to take the time to wash my hands properly at work. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Washing my hands properly at work is an inconvenience. (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The water is too hot to wash my hands properly at work. (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



I do not wash my hands because the handwashing sinks are not located close enough to my work station. (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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Q10 Please choose the response that corresponds to the way you feel. There are no right or wrong answers.

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
If I wash my hands properly at work I can control the spread of disease and illness. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Less people will get a foodborne illness if I wash my hands properly at work. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am more satisfied with my work when I wash my hands properly. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Proper handwashing at work is important for reducing the chances of a foodborne illness outbreak. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q11 Please choose the response that corresponds to the way you feel. There are no right or wrong answers.

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
I am confident I can wash my hands properly at work. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have the skills to wash my hands properly at work. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I need to learn more about how to wash my hands properly at work. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am confident I know when to wash my hands at work. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I need to learn more about when to properly wash my hands at work. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q12 Please provide the following information about yourself. What is your gender?

- Male (1)
- Female (2)

Q13 What is your age in years?

Q14 What is your ethnicity?

- White, non-Hispanic (1)
- Hispanic (2)
- Black or African American (3)
- Asian (4)
- Native Hawaiian or Pacific Islander (5)
- American Indian or Alaskan Native (6)
- Other (7) \_\_\_\_\_

Q15 Years of work experience with dining services.

- Less than 6 months (1)
- 6-12 months (2)
- Greater than 1 year to 3 years (3)
- Greater than 3 years to 6 years (4)
- More than 6 years (5)

Q16 What is your highest level of education?

- Some high school (1)
- High school/GED (2)
- Some college (3)
- Associates degree (4)
- Bachelor's degree (5)
- Master's degree (6)
- Doctorate (7)
- Professional degree (8)

Q17 Are you classified as a:

- Student employee (1)
- Classified employee (2)
- Manager (3)

Q18 What is your current position in dining services?

- Service (1)
- Sanitation (2)
- Production (3)
- Supervisor (4)
- Manager (5)

Q19 Do you have a food safety certification?

- Yes (1)
- No (2)
- If yes, please specify what certification you have below. (i.e. ServSafe, Food Handlers card, HACCP, etc...) (3) \_\_\_\_\_

Q20 Did any of the questions seem to have content you did not understand? If so, which one(s) and why?

Q21 Did any of the questions seem unclear to you? If so, which one(s) and how would you improve the question?

Q22 Did any part of this questionnaire seem inapplicable to foodservice operations or employees? If so, which part and why?

Q23 Is there anything else that you would like to say about the survey? Are there any other changes you would make?

## **Appendix F - Final Survey**

### Handwashing & Foodborne Illness - Final Online

Please carefully read each question and do not leave any items blank. You may notice there are some statements that sound similar, please try to answer all the questions. There are no right or wrong answers. Your honest and thoughtful replies are appreciated and help with my thesis research. Thank you for participating.

The purpose of this survey is to collect your opinion about handwashing and foodborne illness. Please carefully read each question and do not leave any items blank. You may notice there are some statements that sound similar, please try to answer all the questions. There are no right or wrong answers. Your honest and thorough replies will help my research. Most people are able to complete the survey in less than 15 minutes. This project is research and your participation is completely voluntary. There is no risk to your employment by taking this survey.

By completing this survey, you indicate to the researcher your willingness to participate in this research. If you decide to participate, you may withdraw and stop participating at any time without explanation or penalty. All information from the completed survey will be kept confidential and reported in summary form.

If you have any questions regarding this research, you may contact Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224. For further information about this study, contact Becky Bolte, 785-532-5164 or [jojobolt@ksu.edu](mailto:jojobolt@ksu.edu). You may also contact my major professor, Elizabeth B. Barrett, PhD at 785-532-2208.

Q1 Which of the following cause foodborne illness? Choose all that apply

- Disease causing E. coli (1)
- Poor personal hygiene (2)
- Eating food that has been contaminated by a sick employee (3)
- Not using soap when washing hands at work (4)
- Salmonella (5)
- Cold food kept at 35 degrees (6)

Q2 The majority of foodborne illness can be prevented by which of the following? Choose one

- Eliminating cross-contamination at work (1)
- Proper hand hygiene at work (2)
- Covering your mouth when you sneeze or cough at work (3)
- Cooking food to the proper temperature at work (4)
- I am not sure (5)

Q3 If you are not feeling well (fever, vomiting, or diarrhea), is it okay to prepare and serve food for others if you properly wash your hands?

- Yes (1)
- No (2)
- I am not sure (3)

Q4 Hands should be washed in which of the following circumstances: Choose all that apply

- Before work (1)
- When switching food preparation tasks (2)
- After touching body parts (3)
- Before going to the bathroom (4)
- Before putting on gloves (5)
- After going to the bathroom (6)
- I am not sure (7)

Q5 Which of the following are necessary for proper handwashing? Choose all that apply

- Hot water (1)
- Hand sanitizer (2)
- Soap (3)
- Wash for 20 seconds (4)
- Warm water (5)
- Wash for 10 seconds (6)
- I am not sure (7)

Q6 After handwashing, hands should be properly dried by which of the following? Choose all that apply

- With a towel (1)
- With my apron (2)
- With a single use paper towel (3)
- With an air dryer (4)
- By shaking off the water (5)
- On my uniform (6)
- I am not sure (7)

Q7 Please choose the response that corresponds to the way you feel. There are no right or wrong answers.

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
When I think about a foodborne illness occurring at work, I feel concerned. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I worry a lot about a foodborne illness if I do not wash my hands at work. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The chances of my customers getting a foodborne illness is great if I do not wash my hands at work. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I follow proper handwashing practices at work, my chances of causing a foodborne illness outbreak would decrease. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I worry a lot about my customers getting a foodborne illness if I do not wash my hands at work. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My chances of getting a foodborne illness is great if I do not wash my hands at work. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Q8 Please choose the response that corresponds to the way you feel. There are no right or wrong answers.

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
I am afraid to think about the possibility of a foodborne illness outbreak at my operation. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I do not wash my hands at work and cause a foodborne illness outbreak, the operation could get sued. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I do not wash my hands at work and a foodborne illness outbreak occurs, our customers would get upset and stop eating at our operations. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Our customers could get very sick if I do not wash my hands at work. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My relationship with my fellow employees would change if I caused a foodborne illness outbreak at work because I did not wash my hands. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I could lose my job if I did not wash my hands and caused a foodborne illness outbreak. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q9 Please choose the response that corresponds to the way you feel. There are no right or wrong answers.

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
There is not enough time at work to wash my hands properly. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Washing my hands irritates my skin. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When I am in a hurry at work I do not wash my hands. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would wash my hands properly at work if I knew more about food safety. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do not wash my hands properly at work because there is no soap. (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do not wash my hands properly at work because there are no paper towels. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I do not make an effort to wash my hands properly at work. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Washing my hands properly at work is an inconvenience. (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The water is too hot to wash my hands properly at work. (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

I do not wash my hands because the handwashing sinks are not located close enough to my work station. (10)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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Q10 Please choose the response that corresponds to the way you feel. There are no right or wrong answers.

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
If I wash my hands properly at work I can control the spread of disease and illness. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Less people will get a foodborne illness if I wash my hands properly at work. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am more satisfied with my work when I wash my hands properly. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Proper handwashing at work is important for reducing the chances of a foodborne illness outbreak. (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q11 Please choose the response that corresponds to the way you feel. There are no right or wrong answers.

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
I am confident I can wash my hands properly at work. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have the skills to wash my hands properly at work. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am confident I know when to wash my hands at work. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q12 Please provide the following information about yourself. What is your gender?

- Male (1)
- Female (2)

Q13 What is your age in years?

Q14 What is your ethnicity?

- White, non-Hispanic (1)
- Hispanic (2)
- Black or African American (3)
- Asian (4)
- Native Hawaiian or Pacific Islander (5)
- American Indian or Alaskan Native (6)
- Other (7) \_\_\_\_\_

Q15 Years of work experience with dining services.

- Less than 6 months (1)
- 6-12 months (2)
- Greater than 1 year to 3 years (3)
- Greater than 3 years to 6 years (4)
- More than 6 years (5)

Q16 What is your highest level of education?

- Some high school (1)
- High school/GED (2)
- Some college (3)
- Associates degree (4)
- Bachelor's degree (5)
- Master's degree (6)
- Doctorate (7)
- Professional degree (8)

Q17 Are you classified as a:

- Student employee (1)
- Classified employee (2)
- Manager (3)

Q18 What is your current position in dining services?

- Service (1)
- Sanitation (2)
- Production (3)
- Supervisor (4)
- Manager (5)
- Other (6) \_\_\_\_\_

Q19 Do you have a food safety certification?

- Yes (1)
- No (2)
- If yes, please specify what certification you have below. (i.e. ServSafe, Food Handlers card, HACCP, etc...) (3) \_\_\_\_\_

## Appendix G - Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self- efficacy Based on Gender – T-test

Item <sup>3</sup>	Statement <sup>1,2</sup>	Male		Female		t**	Sig
		N	Mean SD	N	Mean SD		
1.	If I follow proper handwashing practices at work, my chances of causing a foodborne illness outbreak would decrease.	58	4.24 0.96	134	4.49 0.75	-1.88	0.06
2.	The chances of my customers getting a foodborne illness are great if I do not wash my hands at work.	58	3.95 1.00	134	4.11 0.95	-1.08	0.28
3.	When I think about a foodborne illness occurring at work, I feel concerned.	58	3.94 1.09	134	4.07 0.99	-2.69	0.008*
4.	I worry a lot about my customers getting a foodborne illness if I do not wash my hands at work.	58	3.84 1.09	134	3.9 1.02	-0.58	0.57
5.	My chances of getting a foodborne illness are great if I do not wash my hands at work.	58	3.52 1.01	134	3.81 1.04	-1.78	0.08
6.	I worry a lot about getting a foodborne illness if I do not wash my hands at work.	58	3.41 1.26	134	3.51 1.05	-0.36	0.72
7.	Our customers could get very sick if I do not wash my hands at work.	58	4.02 0.81	134	4.19 0.72	-1.51	0.13
8.	If I do not wash my hands at work and a foodborne illness outbreak occurs, our customers would get upset and stop eating at our operations.	58	3.98 0.85	134	4.15 0.82	-1.28	0.202
9.	If I do not wash my hands at work and cause a foodborne illness outbreak, the operation could get sued.	58	4.16 0.83	134	4.01 0.83	1.07	0.285
10.	I could lose my job if I did not wash my hands and caused a foodborne illness outbreak.	58	4.03 0.90	134	4.05 0.93	-0.07	0.94
11.	My relationship with my fellow employees would change if I caused a foodborne illness outbreak at work because I did not wash my hands.	58	3.67 1.02	134	3.93 0.92	-1.69	0.09

**Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Gender – T-test (cont.)**

Item <sup>3</sup>	Statement <sup>1,2</sup>	Male		Female		t**	Sig
		N	Mean SD	N	Mean SD		
12.	I am afraid to think about the possibility of a foodborne illness outbreak at my operation.	58	3.11 1.26	134	3.38 1.20	-1.44	0.15
13.	I would wash my hands properly at work if I knew more about food safety.	58	2.76 1.23	134	2.84 1.20	-0.45	0.66
14.	Washing my hands irritates my skin.	58	2.07 1.17	134	2.39 1.18	-1.72	0.09
15.	The water is too hot to wash my hands properly at work.	58	1.93 1.09	134	2.02 1.14	-0.52	0.61
16.	When I am in a hurry at work I do not wash my hands.	58	1.84 0.97	134	1.63 0.78	1.65	0.10
17.	Washing my hands properly at work is an inconvenience.	58	1.75 1.06	134	1.64 0.90	0.75	0.46
18.	There is not enough time at work to wash my hands properly.	58	1.64 0.95	134	1.61 0.84	0.19	0.85
19.	I do not wash my hands properly at work because there are no paper towels.	58	1.72 1.06	134	1.58 0.86	0.98	0.33
20.	I do not wash my hands because the handwashing sinks are not located close enough to my work station.	58	1.59 0.95	134	1.54 0.80	0.31	0.76
21.	I do not make an effort to wash my hands properly at work.	58	1.62 0.91	134	1.49 0.78	0.99	0.32
22.	I do not wash my hands properly at work because there is no soap.	58	1.65 0.97	134	1.46 0.69	1.56	0.12

### Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Gender –T-test (cont.)

Item <sup>3</sup>	Statement <sup>1,2</sup>	Male		Female		t**	Sig
		N	Mean SD	N	Mean SD		
23.	Proper handwashing at work is important for reducing the chances of a foodborne illness outbreak.	58	4.31 0.71	134	4.44 0.69	-1.312	0.19
24.	If I wash my hands properly at work I can control the spread of disease and illness.	58	4.17 0.68	134	4.28 0.69	-0.96	0.34
25.	Less people will get a foodborne illness if I wash my hands properly at work.	58	4.10 0.69	134	4.25 0.72	-1.37	0.18
26.	I am more satisfied with my work when I wash my hands properly.	58	3.79 1.01	134	3.96 0.95	-1.11	0.27
27.	I am confident I can wash my hands properly at work.	58	4.6 0.59	134	4.65 0.54	-0.53	0.60
28.	I have the skills to wash my hands properly at work.	58	4.53 0.78	134	4.66 0.52	-1.28	0.20
29.	I am confident I know when to wash my hands at work.	58	4.59 0.62	134	4.6 0.59	-0.19	0.85

<sup>1</sup>All statements were preceded by the instructions to “Choose the response that corresponds to the way you feel.”

<sup>2</sup>All statements were measured on a 5-point Likert scale with 1=strongly disagree, 2=disagree, 3=neither agree or disagree, 4=agree, 5=strongly agree

<sup>3</sup>Items number 1-6 measured Perceived Susceptibility, 7-12 Perceived Severity, 13-22 Perceived Barriers, 23-26 Perceived Benefits, 27-29 and Self-efficacy

\*p-value <0.05

\*\*Independent Sample t-test



## Appendix H - Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self- efficacy Based on Age – T-test

Item <sup>3</sup>	Statement <sup>1,2</sup>	23 or less		23 +		t**	Sig
		N	Mean SD	N	Mean SD		
1.	If I follow proper handwashing practices at work, my chances of causing a foodborne illness outbreak would decrease.	125	4.32 0.89	64	4.58 0.66	-1.94	0.05
2.	The chances of my customers getting a foodborne illness are great if I do not wash my hands at work.	125	3.88 0.97	64	4.34 0.88	-2.97	0.003*
3.	When I think about a foodborne illness occurring at work, I feel concerned.	125	3.70 1.13	64	4.36 0.88	-3.92	0*
4.	I worry a lot about my customers getting a foodborne illness if I do not wash my hands at work.	125	3.23 1.08	64	4.3 0.83	-4.04	0*
5.	My chances of getting a foodborne illness are great if I do not wash my hands at work.	125	3.48 1.04	64	4.11 0.91	-3.95	0*
6.	I worry a lot about getting a foodborne illness if I do not wash my hands at work.	125	3.65 1.07	64	3.92 0.98	-4.04	0*
7.	Our customers could get very sick if I do not wash my hands at work.	125	4.06 0.76	64	4.27 0.72	-1.60	0.11
8.	If I do not wash my hands at work and a foodborne illness outbreak occurs, our customers would get upset and stop eating at our operations.	125	4.06 0.89	64	4.14 0.69	-0.39	0.70
9.	If I do not wash my hands at work and cause a foodborne illness outbreak, the operation could get sued.	125	4.02 0.84	64	4.09 0.83	-0.50	0.62
10.	I could lose my job if I did not wash my hands and caused a foodborne illness outbreak.	125	4.16 0.82	64	3.78 1.05	2.71	0.007*
11.	My relationship with my fellow employees would change if I caused a foodborne illness outbreak at work because I did not wash my hands.	125	3.76 0.99	64	4.02 0.88	-1.58	0.12

### Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Age – T-test (cont.)

Item <sup>3</sup>	Statement <sup>1,2</sup>	23 or less		23 +		t**	Sig
		N	Mean SD	N	Mean SD		
12.	I am afraid to think about the possibility of a foodborne illness outbreak at my operation.	25	3.16 1.15	64	3.52 1.29	-1.66	0.10
13.	I would wash my hands properly at work if I knew more about food safety.	125	2.90 1.12	64	3.30 1.35	0.82	0.41
14.	Washing my hands irritates my skin.	125	2.29 1.15	64	2.70 1.35	-0.44	0.66
15.	The water is too hot to wash my hands properly at work.	125	2.02 1.11	64	2.35 1.24	0.14	0.89
16.	When I am in a hurry at work I do not wash my hands.	125	1.69 0.86	64	1.98 1.13	-0.42	0.68
17.	Washing my hands properly at work is an inconvenience.	125	1.65 0.92	64	1.75 0.87	-0.98	0.33
18.	There is not enough time at work to wash my hands properly.	125	1.61 0.83	64	1.78 1.03	-0.28	0.78
19.	I do not wash my hands properly at work because there are no paper towels.	125	1.59 0.89	64	1.66 0.93	-0.71	0.48
20.	I do not wash my hands because the handwashing sinks are not located close enough to my work station.	125	1.54 0.80	64	1.69 0.96	-0.52	0.61
21.	I do not make an effort to wash my hands properly at work.	125	1.50 0.77	64	1.61 0.88	-0.72	0.48
22.	I do not wash my hands properly at work because there is no soap.	125	1.49 0.75	64	1.61 0.88	-1.163	0.25
23.	Proper handwashing at work is important for reducing the chances of a foodborne illness outbreak.	125	4.34 0.61	64	4.48 0.69	-1.29	0.20
24.	If I wash my hands properly at work I can control the spread of disease and illness.	125	4.11 0.66	64	4.45 0.69	-3.15	0.002*

### Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Age – T-test (cont.)

Item <sup>3</sup>	Statement <sup>1,2</sup>	23 or less		23+		t**	Sig
		N	Mean SD	N	Mean SD		
25.	Less people will get a foodborne illness if I wash my hands properly at work.	125	4.13 0.72	64	4.33 0.71	-1.61	0.11
26.	I am more satisfied with my work when I wash my hands properly.	125	3.84 0.95	64	3.98 1.00	-0.72	0.47
27.	I am confident I can wash my hands properly at work.	125	4.61 0.59	64	4.66 0.51	-0.53	0.60
28.	I have the skills to wash my hands properly at work.	125	4.58 0.66	64	4.69 0.50	-1.074	0.28
29.	I am confident I know when to wash my hands at work.	125	4.52 0.66	64	4.73 0.445	-2.225	0.03*

<sup>1</sup>All statements were preceded by the instructions to “Choose the response that corresponds to the way you feel.”

<sup>2</sup>All statements were measured on a 5-point Likert scale with 1=strongly disagree, 2=disagree, 3=neither agree or disagree, 4=agree, 5=strongly agree

<sup>3</sup>Items number 1-6 measured Perceived Susceptibility, 7-12 Perceived Severity, 13-22 Perceived Barriers, 23-26 Perceived Benefits, 27-29 and Self-efficacy

\*p-value <0.05

\*\*Independent Sample t-test

## Appendix I - Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Ethnicity – T-test

Item <sup>3</sup>	Statement <sup>1,2</sup>	White, non-Hispanic		Non-white		t**	Sig
		N	Mean SD	N	Mean SD		
1.	If I follow proper handwashing practices at work, my chances of causing a foodborne illness outbreak would decrease.	141	4.43 0.79	52	4.35 0.93	0.645	0.52
2.	The chances of my customers getting a foodborne illness are great if I do not wash my hands at work.	141	4.03 0.98	52	4.13 0.93	-0.68	0.50
3.	When I think about a foodborne illness occurring at work, I feel concerned.	141	3.89 1.07	52	4.04 1.14	-0.82	0.41
4.	I worry a lot about my customers getting a foodborne illness if I do not wash my hands at work.	141	3.83 1.02	52	4.04 1.07	-1.25	0.22
5.	My chances of getting a foodborne illness are great if I do not wash my hands at work.	141	3.65 1.03	52	3.9 1.05	-1.54	0.13
6.	I worry a lot about getting a foodborne illness if I do not wash my hands at work.	141	3.33 1.05	52	3.9 1.18	-1.25	0.22
7.	Our customers could get very sick if I do not wash my hands at work.	141	4.18 0.71	52	4.02 0.83	1.37	0.17
8.	If I do not wash my hands at work and a foodborne illness outbreak occurs, our customers would get upset and stop eating at our operations.	141	4.13 0.78	52	4.02 0.94	0.81	0.42
9.	If I do not wash my hands at work and cause a foodborne illness outbreak, the operation could get sued.	141	4.12 0.76	52	3.87 0.99	1.90	0.06
10.	I could lose my job if I did not wash my hands and caused a foodborne illness outbreak.	141	4.06 0.94	52	3.96 0.87	0.69	0.49
11.	My relationship with my fellow employees would change if I caused a foodborne illness outbreak at work because I did not wash my hands.	141	3.87 0.96	52	3.81 0.97	0.42	0.68

**Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Ethnicity – T-test (cont.)**

Item <sup>3</sup>	Statement <sup>1,2</sup>	White, non-Hispanic		Non-white		t**	Sig
		N	Mean SD	N	Mean SD		
12.	I am afraid to think about the possibility of a foodborne illness outbreak at my operation.	141	3.27 1.24	52	3.38 1.7	-0.60	0.55
14.	Washing my hands irritates my skin.	141	2.36 1.21	52	2.14 1.11	1.14	0.26
15.	The water is too hot to wash my hands properly at work.	141	1.94 1.09	52	2.18 1.20	-1.31	0.19
16.	When I am in a hurry at work I do not wash my hands.	141	1.70 0.83	52	1.73 0.95	-0.26	0.80
17.	Washing my hands properly at work is an inconvenience.	141	1.66 0.97	52	1.73 0.91	-0.43	0.70
18.	There is not enough time at work to wash my hands properly.	141	1.62 0.88	52	1.65 0.88	-0.26	0.80
19.	I do not wash my hands properly at work because there are no paper towels.	141	1.60 0.94	52	1.69 0.88	-0.60	0.55
20.	I do not wash my hands because the handwashing sinks are not located close enough to my work station.	141	1.55 0.88	52	1.60 0.80	-0.31	0.76
21.	I do not make an effort to wash my hands properly at work.	141	1.52 0.85	52	1.56 0.75	-0.25	0.81
22.	I do not wash my hands properly at work because there is no soap.	141	1.5 0.80	52	1.58 0.78	-0.60	0.55
23.	Proper handwashing at work is important for reducing the chances of a foodborne illness outbreak.	141	4.44 0.59	52	4.27 0.74	1.66	0.10
24.	If I wash my hands properly at work I can control the spread of disease and illness.	141	4.29 0.67	52	4.1 0.75	1.75	0.08

**Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Ethnicity – T-test (cont.)**

Item <sup>3</sup>	Statement <sup>1,2</sup>	White, non-Hispanic		Non-white		t**	Sig
		N	Mean SD	N	Mean SD		
25.	Less people will get a foodborne illness if I wash my hands properly at work.	141	4.23 0.69	52	4.12 0.78	1.02	0.31
26.	I am more satisfied with my work when I wash my hands properly.	141	3.9 1.00	52	3.92 0.88	-0.14	0.89
27.	I am confident I can wash my hands properly at work.	141	4.70 0.49	52	4.42 0.74	3.12	0.002*
28.	I have the skills to wash my hands properly at work.	141	4.74 0.44	52	4.29 0.85	4.78	0*
29.	I am confident I know when to wash my hands at work.	141	4.67 0.54	52	4.4 0.69	2.76	0.006*

<sup>1</sup>All statements were preceded by the instructions to “Choose the response that corresponds to the way you feel.”

<sup>2</sup>All statements were measured on a 5-point Likert scale with 1=strongly disagree, 2=disagree, 3=neither agree or disagree, 4=agree, 5=strongly agree

<sup>3</sup>Items number 1-6 measured Perceived Susceptibility, 7-12 Perceived Severity, 13-22 Perceived Barriers, 23-26 Perceived Benefits, 27-29 and Self-efficacy

\*p-value <0.05

\*\*Independent Sample t-test

## Appendix J - Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Food Safety –T-test

Item <sup>3</sup>	Statement <sup>1,2</sup>	Certified		Not Certified		t**	Sig
		N	Mean SD	N	Mean SD		
1.	If I follow proper handwashing practices at work, my chances of causing a foodborne illness outbreak would decrease.	52	4.81* 0.45	139	4.27* 0.88	4.23	0*
2.	The chances of my customers getting a foodborne illness are great if I do not wash my hands at work.	52	4.40* 0.72	139	3.91* 1.01	3.20	0.002*
3.	When I think about a foodborne illness occurring at work, I feel concerned.	52	4.40* 0.80	139	3.76* 1.12	3.82	0*
4.	I worry a lot about my customers getting a foodborne illness if I do not wash my hands at work.	52	4.19* 0.91	139	3.76* 1.05	2.60	0.01*
5.	My chances of getting a foodborne illness are great if I do not wash my hands at work.	52	4.17* 0.90	139	3.53* 1.03	3.99	0*
6.	I worry a lot about getting a foodborne illness if I do not wash my hands at work.	52	3.81* 1.03	139	3.34* 1.12	2.64	0.01*
7.	Our customers could get very sick if I do not wash my hands at work.	52	4.40* 0.63	139	4.04* 0.76	3.12	0.002*
8.	If I do not wash my hands at work and a foodborne illness outbreak occurs, our customers would get upset and stop eating at our operations.	52	4.33* 0.65	139	4.01* 0.87	2.36	0.02*
9.	If I do not wash my hands at work and cause a foodborne illness outbreak, the operation could get sued.	52	4.25* 0.68	139	3.97* 0.87	2.09	0.04*
10.	I could lose my job if I did not wash my hands and caused a foodborne illness outbreak.	52	3.92 0.98	139	4.07 0.90	-1.00	0.32
11.	My relationship with my fellow employees would change if I caused a foodborne illness outbreak at work because I did not wash my hands.	52	4.08 0.88	139	3.77 0.97	1.99	0.048*

**Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Food Safety – T-test (cont.)**

Item <sup>3</sup>	Statement <sup>1,2</sup>	Certified		Not Certified		t**	Sig
		N	Mean SD	N	Mean SD		
12.	I am afraid to think about the possibility of a foodborne illness outbreak at my operation.	52	3.44 1.33	139	3.23 1.17	1.05	0.30
13.	I would wash my hands properly at work if I knew more about food safety.	52	2.83 1.40	139	2.81 1.15	0.11	0.92
14.	Washing my hands irritates my skin.	52	2.50 1.26	139	2.23 1.17	1.37	0.17
15.	The water is too hot to wash my hands properly at work.	52	2.10 1.27	139	1.95 1.06	0.81	0.42
16.	When I am in a hurry at work I do not wash my hands.	52	1.65 0.97	139	1.73 0.84	-0.51	0.61
17.	Washing my hands properly at work is an inconvenience.	52	1.69 1.06	139	1.65 0.89	0.26	0.79
18.	There is not enough time at work to wash my hands properly.	52	1.46 0.87	139	1.67 0.86	-1.49	0.14
19.	I do not wash my hands properly at work because there are no paper towels.	52	1.56 1.02	139	1.64 0.89	-0.55	0.58
20.	I do not wash my hands because the handwashing sinks are not located close enough to my work station.	52	1.58 1.00	139	1.53 0.75	0.39	0.70
21.	I do not make an effort to wash my hands properly at work.	52	1.44 0.94	139	1.53 0.72	-0.71	0.48
22.	I do not wash my hands properly at work because there is no soap.	52	1.48 0.98	139	1.52 0.71	-0.32	0.75
23.	Proper handwashing at work is important for reducing the chances of a foodborne illness outbreak.	52	4.65* 0.56	139	4.30* 0.63	3.53	0.001*
24.	If I wash my hands properly at work I can control the spread of disease and illness.	52	4.40* 0.77	139	4.18* 0.64	2.03	0.04*



**Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Food Safety - T-test (cont.)**

Item <sup>3</sup>	Statement <sup>1,2</sup>	Certified		Not Certified		t <sup>**</sup>	Sig
		N	Mean SD	N	Mean SD		
25.	Less people will get a foodborne illness if I wash my hands properly at work.	52	4.48* 0.67	139	4.10* 0.71	3.36	0.001*
26.	I am more satisfied with my work when I wash my hands properly.	52	4.08 1.01	139	3.83 0.95	1.55	0.123
27.	I am confident I can wash my hands properly at work.	52	4.69 0.54	139	4.60 0.56	0.97	0.33
28.	I have the skills to wash my hands properly at work.	52	4.75 0.48	139	4.58 0.64	1.79	0.08
29.	I am confident I know when to wash my hands at work.	52	4.77* 0.469	139	4.54* 0.62	2.43	0.02*

<sup>1</sup>All statements were preceded by the instructions to “Choose the response that corresponds to the way you feel.”

<sup>2</sup>All statements were measured on a 5-point Likert scale with 1=strongly disagree, 2=disagree, 3=neither agree or disagree, 4=agree, 5=strongly agree

<sup>3</sup>Items number 1-6 measured Perceived Susceptibility, 7-12 Perceived Severity, 13-22 Perceived Barriers, 23-26 Perceived Benefits, 27-29 and Self-efficacy

\*p-value <0.05

\*\*Independent Sample t-test

## Appendix K - Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self- efficacy Based on Classification – T-test

Item <sup>3</sup>	Statement <sup>1,2</sup>	Student		Full-time		t**	Sig
		N	Mean SD	N	Mean SD		
1.	If I follow proper handwashing practices at work, my chances of causing a foodborne illness outbreak would decrease.	138	4.32 0.88	55	4.64 0.62	-2.45	0.02*
2.	The chances of my customers getting a foodborne illness are great if I do not wash my hands at work.	138	3.86 0.98	55	4.55 0.72	-4.68	0*
3.	When I think about a foodborne illness occurring at work, I feel concerned.	138	3.72 1.12	55	4.47 0.79	-4.57	0*
4.	I worry a lot about my customers getting a foodborne illness if I do not wash my hands at work.	138	3.67 1.06	55	4.44 0.74	-4.94	0*
5.	My chances of getting a foodborne illness are great if I do not wash my hands at work.	138	3.48 1.05	55	4.31 0.74	-5.36	0*
6.	I worry a lot about getting a foodborne illness if I do not wash my hands at work.	138	3.25 1.13	55	4.09 0.82	-5.05	0*
7.	Our customers could get very sick if I do not wash my hands at work.	138	4.05 0.79	55	4.36 0.59	-2.67	0.008*
8.	If I do not wash my hands at work and a foodborne illness outbreak occurs, our customers would get upset and stop eating at our operations.	138	4.07 0.89	55	4.18 0.64	-0.88	0.38
9.	If I do not wash my hands at work and cause a foodborne illness outbreak, the operation could get sued.	138	4.01 0.85	55	4.15 0.78	-0.99	0.33
10.	I could lose my job if I did not wash my hands and caused a foodborne illness outbreak.	138	4.13 0.83	55	3.80 1.09	2.29	0.02*
11.	My relationship with my fellow employees would change if I caused a foodborne illness outbreak at work because I did not wash my hands.	138	3.77 0.99	55	4.07 0.84	-2.01	0.046*

**Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Classification - T-test (cont.)**

Item <sup>3</sup>	Statement <sup>1, 2</sup>	Student		Full-time		t**	Sig
		N	Mean SD	N	Mean SD		
12.	I am afraid to think about the possibility of a foodborne illness outbreak at my operation.	138	3.16 1.17	55	3.66 1.27	-2.58	0.01*
13.	I would wash my hands properly at work if I knew more about food safety.	138	2.88 1.20	55	2.67 1.33	1.10	0.27
14.	Washing my hands irritates my skin.	138	2.29 1.16	55	2.32 1.25	-0.16	0.87
15.	The water is too hot to wash my hands properly at work.	138	2.01 1.10	55	1.98 1.19	0.14	0.89
16.	When I am in a hurry at work I do not wash my hands.	138	1.69 0.83	55	1.75 0.95	-0.42	0.68
17.	Washing my hands properly at work is an inconvenience.	138	1.63 0.88	55	1.81 1.12	-1.21	0.23
18.	There is not enough time at work to wash my hands properly.	138	1.59 0.79	55	1.73 1.06	-1.01	0.32
19.	I do not wash my hands properly at work because there are no paper towels.	138	1.57 0.82	55	1.78 1.13	-1.48	0.14
20.	I do not wash my hands because the handwashing sinks are not located close enough to my work station.	138	1.49* 0.70	55	1.76* 1.15	-2.05	0.04*
21.	I do not make an effort to wash my hands properly at work.	138	1.47 0.70	55	1.69 1.07	-1.68	0.09
22.	I do not wash my hands properly at work because there is no soap.	138	1.46 0.67	55	1.69 1.07	-1.81	0.07
23.	Proper handwashing at work is important for reducing the chances of a foodborne illness outbreak.	138	4.33 0.64	55	4.56 0.60	-2.36	0.02*
24.	If I wash my hands properly at work I can control the spread of disease and illness.	138	4.12 0.68	55	4.53 0.63	-3.81	0*

### Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Classification – T-test (cont.)

Item <sup>3</sup>	Statement <sup>1,2</sup>	Student		Full-time		t**	Sig
		N	Mean SD	N	Mean SD		
25.	Less people will get a foodborne illness if I wash my hands properly at work.	138	4.13 0.73	55	4.38 0.65	-2.22	0.03*
26.	I am more satisfied with my work when I wash my hands properly.	138	3.83 0.93	55	4.09 1.04	-1.68	0.10
27.	I am confident I can wash my hands properly at work.	138	4.62 0.60	55	4.65 0.48	-0.43	0.67
28.	I have the skills to wash my hands properly at work.	138	4.61 0.64	55	4.64 0.52	-0.28	0.78
29.	I am confident I know when to wash my hands at work.	138	4.55 0.64	55	4.47 0.46	-1.67	0.10

<sup>1</sup>All statements were preceded by the instructions to “Choose the response that corresponds to the way you feel.”

<sup>2</sup>All statements were measured on a 5-point Likert scale with 1=strongly disagree, 2=disagree, 3=neither agree or disagree, 4=agree, 5=strongly agree

<sup>3</sup>Items number 1-6 measured Perceived Susceptibility, 7-12 Perceived Severity, 13-22 Perceived Barriers, 23-26 Perceived Benefits, 27-29 and Self-efficacy

\*p-value <0.05

\*\*Independent sample t-test

## Appendix L - Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self- efficacy Based on Work Experience - ANOVA

Item <sup>3</sup>	Statement <sup>1,2</sup>	<1 Year		1-3 Years		>3 years		F**	Sig
		N	Mean SD	N	Mean SD	N	Mean SD		
1.	If I follow proper handwashing practices at work, my chances of causing a foodborne illness outbreak would decrease.	92	4.26 0.81	70	4.51 0.86	31	4.61 0.72	3.07	0.049*
2.	The chances of my customers getting a foodborne illness are great if I do not wash my hands at work.	92	3.84 0.94	70	4.09 0.96	31	4.65 0.80	8.87	0*
3.	When I think about a foodborne illness occurring at work, I feel concerned.	92	3.77 1.12	70	3.87 1.08	31	4.55 0.81	6.40	0.002*
4.	I worry a lot about my customers getting a foodborne illness if I do not wash my hands at work.	92	3.33 1.05	70	3.83 1.05	31	4.48 0.89	6.73	0.001*
5.	My chances of getting a foodborne illness are great if I do not wash my hands at work.	92	3.49 1.04	70	3.66 0.99	31	4.52 0.72	12.92	0*
6.	I worry a lot about getting a foodborne illness if I do not wash my hands at work.	92	3.73 1.01	70	3.34 1.13	31	4.29 0.94	10.57	0*
7.	Our customers could get very sick if I do not wash my hands at work.	92	3.98 0.74	70	4.23 0.77	31	4.42 0.62	5.01	0.008*
8.	If I do not wash my hands at work and a foodborne illness outbreak occurs, our customers would get upset and stop eating at our operations.	92	3.97 0.83	70	4.23 0.84	31	4.19 0.75	2.26	0.11
9.	If I do not wash my hands at work and cause a foodborne illness outbreak, the operation could get sued.	92	3.89 0.85	70	4.23 0.78	31	4.13 0.85	3.50	0.03*
10.	I could lose my job if I did not wash my hands and caused a foodborne illness outbreak.	92	4.14 0.78	70	4.11 0.89	31	3.53 1.20	5.62	0.004*
11.	My relationship with my fellow employees would change if I caused a foodborne illness outbreak at work because I did not wash my hands.	92	3.83 0.92	70	3.8 1.00	31	4.06 0.96	0.90	0.41

**Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Work Experience – ANOVA (cont.)**

Item <sup>3</sup>	Statement <sup>1,2</sup>	<1 Year		1-3 Years		> 3 years		F**	Sig
		N	Mean SD	N	Mean SD	N	Mean SD		
12.	I am afraid to think about the possibility of a foodborne illness outbreak at my operation.	92	3.25 1.11	70	3.17 1.23	31	3.76 1.46	2.564	0.08
13.	I would wash my hands properly at work if I knew more about food safety.	92	2.84 1.14	70	2.74 1.19	31	2.97 1.45	0.38	0.68
14.	Washing my hands irritates my skin.	92	2.30 1.16	70	2.28 1.20	31	2.33 1.27	0.03	0.97
15.	The water is too hot to wash my hands properly at work.	92	2.03 1.11	70	1.94 1.07	31	2.03 1.28	0.14	0.87
16.	When I am in a hurry at work I do not wash my hands.	92	1.73 0.87	70	1.69 0.84	31	1.68 0.91	0.38	0.68
17.	Washing my hands properly at work is an inconvenience.	92	1.77 0.96	70	1.51 0.78	31	1.80 1.24	1.73	0.18
18.	There is not enough time at work to wash my hands properly.	92	1.67 0.85	70	1.56 0.83	31	1.65 1.05	0.36	0.70
19.	I do not wash my hands properly at work because there are no paper towels.	92	1.67 0.93	70	1.47 0.72	31	1.84 1.24	1.95	0.15
20.	I do not wash my hands because the handwashing sinks are not located close enough to my work station.	92	1.63 0.82	70	1.39 0.64	31	1.77 1.26	2.77	0.07
21.	I do not make an effort to wash my hands properly at work.	92	1.57 0.79	70	1.41 0.63	31	1.71 1.22	1.52	0.22
22.	I do not wash my hands properly at work because there is no soap.	92	1.57 0.76	70	1.39 0.62	31	1.7 1.15	1.95	0.15
23.	Proper handwashing at work is important for reducing the chances of a foodborne illness outbreak.	92	4.21 0.64	70	4.53 0.56	31	4.65 0.66	8.57	0*
24.	If I wash my hands properly at work I can control the spread of disease and illness.	92	4.05 0.64	70	4.33 0.68	31	4.58 0.72	8.30	0*

**Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Work Experience – ANOVA (cont.)**

Item <sup>3</sup>	Statement <sup>1,2</sup>	<1 Year		1-3 Years		>3 years		F**	Sig
		N	Mean SD	N	Mean SD	N	Mean SD		
25.	Less people will get a foodborne illness if I wash my hands properly at work.	92	4.05 0.69	70	4.33 0.72	31	4.35 0.76	3.84	0.02*
26.	I am more satisfied with my work when I wash my hands properly.	92	3.85 0.89	70	4.00 0.92	31	3.87 1.28	0.51	0.60
27.	I am confident I can wash my hands properly at work.	92	4.53 0.64	70	4.70 0.49	31	4.74 0.45	2.56	0.08
28.	I have the skills to wash my hands properly at work.	92	4.52 0.62	70	4.69 0.63	31	4.74 0.51	2.24	0.11
29.	I am confident I know when to wash my hands at work.	92	4.42 0.70	70	4.73 0.45	31	4.81 0.40	8.02	0*

<sup>1</sup>All statements were preceded by the instructions to “Choose the response that corresponds to the way you feel.”

<sup>2</sup>All statements were measured on a 5-point Likert scale with 1=strongly disagree, 2=disagree, 3=neither agree or disagree, 4=agree, 5=strongly agree

<sup>3</sup>Items number 1-6 measured Perceived Susceptibility, 7-12 Perceived Severity, 13-22 Perceived Barriers, 23-26 Perceived Benefits, 27-29 and Self-efficacy

\*p-value <0.05

\*\*ANOVA using the Tukey post hoc test

## Appendix M - Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self- efficacy Based on Position - ANOVA

Item <sup>3</sup>	Statement <sup>1,2</sup>	Service (n=96)	Sanitation (n=26)	Production (n=34)	Supervisor/Manager (n=37)		
		Mean SD	Mean SD	Mean SD	Mean SD	F**	Sig
1.	If I follow proper handwashing practices at work, my chances of causing a foodborne illness outbreak would decrease.	4.37 0.79	4.08 1.16	4.59 0.78	4.65 0.54	3.29	0.02*
2.	The chances of my customers getting a foodborne illness are great if I do not wash my hands at work.	3.84 1.03	4.08 0.94	4.32 0.95	4.30 0.70	3.31	0.02*
3.	When I think about a foodborne illness occurring at work, I feel concerned.	3.88 1.02	3.62 1.30	4.06 1.21	4.16 0.96	1.54	0.21
4.	I worry a lot about my customers getting a foodborne illness if I do not wash my hands at work.	3.75 0.96	4.31 0.74	4.00 1.10	3.81 1.24	2.25	0.08
5.	My chances of getting a foodborne illness are great if I do not wash my hands at work.	3.55 1.00	3.77 1.07	3.97 1.06	3.81 1.05	1.62	0.19
6.	I worry a lot about getting a foodborne illness if I do not wash my hands at work.	3.34 1.06	3.77 1.11	3.74 1.11	3.35 1.23	1.84	0.14
7.	Our customers could get very sick if I do not wash my hands at work.	4.05 0.88	4.12 0.65	4.29 0.63	4.22 0.85	1.07	0.34
8.	If I do not wash my hands at work and a foodborne illness outbreak occurs, our customers would get upset and stop eating at our operations.	4.05 0.88	4.12 0.65	4.32 0.64	4.00 0.94	1.12	0.34
9.	If I do not wash my hands at work and cause a foodborne illness outbreak, the operation could get sued.	3.93 0.80	4.19 0.85	4.18 0.90	4.14 0.82	1.35	0.26
10.	I could lose my job if I did not wash my hands and caused a foodborne illness outbreak.	4.07 0.85	4.04 1.11	4.12 0.77	3.84 1.07	0.71	0.55



**Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Position - ANOVA (cont.)**

Item <sup>3</sup>	Statement <sup>1,2</sup>	Service	Sanitation	Production	Supervisor/Manager	F**	Sig
		(n=96)	(n=26)	(n=34)	(n=37)		
		Mean SD	Mean SD	Mean SD	Mean SD		
11.	My relationship with my fellow employees would change if I caused a foodborne illness outbreak at work because I did not wash my hands.	3.83 0.93	4.12 0.77	3.88 1.04	3.70 1.08	0.98	0.40
12.	I am afraid to think about the possibility of a foodborne illness outbreak at my operation.	3.40 1.13	3.20 1.16	3.67 1.24	2.76 1.3	3.90	0.01*
13.	I would wash my hands properly at work if I knew more about food safety.	2.93 1.21	3.00 1.30	2.50 1.13	2.65 1.21	1.48	0.22
14.	Washing my hands irritates my skin.	2.19 1.13	2.38 2.04	2.64 1.25	2.27 1.26	1.21	0.31
15.	The water is too hot to wash my hands properly at work.	2.00 1.07	3.96 1.11	2.24 1.35	1.73 0.99	1.26	0.29
16.	When I am in a hurry at work I do not wash my hands.	1.64 0.81	1.96 1.04	1.71 0.84	1.76 0.96	0.98	0.40
17.	Washing my hands properly at work is an inconvenience.	1.56 0.83	2.04 1.21	1.79 0.88	1.62 1.04	1.95	0.12
18.	There is not enough time at work to wash my hands properly.	1.60 <sup>*x</sup> 0.84	2.12 <sup>*xy</sup> 1.14	1.65 0.81	1.30 <sup>*y</sup> 0.57	4.87	0.003*
19.	I do not wash my hands properly at work because there are no paper towels.	1.57 <sup>*x</sup> 0.83	2.19 <sup>*xya</sup> 1.30	1.56 <sup>*y</sup> 0.71	1.43 <sup>*xa</sup> 0.90	4.18	0.007*
20.	I do not wash my hands because the handwashing sinks are not located close enough to my work station.	1.52 <sup>*</sup> 0.73	1.96 <sup>*x</sup> 1.15	1.5 <sup>*</sup> 0.75	1.38 <sup>*x</sup> 0.79	2.87	0.04*
21.	I do not make an effort to wash my hands properly at work.	1.47 0.68	1.81 1.10	1.50 0.75	1.46 0.80	1.39	0.25
22.	I do not wash my hands properly at work because there is no soap.	1.47 0.66	1.92 1.19	1.56 0.71	1.35 0.79	2.93	0.04*

### Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Position - ANOVA (cont.)

Item <sup>3</sup>	Statement <sup>1,2</sup>	Service	Sanitation	Production	Supervisor/Manager	F**	Sig
		(n=96)	(n=26)	(n=34)	(n=37)		
		Mean SD	Mean SD	Mean SD	Mean SD		
23.	Proper handwashing at work is important for reducing the chances of a foodborne illness outbreak.	4.32 0.59	4.23 0.82	4.53 0.62	4.57 0.60	2.44	0.06
24.	If I wash my hands properly at work I can control the spread of disease and illness.	4.16 0.64	4.15 0.73	4.44 0.71	4.32 0.75	1.78	0.15
25.	Less people will get a foodborne illness if I wash my hands properly at work.	4.14 0.69	4.00 0.75	4.38 0.74	4.35 0.72	2.25	0.08
26.	I am more satisfied with my work when I wash my hands properly.	3.91 0.90	3.77 1.03	4.06 0.98	3.84 1.09	0.51	0.67
27.	I am confident I can wash my hands properly at work.	4.64 0.56	4.54 0.58	4.56 0.61	4.70 0.52	0.60	0.62
28.	I have the skills to wash my hands properly at work.	4.64 0.55	4.50 0.65	4.59 0.61	4.68 0.75	0.48	0.70
29.	I am confident I know when to wash my hands at work.	4.56 0.63	4.46 0.65	4.56 0.61	4.81 0.40	2.22	0.09

<sup>1</sup>All statements were preceded by the instructions to “Choose the response that corresponds to the way you feel.”

<sup>2</sup>All statements were measured on a 5-point Likert scale with 1=strongly disagree, 2=disagree, 3=neither agree or disagree, 4=agree, 5=strongly agree

<sup>3</sup>Items number 1-6 measured Perceived Susceptibility, 7-12 Perceived Severity, 13-22 Perceived Barriers, 23-26 Perceived Benefits, 27-29 and Self-efficacy

\*p-value <0.05    \*\*ANOVA using the Tukey post hoc test

## Appendix N - Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self- efficacy Based on Knowledge – T-test

Item <sup>3</sup>	Statement <sup>1,2</sup>	Less than Mean		Greater than Mean		t**	Sig
		N	Mean SD	N	Mean SD		
Overall Mean = 21.83 ±							
1.	If I follow proper handwashing practices at work, my chances of causing a foodborne illness outbreak would decrease.	76	4.16 0.90	119	4.58 0.73	-3.60	0.00*
2.	The chances of my customers getting a foodborne illness are great if I do not wash my hands at work.	76	3.84 0.98	119	4.19 0.93	-2.51	0.01*
3.	When I think about a foodborne illness occurring at work, I feel concerned.	76	3.82 1.08	119	4.02 1.09	-1.26	0.21
4.	I worry a lot about my customers getting a foodborne illness if I do not wash my hands at work.	76	3.42 1.13	119	3.94 1.08	-0.92	0.36
5.	My chances of getting a foodborne illness are great if I do not wash my hands at work.	76	3.59 1.06	119	3.59 1.06	-1.18	0.24
6.	I worry a lot about getting a foodborne illness if I do not wash my hands at work.	76	3.80 0.95	119	3.53 1.11	-0.66	0.51
7.	Our customers could get very sick if I do not wash my hands at work.	76	4.09 0.70	119	4.18 0.78	-0.77	0.44
8.	If I do not wash my hands at work and a foodborne illness outbreak occurs, our customers would get upset and stop eating at our operations.	76	4.03 0.83	119	4.16 0.82	-1.10	0.27
9.	If I do not wash my hands at work and cause a foodborne illness outbreak, the operation could get sued.	76	3.88 0.71	119	4.16 0.88	-2.31	0.02*
10.	I could lose my job if I did not wash my hands and caused a foodborne illness outbreak.	76	3.95 0.80	119	4.08 0.98	-1.06	0.29
11.	My relationship with my fellow employees would change if I caused a foodborne illness outbreak at work because I did not wash my hands.	76	3.76 0.86	119	3.92 1.01	-1.15	0.25

### Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Knowledge - T-test (cont.)

Item <sup>3</sup>	Statement <sup>1, 2</sup>	Less than Mean		Greater than Mean		t**	Sig
		N	Mean SD	N	Mean SD		
12.	I am afraid to think about the possibility of a foodborne illness outbreak at my operation.	76	3.37 1.212	119	3.26 1.22	0.58	0.56
13.	I would wash my hands properly at work if I knew more about food safety.	76	2.86 1.23	119	2.77 1.21	0.46	0.65
14.	Washing my hands irritates my skin.	76	2.39 1.19	119	2.24 1.19	0.89	0.38
15.	The water is too hot to wash my hands properly at work.	76	2.00 1.07	119	2.00 1.16	0.000	1.00
16.	When I am in a hurry at work I do not wash my hands.	76	1.89 0.93	119	1.60 0.82	2.35	0.02*
17.	Washing my hands properly at work is an inconvenience.	76	1.83 0.96	119	1.60 0.94	1.62	0.10
18.	There is not enough time at work to wash my hands properly.	76	1.80 0.85	119	1.52 0.88	2.21	0.03*
19.	I do not wash my hands properly at work because there are no paper towels.	76	1.67 0.89	119	1.59 0.94	0.61	0.54
20.	I do not wash my hands because the handwashing sinks are not located close enough to my work station.	76	1.67 0.82	119	1.50 0.87	1.40	0.16
21.	I do not make an effort to wash my hands properly at work.	76	1.62 0.80	119	1.48 0.83	1.16	0.25
22.	I do not wash my hands properly at work because there is no soap.	76	1.59 0.77	119	1.47 0.80	1.00	0.32
23.	Proper handwashing at work is important for reducing the chances of a foodborne illness outbreak.	76	4.20 0.67	119	4.53 0.58	-3.66	0.00*
24.	If I wash my hands properly at work I can control the spread of disease and illness.	76	4.14 0.74	119	4.29 0.68	-1.36	0.17

**Beliefs and Perceptions of Susceptibility, Severity, Benefits, Barriers, Self-efficacy Based on Knowledge - T-test (cont.)**

Item <sup>3</sup>	Statement <sup>1,2</sup>	Less than Mean		Greater than Mean		t**	Sig
		N	Mean SD	N	Mean SD		
25.	Less people will get a foodborne illness if I wash my hands properly at work.	76	4.11 0.72	119	4.28 0.71	-1.636	0.10
26.	I am more satisfied with my work when I wash my hands properly.	76	3.88 0.97	119	3.93 0.97	-0.36	0.72
27.	I am confident I can wash my hands properly at work.	76	4.55 0.60	119	4.67 0.54	-1.45	0.15
28.	I have the skills to wash my hands properly at work.	76	4.55 0.60	119	4.66 0.61	-1.25	0.21
29.	I am confident I know when to wash my hands at work.	76	4.50 0.66	119	4.66 0.64	-1.89	0.06

<sup>1</sup>All statements were preceded by the instructions to “Choose the response that corresponds to the way you feel.”

<sup>2</sup>All statements were measured on a 5-point Likert scale with 1=strongly disagree, 2=disagree, 3=neither agree or disagree, 4=agree, 5=strongly agree

<sup>3</sup>Items number 1-6 measured Perceived Susceptibility, 7-12 Perceived Severity, 13-22 Perceived Barriers, 23-26 Perceived Benefits, 27-29 and Self-efficacy

\*p-value <0.05

\*\*Independent Sample t-test

## Appendix O - Self-efficacy based on Student/Ethnicity – T-test

Item <sup>3</sup>	Statement <sup>1,2</sup>	Student White, Non- Hispanic		Student Non-white		t**	Sig
		N	Mean SD	N	Mean SD		
	Self-efficacy						
27.	I am confident I can wash my hands properly at work.	98	4.71 0.50	40	4.38 0.74	3.13	0.000*
28.	I have the skills to wash my hands properly at work.	98	4.77 0.43	40	4.23 0.89	4.82	0.000*
29.	I am confident I know when to wash my hands at work.	98	4.64 0.58	40	4.33 0.73	2.71	0.01*

<sup>1</sup>All statements were preceded by the instructions to “Choose the response that corresponds to the way you feel.”

<sup>2</sup>All statements were measured on a 5-point Likert scale with 1=strongly disagree, 2=disagree, 3=neither agree or disagree, 4=agree, 5=strongly agree

<sup>3</sup>Items number 1-6 measured Perceived Susceptibility, 7-12 Perceived Severity, 13-22 Perceived Barriers, 23-26 Perceived Benefits, 27-29 and Self-efficacy

\*p-value <0.05