

Fall 2020

# Assessing Hotel Employee Knowledge on Risk Factors and Risk Management Procedures for Microbial Contamination of Hotel Water Distribution Systems

Brandon Leftwich

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ASSESSING HOTEL EMPLOYEE KNOWLEDGE ON RISK FACTORS AND RISK  
MANAGEMENT PROCEDURES FOR MICROBIAL CONTAMINATION OF HOTEL  
WATER DISTRIBUTION SYSTEMS

by

BRANDON LEFTWICH

(Under the Direction of Atin Adhikari)

ABSTRACT

*Background:* Compromised hotel water supply lines by neglect or by physical and structural damage can lead to exposure of harmful pathogens to guests and staff. To reduce the risk of having contaminated water in a hotel plumbing system, some facilities may incorporate a water safety plan (WSP). WSPs are not mandatory for hotels in many US states, including the state of Georgia. As such, many hotel personnel are uninformed of WSPs and the precautions to take if their hotel water system is compromised. The purpose of this study was to identify hotel personnel's knowledge and practices of WSPs through a survey incorporating the Health Belief Model (HBM). *Methods:* Data were collected from 59 hotels within Fulton County, Georgia, through a questionnaire, and questions were developed tailored to the HBM. *Results:* Significant associations were found between the perceived susceptibility of contracting a waterborne illness and WMP for hotel personnel as well as between cues to action and having a WMP in general linear models ( $p < 0.05$ ). *Conclusions:* Our study concluded that many key personnel are not aware of WSPs. Many hotel facilities do not have a plan in place, and some facilities are unaware of a current plan in place. This study provides insight into the importance of WSP and the risk factors associated with microbial contamination in a hotel building's plumbing system. Future research and potential law change should be emphasized due to employees' and owners' lack of knowledge and for the continuation of waterborne outbreaks in hotel facilities.

INDEX WORDS: Health belief model; Hotels; Water safety plans; Legionella; Microbial contamination

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WATER DISTRIBUTION SYSTEMS

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A Dissertation Submitted to the Graduate Faculty of the Georgia Southern University

In Partial Fulfillment of the Requirements for the Degree of

DOCTOR OF PUBLIC HEALTH

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December 2020

## ACKNOWLEDGMENTS

I would like to personally give thanks to God for giving me the strength to make it through this dissertation process. I would like to show appreciation to all the hotel personnel who participated in this study. Thank you for your time and courtesy. Thank you to all my Family and friends for the love and support during my tenure at Georgia Southern. A special thanks to my chair and committee members for preparing me and providing great guidance on this stressful journey.

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## CHAPTER 1

### INTRODUCTION

Assessing risk factors and risk management procedures for potential microbial contamination of Georgia hotel water distribution systems.

#### **Background**

Having a safe water supply is an essential part of maintaining a great quality of life. In 1974 the Safe Drinking Water Act (SDWA) was established in which the Environmental Protection Agency (EPA) was required to set standards for drinking water quality (EPA, 2017). With corroboration with local and state partners EPA must implement various standards and control programs to ensure safe drinking water. (EPA, 2017). Often, events may occur that may compromise a water supply system that serves the public. When water supply systems are threatened, the utility provider and in some cases local health authorities will issue a boil water advisory. A Boil Water Advisory (BWA) is a public service announcement that water should be boiled before consuming it due to the threat of contamination. Causes of a BWA may include a main break in the water supply line, the pressure loss in the water lines, loss of power, positive bacteria lab tests from the water source providers, and natural disasters. It is required by law for water utility providers to ensure water is safe when entering homes and businesses. However, it is the responsibility of the landowner and homeowner to maintain the water once it has entered the premise.

When water supply lines are compromised by neglect of maintenance or by physical structural damage, it can lead the public susceptible to harmful bacteria and viruses. These

microorganisms causing waterborne diseases include but not limited to: *Legionella*, *Cryptosporidium*, *Giardia*, *Escherichia coli*, and more. Drinking water can also be contaminated due to the lack of maintenance of the buildings water system, which will be further explained in this study.

To help reduce the risk of having contaminated drinking water in hotels, some facilities incorporate a water safety plan (WSP), sometimes referred to as Risk Management Plan (RMP) or Water Management Plan (WMP) which terms will be interchangeable throughout this dissertation. These plans identify potential hazards within the hotel and provide procedures that the building operators and managers must perform to ensure that the water is safe for human consumption. WSPs must also address what procedures to take if *Legionella* or other harmful microbial pathogens are detected.

In the state of Georgia, under the Official Code of Georgia (O.C.G.A. 31-28-5) hotels and motels are regulated by the Georgia Department of Public Health through its respective county boards of health to ensure the protection of the public's health. Hotels are classified as a tourist accommodation. DPH defines a tourist accommodation as: "means any facility consisting of two or more rooms or dwelling units providing lodging and other accommodations to the general public, such as tourist courts, tourist cottages, tourist homes, trailer parks, trailer courts, motels, motor hotels, hotels, and any similar place by whatever name called and any food, beverage, laundry, recreational or other facilities or establishments operated in conjunction therewith. This definition includes any facility consisting of two or more rooms or dwelling units either joined together or separate on a common piece of property, furnished for pay, and further includes campgrounds, recreational vehicle parks and bed and breakfast inns. A tourist accommodation is

not a facility intended for permanent residence, or a facility available only to members of a club or through private lease or invitation” (Georgia Department of Public Health, pg.9, 2014).

According to the Georgia Department of Public Health’s Digital Health Department Database nearly 2,000 tourist accommodations are permitted in the state of Georgia (DHD, 2018). The hotel industry has a tremendous economic impact within the state of Georgia. According to the Georgia Hotel and Lodging Association, “9.7 percent of all jobs in Georgia are directly or indirectly related to the lodging industry, with hotels, motels, resorts, or lodges generating \$3.7 billion in direct sales... Georgia's lodging industry employs 56,703 people, earning \$2.5 billion in total employee wages and serving more than 48 million visitors annually” (GHLA.net, 2018). An outbreak could be devastating not only to a hotel’s reputation and finances but, more importantly, to its workers and patrons they serve. For example, a 2010 press release by the CDC estimated an annual cost for Legionnaires' disease of \$101-321 million (CDC Press Release, 2010).

### **Purpose of the study**

The purpose of this study was to assess the risk management procedures for potential microbial contamination of Georgia hotel water distribution systems and to assess risk factors associated with waterborne illnesses through a questionnaire survey incorporating the HBM. The following specific research questions were addressed in this study: (1) is there a significant relationship between hotel workers’ knowledge of water management plans and perceived susceptibility of waterborne illness for hotels? (2) what are the perceived benefits and barriers identified by hotel workers for implementing water management plans? (3) how do cues to action correlate with implementing water management plans in hotel establishments? (4) do hotel workers feel it’s necessary to have a water management plan to prevent the risk of microbial

contamination in hotel water systems? The main intent was to provide a foundation to (1) develop resourceful guidelines to provide hotel facilities to help reduce the risk of a waterborne illness outbreak; (2) increase awareness for the need for water safety plans for tourist accommodation hotels and (3) increase knowledge of risk factors associated with hotel waterborne disease outbreaks.

### **Significance of the Study**

Currently, the State of Georgia Department of Public Health does not have any mandatory guidelines to prevent hotel facilities water system from being comprised. DPH has recommendations for tourist accommodations after there has been a *Legionella* report. DPH developed the Georgia Legionellosis control and investigation manual, which is used for investigating an outbreak. For tourist accommodation associated cases, “if a person with *Legionella* reports overnight stay at a tourist accommodation, they will be classified as a travel-associated case” (Georgia Legionellosis Control and Investigation Manual, p. 9, 2017). The manual further instructs if a single travel-associated case is reported for a tourist accommodation, the facility should be notified for their situational awareness. Also, DPH states that the health authority should provide the facility with educational material about prevention of *Legionella* for tourist accommodations, including the CDC Water Management Program Toolkit. The facility should implement a water management plan to prevent Legionella, per CDC recommendations. If the facility had a WMP in place, they should review the plan and revise it as needed (Georgia Legionellosis Control and Investigation Manual, p. 9, 2017). However, many hotel owners, managers, and employees are not aware of what precautions to take if their hotel water system is compromised. This lack of knowledge can hinder their proactive roles in helping to raise

awareness about the water quality standards and implementing these standards in Georgia hotels and tourist accommodations.

There is little to no literature on WSP plans in buildings' water supply systems, particularly for hotels. This study was intended to identify the gaps between limited knowledge of WSPs and the increased need for water safety plans for hotel facilities, which can ensure a safe environment for the public. By completing this study, the findings will be used to explain what barriers hotel owners and or management are facing that are preventing them from developing a water safety plan. In return, these findings can be used for potential policy change within the plumbing code and for the tourist accommodations rules and regulations in the state of Georgia. If these barriers are identified and addressed, the potential for hotels to have a smooth transition for adopting a water safety plan will be favorable.

## Abbreviations used in text

ASHARE- American Society of Heating, Refrigerating and Air-Conditioning Engineers

BWA- Boil Water Advisory

CDC- Center for Disease Control and Prevention

DFA- Direct Fluorescent Antibody

DPH - Department of Public Health

EPA- Environmental Protection Agency

HACCP- Hazard Analysis Critical Control Point

LD- Legionaries Disease

LP- *Legionella pneumophila*

OPPP- Opportunistic Premise Plumbing Pathogens

WHO- World Health Organization

WMP- Water Management Plan

WSP- Water Safety Plan

## CHAPTER 2

### LITERATURE REVIEW

Hotels pose a significant threat to being exposed to *Legionella* if hotel water systems are not properly maintained and accounted for. As stated earlier in chapter 1, *Legionella* can be found in the natural environment, however *Legionella* can become a threat when favorable conditions are amplified where growth and exposure is increased. Increase risk of survival includes stagnation/ lack of sufficient and consistent water flow (water heaters, tanks, reservoirs, and basin), water temperatures of 68 to 122 degrees Fahrenheit, and the presence of biofilm (Green, 2013). When adding the lack of maintenance for swimming pool and spa, neglected deactivated water fountains, and other points of use of water makes a poorly maintained hotel a risk factor for *Legionella*.

#### **Opportunistic Premise Plumbing Pathogens**

Premise plumbing is referred to as the water piping that connects from the main water distribution system within the building to the point of use (all faucets and fixtures). When the components of a plumbing system are left untreated, not maintained, or constructed of poor design and material, it increases the risk for opportunistic pathogens to grow. These pathogens are commonly referred to as opportunistic premise plumbing pathogens (OPPPs). Opportunistic premise plumbing pathogens are microorganisms that are naturally found in the environment. Unlike other commonly known waterborne pathogens, the opportunistic premise plumbing pathogens are native to the premise plumbing environment and are adapted to survival, growth, and persistence in drinking water distribution systems and premise plumbing (Falkinham, III, p.374, 2015). These pathogens differ from fecal pathogens because they do not need human or



animal host to survive and these opportunistic pathogens do not correlate with the total coliform and *E. coli* testing that is routinely used for testing drink water.

The goal for water treatment is to remove potentially harmful bacteria from potable water however, the OPPPs can reoccur if water systems are not continuously maintained. “*Legionella pneumophila*, *Mycobacterium avium*, *Pseudomonas aeruginosa*, *Methylobacterium spp.*, *Acinetobacter baumannii*, and *Aeromonas hydrophila* have all been found in premise plumbing” (Falkinham III, 2015). Falkinham further states that premise plumbing has numerous inimitable characteristics, such as high surface to volume ratio, distinct pipe materials, low organic carbon levels, and times of stagnation, that select for correspondingly distinct communities of microorganisms (Falkinham III, 2015). With these complex factors and the lack of constant disinfecting, this will promote the growth of OPPPs. The Georgia Department of Public Health states that *Legionella* is vastly increasing in the state. DPH indicates that 133 cases of *legionellosis* were reported in 2016 which is a 78-case increase from 2011 and a 95-case increase from 2006.

### ***Water Management Plans***

Water Management Plans (WMP), also referred to as Water Safety Plans (WSP) are procedures that identify areas within the plumbing of a building where the potential risk of contamination may occur. According to an article entitled “The human dimension of WSPs” it states that “Water Safety Plans includes a wide-range assessment of current and potential risks throughout a water supply, from the water source to the consumer’s tap (The point of use). While most conventional water management approaches seek to mitigate risks already present in a water supply, a WSP approach is focused on preventing these risks from entering, thus reducing the likelihood that a negative impact on human health will occur” (Kot et al., 2015). The World

Health Organization (WHO) considers Water Safety Plans as the most effective means of consistently ensuring the safety and acceptability of a drinking-water supply. (WHO, 2017)

With identifying potential hazards and taking preventive and corrective measures, the WSP follows a similar approach that is used in the Food industry called HACCP (Hazard Analysis Critical Control Point). The Federal Drug Administration considers HACCP as management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product (FDA, 2017). HACCP plans have been deemed an effective method for building water system management (McCoy & Rosenblatt, 2015). Through various investigations of Legionnaires' disease outbreaks by the CDC, it was discovered that many of the facilities shared common factors:

- 1) Lack of documentation of building water systems and familiarity with water processes, especially in large, complex systems.
- 2) The lack of a systematic program for identifying, monitoring, and controlling factors known to affect microbial growth (e.g., water temperatures, residual levels)
- 3) The lack of inter-disciplinary/inter-departmental communication, e.g., between facility managers and clinicians.

The article of McCoy & Rosenblatt (2015) further states that the CDC Legionnaires' disease Outbreak Response Team has recommended HACCP-based practices for facilities that have been associated with outbreaks of Legionnaires' disease.

The WHO developed drinking water guidelines to "promote the protection of the public's health by encouraging the development of appropriate standards and regulations at the local and

state level along with the adoption of preventive risk management approaches covering catchment to consumer (Water Safety Plans) and independent surveillance to ensure that Water Safety Plans are being implemented and effective and that national standards are being met” (WHO, 2018).

The Center for Disease Control and Prevention (CDC) recognizes the severity of *Legionellosis*. Since *Legionellosis* cases are increasing, the CDC has developed a water management plan tool kit to help large buildings combat *Legionella* growth (CDC.gov Toolkit, 2017). The CDC states that the toolkit is intended to assist building owners/ businesses to understand if their facility is in need of a *Legionella* water management program and also to decrease the risk for Legionnaires’ disease, how to develop the program, and how to maintain the WSP (CDC Toolkit 2018). The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) has developed a standard for minimizing the risk of *Legionella* growth in building plumbing. According to ASHRAE, the purpose of standard 188 is to “institute minimum *legionellosis* risk management requirements for building water system” (ANSI/ASHRAE Standard 188, 2018). ASHRAE further explains that the standard is intended for “the use of owners and managers of human-occupied buildings, excluding single-family residential buildings.” (ANSI/ASHRAE Standard 188, 2018). Though these guidelines and procedures, such as the CDC tool-kit and the ASHRAE standard 188 have been developed over recent years to help building owners be protected from the risk of *Legionella*, these are not mandated and are not required to have by US law. If these guidelines are available, why have hotel managers and owners not adopted these voluntary procedures? Are hotel personnel aware of these resources that are available to them? These questions will be addressed in the proposed study.

### *Legionella and Legionnaires Disease*

One of the most commonly reported and known waterborne disease today is *Legionnaire's disease* (LD) (Water Quality & Health Council, 2018). LD is a pneumonia type disease caused by a bacterium called *Legionella* (*L. pneumophila*, LP). There is approximal 45 different species of legionella found. *Legionella* is a Gram-negative bacteria that is found in fresh water environment (Barna, 2015, p.1). This bacterium becomes an issue when it grows in a buildings' water system. According to the CDC's *Legionella* webpage, "*Legionella* grows best in large complex water systems that are not adequately maintained" (CDC.gov 2018). Hotels are a prime example of a building that comprises of a complex water system.

LD was "discovered" and received its name from an outbreak that occurred at the American Legion convention in Philadelphia Pennsylvania in 1976 (OSHA.gov). There were 180 reported cases with 30 deaths associated with this outbreak. Patients became ill with pneumonia-like symptoms. It was later discovered that the buildings' cooling towers were contaminated when the contaminated water misted into the air. People coming into the building were inhaling the aerosolized mist, thus becoming exposed to the airborne pathogen. It is imperative that facilities maintain adequate maintenance of their water system to reduce and prevent the risk of *Legionella* growth.

The incubation period for LD is typically 2-10 days after exposure depending on the person's immunocompetence. According to the CDC's *Legionella* website symptoms include:

- Cough
- Shortness of breath
- Fever

- Muscle aches
- Headaches

Symptoms are identical to other pneumonia-like infections in which LD could be misdiagnosed if the patient's exposure history is not properly assessed. According to the Georgia Department of Public Health Georgia *Legionellosis* Control and investigation Manual "Laboratory tests to confirm the diagnosis of *Legionellosis* include a positive urine antigen, culture, direct fluorescent antibody (DFA) staining of respiratory samples and tissue, PCR assays of urine, respiratory samples, or blood for *Legionella*. Serologic tests of antibodies are only diagnostic with a 4-fold or greater rise in antibody titer in paired (acute and convalescent) antibody tests collected 4-8 weeks apart" (p.4). *Legionellosis* is a notifiable disease in the state of Georgia. Reports must be made within 7 days of receiving results. *Legionellosis* is a term used that when an illness is caused by *Legionella*, for example, LD or Pontiac fever.

### ***The spread of Legionella***

Though *Legionella* is found in the natural water environment, it does not pose a significant risk to people unless exposure is amplified. *Legionella* grows in buildings water supply lines when the environment is favorable. When conditions are favorable, the growth of *Legionella* can double with in eight hours (Armstrong, 2005). The WHO states that *Legionella* lives and cultivates in water systems at temperatures of 20 to 50 degrees Celsius (68 to 122 degrees Fahrenheit). Other factors that support the growth of *Legionella* include water stagnation, low water pressure/flow, lack of residual disinfectant (such as chlorine), pH of 5.0 to 8.5, sedimentation that grows biofilm, and growth of micro-organisms.

*Legionella* can survive and grow with parasites, such as within free-living protozoa and within biofilms, which develop in water systems (WHO.int). *Legionella* can kill and conquer its host protozoa and replicate within the protozoa body (Atlas, 1999). Biologic growth layers (biofilm) may provide a protected environment for *Legionella* and its host organisms. *Legionella* can be killed at 0.25 ppm chlorine, but they can survive to 4ppm to 10 ppm (Kutchka 1983). The biofilm provides a buffer layer against biocides which makes the bacteria difficult to kill.

### ***Transmission***

The primary route of contracting *Legionella* is by contaminated water aerosolized and inhaled by the susceptible person. Aspiration is another method of transmission for *Legionella*. Aspiration of drinking water occurs when a susceptible person drinks water and that water enters the airway into the lungs instead of entering the esophagus leading to the stomach. There have been no reported cases of *Legionella* being spread via person to person contact (WHO 2018).

### ***Methods of Exposure/ Risk factors for water contaminates***

#### **Cooling towers**

Cooling towers are a method of heating, ventilating, and air conditioning systems (HVAC). Cooling towers use water to remove heat from large buildings such as hotels and hospitals. With the excessive amount of water that is used along with heat exchanges that occurs in the process, it becomes imperative to maintain routine maintenance of the HVAC unit. During the heat exchange of water, fans that are used during the cooling process creates an aerosol mist that is released into the atmosphere. Cooling towers can spread aerosol water over several miles away. In November of 2003, a *Legionella* outbreak occurred in Northern France due to infectious aerosols from the cooling tower of a local plant. In the case study, it indicates that all cases lived

in or visited an area within a 12-km radius of the plant without having any visited places in common (Tran Minh et al., 2006). The temperature of the water used and how it flows through cooling towers range from 85-95 degrees Fahrenheit, which are optimal conditions to support *Legionella* growth. If the cooling tower becomes contaminated with *Legionella*, it exposes and increases the risk of infection for not only the occupants inside the building but for the general public with in the area.

The outbreak of *Legionnaires'* in the American legion hotel in Philadelphia Pennsylvania in 1976 is considered the first known outbreak that was caused by a contaminated cooling tower. Since this event occurred, cases of Legionnaires and other waterborne outbreaks associated with cooling towers still arise. In the summer of 2015 in New York City, a severe outbreak of LD spread in South Bronx. A total number of 138 cases, with 16 cases being fatal, were linked to a single cooling tower from a hotel in the South Bronx (Pascal Lapierre et al., 2017). In this investigation case, 289 samples were collected from 183 cooling towers from facilities in the vicinity of the hotel, which included a homeless shelter, and a local college.

For the findings in the South Bronx outbreak, “a total of 162 (88.5%) cooling towers were positive for *Legionella* species DNA. *L. pneumophila* DNA was detected in 87 (47.5%) cooling towers; 52 (28.4%) cooling towers were positive *L. pneumophila* serogroup 1, and 21 (11.5%) showed negative or inconclusive results” (Lapierre et al., 2017). The study further suggested that cooling towers colonized with *L. pneumophila* might contaminate other sites located nearby, enabling the opportunity for an endemic strain to recreate colonization even after the elimination of the organism. Therefore, cooling towers in hotels should be routinely maintained.

A *Legionella* outbreak occurred at a Sheraton hotel in Atlanta in 2019. According to a press release by DPH, there were 13 confirmed cases of Legionnaires' disease, 68 probable cases, and one death (*Legionella* Outbreak Investigation Update, 2019). The cause of the outbreak was due to bacteria in a cooling tower at the hotel and a decorative fountain in the lobby area. (*Legionella* Outbreak Investigation Update, 2019).

### ***Stagnation and Biofilm***

Slow and nonmoving water in building plumbing can increase the chances of biofilm build up inside the plumbing lines. When the biofilms are present, the risks of *Legionella* and other microbial contaminants are increased. As stated by the CDC, "When water does not flow well, the resulting areas of stagnation encourage biofilm growth, reduce water temperatures to levels that allow *Legionella* to grow, and reduce levels of disinfectant. It is important to understand the flow of water in your building in order to identify areas of risk where water may become stagnant." (CDC 2018). If water is constantly moving, recirculating, or being flushed through the system, it reduces the chance for microbial growth to occur.

Often in the hotel industry, some hotels may not receive fluent occupancy throughout the year. Many hotels may only allow certain sections of the building to be rented until the expected busy season. When this scenario occurs, the chances of the stagnation present itself if hotels that do not have a recirculating plumbing system. In an article entitled *Epidemiology and Ecology of Opportunistic Premise Plumbing Pathogens*, the authors stated "The dwelling time of water in premise plumbing enhances biofilm formation, including the growth of resident pathogens. Although greater water ages are thought to enhance attenuation of traditional enteric pathogens, opportunistic pathogens can adapt and grow at low oxygen levels characteristic of stagnation in premise plumbing" (Falkinham III et al., 2015). This could pose a threat to patrons who maybe



the first to occupy a vacant room after the water has not been used for an extended amount of time. The article further states that opportunistic pathogens have been found to grow in shower heads, faucets, along pipe walls, and in water heaters, which are common sources found in each hotel room.

In an article entitled Biofilms in shower hoses, the authors stated that “shower hoses are the last gauge before the water reaches the end-user and are often used to more easily bathe patients and the elderly whom are at higher risk for opportunistic pathogen infection” (Proctor et al., 2017). It is imperative to have these fixtures cleaned, flushed, and sanitized to help reduce the risk of biofilm formation.

### ***Legionella in Spa/hot tubs***

Spas have been associated with *Legionella* outbreaks. Modern spas are also commonly referred to as hot tubs, whirlpools, and or Jacuzzies. Spas are closed-circuit jetted tubs not drained after every use that is used for recreational/ therapeutic purposes and are commonly found in hotel facilities. DPH defines a spa as “a unit that may have a therapeutic use, but which is not drained, cleaned, or refilled for each individual. It may include, but not be limited to, hydrotherapy jet circulation, hot water/cold water mineral baths, air induction bubbles, or any combination thereof” (DPH, 2017). Spas can serve as an ideal breeding ground for *Legionella*. The Georgia Department of Public Health (DPH) Rules and Regulations for Public Swimming Pools, Spas, and Recreational Water Parks, classifies spas as a class E pool which means that any pool that has a water temperature of 90 °F must fall under this category. Also, in the DPH rules, it states that the water temperature of a spa must not exceed 104 °F. These temperature requirements may support the growth of *Legionella* and other harmful pathogens if disinfectants and maintenance are neglected.

In 2008, The CDC released a Morbidity and Mortality Report authored by Yoder and colleagues that stated *P. aeruginosa* and *Legionella* spp. found in spas were responsible for over 20% of outbreaks associated with recreational waters in 2005 and 2006. During this time, eight of the 23 waterborne outbreaks caused by *Legionella* spp. were spa related, resulting in a total of 124 cases and three deaths. (Yoder et al. 2008).

### ***Pontiac Fever***

*Legionella* can cause another type of illness called Pontiac Fever. Pontiac fever is a Gram-negative bacterium that received its name from an outbreak that occurred in Pontiac Michigan in 1968. Ironically the first identified cases of Pontiac Fever were among people who worked at and visited the city's health department. According to the CDC it was not until *Legionella* was discovered after the 1976 outbreak in Philadelphia that public health officials were able to show that the same bacterium causes both diseases (CDC 2018). Pontiac Fever causes flu-like symptoms such as nausea, vomiting, sore throat, abdominal pain, a non-productive cough, without the presence of pneumonia. Symptoms may begin to show 1 to 3 days after being exposed to the bacteria and usually last less than a week. Risk factors for the disease are the same as LD, which includes people 50 years or older, current or former smokers, people with compromised/ susceptible immune systems, and individuals with chronic illnesses.

In 2011 an outbreak of Pontiac fever occurred at a hotel in Dundee Scotland (BBC.com 2016). According to BBC.com there were eighteen people to have contracted the illness. The article further explains that the spa was not being properly maintained stating that the hot tub was not fully drained, cleaned or disinfected for over two months before the outbreak occurred (bbc.com). This unfortunate situation strengthens the importance of monitoring and maintaining the proper operation of a spa. To further exacerbate the situation *Legionella* bacteria was also

found in the water samples collected from the pool shower and in the showers in the men's dressing room. Chargers were filed against the hotel under the United Kingdom's Health and Safety at Work Act 1974.

### ***Subtropical climate that favors Legionella contamination.***

A recent study was conducted to determine if weather and climate had a positive association with the occurrence of LD. The study states that "daily data was used to evaluate the impacts of precipitation, temperature, and relative humidity on LD occurrence in Taiwan from 1995–2011" (Chen et. al, 2014). The study concluded that in warm, humid regions, an increase of daily precipitation is likely to be a critical weather factor triggering LD occurrence where the risk is found particularly significant at an 11-day lag...Additionally, precipitation at 21–40 and 61–80 mm might make LD occurrence more likely" (Chen et al., 2014). The region that the study was conducted in shares the same type of subtropical climate as Georgia does in which makes this study significant to the State of Georgia. The WHO states that temperature and climate can be risk factors for *Legionella* as "risks from *Legionellae* may be greater in warmer regions (subtropical and tropical), because the temperature is an important factor in the ability of the microorganism to survive and grow" (WHO, The prevention of *Legionellosis*. n.d.).

### ***Barriers to implementing Water safety plans***

Currently, there is minimum literature that addresses the barriers that are hindering hotel facilities from implementing water safety plans. When addressing barriers to implement similar water safety programs, a study was conducted to examine the willingness and ability of water utilities to implement water safety plans in North Carolina and what barriers and bridges may exist in adopting WSP (Baum 2016). This study found that "guidelines, regulations, contextual

evidence, and public health focus creates the enabling environment” (Baum 2016). The article further states that “Barriers to adopting and implementing WSPs in North Carolina water utilities include insufficient staff time and perceived duplication of existing practices, lack of cost, and sufficient resources. Implementation of WSPs would require time and resources, perceived benefits, and strong leadership” (Baum 2016). In another study conducted by Parker and Summerill 2013, the authors stated that in East Africa, there is only utility company that has a water safety plan implemented in the region (Parker and Summerill, 2013). Therefore, the study aimed to identify the barriers for implementing WSPs and the potential motivating factors. Low regard for image or inadequate senior management along with a lack of skilled staff, the perceived costs of implementing a WSP, and the lack of awareness were found to be the main barriers from prohibiting utilities from implementing WSPs (Parker and Summerill, 2013, p.121). Common barriers that were discovered during these studies include lack of staff, lack of knowledge, time, and cost.

### ***Public health theories used to address barriers***

In public health there are several behavioral models that are used to try to explain ones behavior. Also, there are multiple theories that are used to explain factors that may persuade the choices people make. The Rural Health Information Hub explains that “theories and models are used in program planning to understand and explain health behavior and to guide the identification, development, and implementation of interventions” (Rural Health, 2019). Several literature review searches have been conducted prior to the start of this study in relation to behavioral models used to asses’ hotel personnel’s knowledge, beliefs, and barriers for the use of water safety plans, but no relevant literature was found. For the purpose of this study, a behavior theory will be used to help explain factors that guide the hotel personnel’s use of water safety

plans at their facility. Of the many behavior theories used to address behavior, this study decided to choose between two models which are the Integrated Behavioral Model and the Health Belief Model (HBM).

### **Integrated Behavioral Model**

The Integrated Behavioral Model (IBM) is a concept that composes both the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB). The reason for the IBM to be considered for this study is because this integrated method focuses on the theoretical constructs concerned with individual motivational factors as determinants of the likelihood of performing a specific behavior (Glanz et al., 2008). IBM indicates that the best predictor of a behavior is behavior intention while attitude is determined by an individual's belief about the outcome (Glanz et al 2008). Could it be possible to address the behavioral beliefs and attitudes of hotel personnel that may serve as a barrier for implementing a Water Safety Plan? However, changing attitude may not result in behavior change if the individual holds strong self-efficacy beliefs about conditions that constrain the behavior (Glanz et al, 2008).

### **The Health Belief Model**

The HBM is a commonly known model that is used in public health theory. The model was developed in the 1950s and has been used to help understand how an individual's belief may affect the behavior towards their health outcome and decisions. The model is comprised of 6 constructs: 1) perceived susceptibility, 2) perceived severity, 3) perceived benefits, 4) perceived barriers, 5) cues to action, 6) self-efficacy.

Perceived susceptibility refers to an individual's belief of contracting an illness. For example: Hotel personal not adopting a water safety plan because he or she doesn't believe an

outbreak can occur at his or her facility. Or, hotel personnel adopt a water safety plan because personnel believes there could be a chance of a waterborne outbreak if not a plan is in place to combat the issue. Perceived severity is an individual's belief in the severity of the risk. For example, hotel personnel may feel that the risk of hotel water systems being contaminated may not pose a serious health risk to the public. Another example is that hotel personnel may feel that the lack of routine maintenance of the hotel water heater is not important. A perceived benefit is one's perception of the efficacy of the advised action to reduce risk or seriousness of the impact. The benefits one gains, knowing that his or her facility is safe in providing a clean adequate water supply to its guest. Having a great reputation in the community of being a clean low-risk health hazard may be rewarding to the hotel personnel.

Perceived barriers refer to the hindrances of performing a healthy action. There are many barriers that one may face. For example, a common barrier in many facets could be the cost. Other barriers could possibly be resources, lack of staff, and lack of support. Cues to action are actions that motivate an individual to take the next step in the right direction for a behavioral change; for example, heightening awareness on the situation along with providing training and resources to assist change. The last construct is self-efficacy. This is the confidence that an individual possesses to successfully achieve a behavior change. If the awareness and resources are provided, will personnel be willing to adopt a water safety plan?

Using the health belief model could be used to identify what barriers are inhibiting hotel personnel from adopting water safety plans for their facility. According to Glanz and colleagues, "perceived barriers may act as impediments to undertaking recommended behaviors" (Glanz et al., 2008). An example provided by them states that "A nonconscious, cost-benefit analysis occurs wherein individuals weigh the actions expected benefits with perceived barriers [it could

help me, but it may be expensive, inconvenient, or time-consuming]” (Glanz et al., 2008). This type of statement has been made in previous literature when addressing implementing similar programs. As hotel personnel play a vital role in creating and maintaining WMPs, assessing one’s thoughts about WMP and willingness to change may be necessary. Is there a significant relationship between hotel workers’ knowledge of water management plans and perceived susceptibility of waterborne illness for hotels? If hotel workers are knowledgeable about WMP, they may feel more susceptible to contracting a waterborne illness in their hotel. What are the perceived benefits and barriers identified by hotel workers for implementing water management plans? Identifying the benefits and barriers may be used as a baseline to address and improve said indicators. How do cues to action correlate with implementing water management plans in hotel establishments? Individuals who possesses a higher cue to action may be more likely to implement a WMP. Do hotel workers feel it is necessary to have a water management plan to prevent the risk of microbial contamination in hotel water systems? For this study, the HBM will be used to address the knowledge, beliefs, attitudes, and barriers of hotel personnel that may be hindering facilities of the use of water management plans.

## CHAPTER 3

### METHODS

#### *Sample and Population*

The target population in this study includes all hotel facilities permitted through the Georgia Department of Public Health, in the Fulton County Health District. Hotels were selected from the Digital Health Department database, which is a state-wide database program used by the State of Georgia Department of Health for data entry for managing records of permitted facilities. Fulton County was chosen due to the larger hotel population size in the area and to get a greater representation of the hotel population due to the variety of hotels in the area. A simple random sampling method was conducted to obtain a sample of 150 out of 260 hotels within Fulton County.

To qualify for this study, the tourist accommodation facility must be permitted through the Georgia Department of Public Health. Participants must be employed by the respective facility. Participants must have the title of: Owner, Manager, Maintenance/Engineer, or Housekeeper, as these positions play a vital role in devolving/maintaining water safety plans. There were 150 tourist accommodations contacted and recruited for the participation of this study. Data collection was accomplished through the means of survey questionnaires. These surveys were conducted via face-to-face to help reduce non-response. The reiteration of confidentiality was stressed to the staff to help reduce the risk of response bias. The researcher was present to administer the questionnaire and to clarify any questions the participants had regarding the survey.



### *Instrumentation*

A 5-point Likert scale was used in the survey, as the format is “often used in hospitality and tourism studies and tends to be favored over more complex scales in mail surveys” (Chain, 2008). The survey was developed by the author of this research. The study survey was formulated using validated questionnaires that used the HBM as an instrument to assess workers beliefs about using personal protection equipment (Wall, 2009), questionnaires that used for the implementation of the environmental management system (Hillary, 2004) and a survey that addresses the attitudes of hotel managers in regards to environmental management (Kirk, 1998). In the article *Development of a health-belief-model-based instrument to assess worker beliefs about using personal protective equipment*, the study used three groups to establish the validity and reliability of the survey instrument (Wall, 2009). To ensure different measures of validity, key personnel who have expertise on the requirement for and the employment of PPE where the instrument was developed to ensure face and content validity (Wall, 2009). The same measures were taken for the purpose of this study.

The measurement scale consists of the following: 1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree. Background information for the corresponding hotels such as the size, ownership, facility type, etc., were requested. Questionnaires were sent to 1 of 4 personnel: (1) the owner; (2) the maintenance engineer, (3) the lead housekeeper, and (4) the lead manager of each hotel. These are the personnel who are usually involved in planning and implementing WSP in a hotel.

## **Data Collection**

Data was gathered over a three-month period (November 2019- January 2020). The researcher recruited hotel facilities via phone, email, and facility visits. Potential participants were provided a consent form that explained the purpose of the survey along with reinsurance of confidentiality and the survey being completely voluntary. If hotel personnel agreed, surveys were administered at the hotel location that was selected to participate. All data was collected specifically for research purposes and identifiable by study ID number only. All study data is stored and analyzed on a desktop PC or network server with built-in security. All paper files are stored in locked cabinets at Georgia Southern University. All information from this study is kept completely confidential. Only the subject ID numbers will be entered into the database. Databases will be maintained in a password protected security system. All hard copy files will be kept in locked filing cabinets. The data collection method has been given a notice of approval by the Georgia Southern University Institution Review Board (H19202).

## ***Data Analysis***

Statistical software that was used for data analysis is the Statistical Analysis System-University Edition program 2020 (SAS). To measure internal consistency and reliability, the Cronbach's alpha data was used (Table 1). Chi-square tests were used to analyze categorized variables. The statistical significance was shown with P-values less than 0.05.

To address specific barriers that may hinder hotel facilities from implementing WSPs, the HBM was used in this study. In this study the model was used to assess hotel facility personnel's attitudes and knowledge towards water management plans in which will get a better understanding of what barriers are in place. The survey consisted of 2 sections. The 1<sup>st</sup> section

consisted of general questions that pertain to the specific characteristics of the tourist accommodation, such as the age of the structure, type of facility (hotel, RV Park, Bed and Breakfast, etc.), and general maintenance knowledge and attitudes. The next section consisted of questions tailored to the Health Belief Model. Questions were developed to assess the six constructs of the HBM. These constructs include perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. The survey comprised of 49 total questions.

## CHAPTER 4

### RESULTS

#### **Descriptive analysis**

As a result of recruitment, 59 out of 150 hotel facilities agreed to participate in this study, however, the researcher only received 50 responses out of the 59 agreed participants. In total this created a 33% response rate of 50 out of 150 (n=50). All the participants classified as hotel-motel establishments. In total, 3 out of the 50 facilities stated that their facility had experienced a waterborne outbreak. The age of the establishments in the sample size consisted as follows: 4% were 0-10 years of age, 24% were ages 11-15, 12 % were 16-20, 36% were 21-30, and 24% were ages 31 and older.

Room capacity was assessed for each hotel establishment. This variable helps gauge the size of each hotel. No hotels that participated had room capacity of 0-25 rooms. Six percent of hotels had a room capacity of 26-50 rooms, 40% had a capacity of 51-75 rooms, 34% with a capacity of 76-100, and 20% of the facilities had rooms more than 100. The majority of the respondents (60%) stated as a corporation/chain ownership for their respective establishments. When answering ownership, 18% were individually owned and LLC respectively. Partnership and association followed by 1% each. The title for each hotel varied. Participants within the study consists of 4 occupancies: Owner (6%), Manager (42%), Lead engineer (34%), and Lead housekeeper at 18%.

Years of experience varied across the board. Participants with experience of 0-5 were 12%, 36% had 6-10 years of experience, 28% had 11-15 years of experience, 16-20 years composed of 18%, and 6% of the respondents had over 21 years of experience. All the establishments have a public water source opposed to having a water well.

Table 1. The internal consistency and reliability of survey questions checked by Cronbach Alpha Reliability test (summative scores for scales).

<b>SCALE</b>	<b>NUMBER OF ITEMS IN SCALE</b>	<b>CRONBACH'S ALPHA</b>
PERCEIVED SUSCEPTIBILITY	5	0.67
PERCEIVED SEVERITY	4	0.70
PERCEIVED BENEFITS	3	0.88
PERCEIVED BARRIERS	8	0.71
CUES TO ACTION	5	0.77
SELF-EFFICACY	5	0.83

Table 2. Descriptive analysis

<b>ITEM</b>	<b>Frequency (n)</b>	<b>Weighted Percentage (%)</b>
<b>Has your facility ever experienced a waterborne outbreak?</b>		
Yes	3	6.0
No	47	94.0
<b>Age of facility</b>		
0-10	2	4.0
11-15	12	24.0
16-20	6	12.0
21-30	18	36.0
>31	13	24.0
<b>Ownership</b>		
Individual	9	18.0
Corporation/Chain	30	60.0
Partnership	1	2.0
LLC	9	18.0
Association	1	2.0
<b>Demographics of the study participants</b>		
<b>Work title</b>		
Owner	3	6.0
Manager	21	42.0
Chief Engineer	17	34.0
Housekeeper	9	18.0
<b>Years of Experience</b>		
0-5	6	12.0
6-10	18	36.0
11-15	14	28.0
16-20	9	18.0
>21	3	6.0

## **Knowledge of Water Management Plans (WMP)**

Questions 9-20 of the questionnaire assess the participants' knowledge of WMP along with risk factors that may lead to a waterborne illness outbreak in a hotel facility. Question 9 asked the participants, "Have you heard of a water management plan?" and 44% stated that they are not aware of a WMP while 56% stated "yes." Participants were then asked if their respective facility has a WMP, and 34% responded with "yes," 44% answered "no," and 22% "did not know" if their facility had a plan in place. During the event of a water outage half of the participants stated that their facility has emergency guidelines in place for such events and 16% stated that they "did not know" and 18% stated "no". When asked if they had heard of a Boiled Water Advisory, 92% of the respondents replied yes. However, 18% said "no" and 32% of the respondents "don't know" if they have emergency guidelines in place during the event of a Boiled Water Advisory. If a "don't know" response was to be combined with a no response that equates to 50% for no emergency response procedures.

It is imperative to have a designated staff to ensure risk factors are limited or removed when monitoring a water system for a building. Question 16 asked participants, "Does your facility have designated personnel/staff for routine maintenance of your buildings' water system?" 28% responded "no" 66% answered "yes" and 6% responded "don't know".

Cooling towers, decorative fountains, swimming pools, and spas have been directly linked to waterborne outbreaks when these items have been neglected and or poorly maintained. Only 6% of the hotels had cooling towers. Only 28 % of the hotels had decorative fountains. Most of the hotels have a swimming pool at their facility (78%). In conjunction, 58% of the hotels had a spa that is not drained between uses. During non-vacation seasons many hotels have

rooms that are not occupied for an extended period. With no use of water within the plumbing fixtures this could cause water to become stagnant. 30% of the hotels stated that they had rooms that are unoccupied for an extended period during their “slow seasons,” which could be a risk factor for bacteria growth in the premise plumbing fixtures.



Table 3. Awareness and guidelines against waterborne illness among hotel employees

<b>ITEM</b>	<b>Frequency (n)</b>	<b>Weighted Percentage (%)</b>
<b>Have you heard of a WMP?</b>		
Yes	28	56.0
No	22	44.0
<b>Does your facility have a WMP?</b>		
Yes	17	22.0
No	22	34.0
Don't Know	11	44.0
<b>Does your facility have emergency guidelines and or procedures in the event of a water outage?</b>		
Yes	16	32.0
No	25	50.0
Don't Know	9	18.0
<b>Have you heard of a Boil Water Advisory?</b>		
Yes	46	92.0
No	4	8.0
<b>Does your facility have emergency guidelines and or procedures during an event of a Boil Water Advisory?</b>		
Yes	25	50.0
No	9	18.0
Don't know	16	32.0

### **Health Belief Model Analysis**

Section 2 of the survey consisted of questions that are tailored to the constructs of the HBM. Participants were given five possible selections to choose on their beliefs toward specific topics. The options were: strongly agree, agree, neither, disagree, and strongly disagree.

### **Perceived susceptibility**

The first construct was perceived susceptibility. The participants were asked five questions to assess their susceptibility to a waterborne illness. Ten percent believe the chances of a waterborne outbreak occurring at their facility are high. Thirty-six percent had no feeling towards the matter, selecting neither agree nor disagree. Twenty-four percent of participants agreed and or strongly agreed that they worry about their guest and staff contracting a waterborne illness at their facility. The third question is to assess the participants' susceptibility. They were asked if they felt that there is a good chance of getting a waterborne illness during their career. Twelve percent either agreed or strongly agreed. Lastly, 60% of the participants agreed or strongly agreed that a waterborne illness could be prevented by developing proper maintenance procedures for their facilities' water/plumbing system. See table 4.0 for further detail.

<b>ITEM</b>	<b>RESPONSE</b>	<b>FREQUENCY (N)</b>	<b>PERCENTAGE (%)</b>
I BELIEVE THE CHANCES OF A WATERBORNE OUTBREAK OCCURRING AT MY FACILITY IS GREAT	Strongly Agree	3	6.0
	Agree	2	4.0
	Neither	18	36.0
	Disagree	14	28.0
	Strongly Disagree	14	26.0
I WORRY ABOUT MY GUEST AND STAFF GETTING A WATERBORNE ILLNESS	Strongly Agree	4	8.0
	Agree	8	16.0
	Neither	10	20.0
	Disagree	13	26.0
	Strongly Disagree	15	30.0
I FEEL THAT THERE IS A GOOD CHANCE OF GETTING A WATERBORNE ILLNESS DURING MY CAREER.	Strongly Agree	5	10.0
	Agree	1	2.0
	Neither	8	16.0
	Disagree	13	26.0
	Strongly Disagree	25	46.0
I KNOW OTHER HOTEL FACILITIES THAT HAD A WATERBORNE OUTBREAK AT THEIR FACILITY	Strongly Agree	9	18.0
	Agree	10	20.0
	Neither	10	20.0
	Disagree	9	18.0
	Strongly Disagree	12	24.0
I CAN PREVENT A WATERBORNE ILLNESS BY DEVELOPING PROPER MAINTENANCE PROCEDURES FOR MY FACILITIES WATER/PLUMBING SYSTEM	Strongly Agree	18	36.0
	Agree	12	24.0
	Neither	8	16.0
	Disagree	7	14.0
	Strongly Disagree	5	10.0

Table 4. Perceived susceptibility of waterborne illnesses among hotel employees.

### **Perceived Severity**

Hotel worker participants answered questions pertaining to their beliefs of severity in relation to a waterborne illness outbreak at their facility. In response to the first question asked, “The thought of my hotel causing a waterborne outbreak concerns me,” 74% agreed or strongly agreed to that statement. Forty-eight percent strongly agreed if a waterborne illness occurred at their facility, the facility reputation would be ruined. Fifty-two percent believed that their financial security would be ruined if an outbreak occurred at their facility. Forty-six of participants disagreed or strongly disagreed that they believe that their guest and staff could prematurely die if they contracted a waterborne illness at their facility. See table 5 for further detail.

Table 5. Perceived severity of waterborne illnesses among hotel employees.

ITEM	RESPONSE	FREQUENCY (N)	PERCENTAGE (%)
THE THOUGHT OF MY HOTEL CAUSING A WATERBORNE OUTBREAK CONCERNS ME	Strongly Agree	18	4.0
	Agree	19	8.0
	Neither	7	14.
	Disagree	4	38.0
	Strongly Disagree	2	36.0
IF A WATERBORNE ILLNESS OCCURS AT MY FACILITY, MY FACILITY REPUTATION WOULD BE RUINED	Strongly Agree	4	48.0
	Agree	8	16.0
	Neither	10	28.0
	Disagree	13	6.0
	Strongly Disagree	15	2.0
FINANCIAL SECURITY WILL ENDANGERED IF A WATERBORNE OUTBREAK OCCURS AT MY FACILITY	Strongly Agree	14	28.0
	Agree	12	24.0
	Neither	12	24.0
	Disagree	11	22.0
	Strongly Disagree	1	2.0
I BELIEVE MY STAFF AND GUESS COULD DIE PREMATURELY IF THEY CONTRACT A WATERBORNE ILLNESS AT MY FACILITY	Strongly Agree	15	30.0
	Agree	6	12.0
	Neither	6	12.0
	Disagree	12	24.0
	Strongly Disagree	11	22.0

**Perceived benefits**

To gauge how the participants felt they would benefit having a WMP, a series of questions was asked. In response to the question- “Having a water management plan will help reduce the risk of a waterborne outbreak from occurring,” 70% agreed and strongly agreed. Next, 84% agreed and strongly agreed that having a water management plan ensures that their staff and guests are not exposed to waterborne contaminants. Lastly, 70% of the participants agreed that a WMP would be beneficial to their facility.

Table 6. Perceived benefits of having a WMP

<b>ITEM</b>	<b>RESPONSE</b>	<b>FREQUENCY (N)</b>	<b>PERCENTAGE (%)</b>
HAVING A WATER MANAGEMENT PLAN WILL HELP REDUCE THE RISK OF A WATERBORNE OUTBREAK FROM OCCURRING	Strongly Agree	20	40.0
	Agree	15	30.0
	Neither	8	16.0
	Disagree	6	12.0
	Strongly Disagree	1	2.0
HAVING A WATER MANAGEMENT PLAN ENSURES THAT MY STAFF AND GUESTS ARE NOT EXPOSED TO WATERBORNE CONTAMINATES	Strongly Agree	23	46.0
	Agree	19	38.0
	Neither	7	14.0
	Disagree	1	2.0
	Strongly Disagree	0	0.0
THE IMPLEMENTATION OF A WATER SAFETY PLAN WILL BE BENEFICIAL TO MY FACILITY.	Strongly Agree	21	42.0
	Agree	14	28.0
	Neither	8	16.0
	Disagree	6	12.0
	Strongly Disagree	1	2.0

## **Perceived barriers**

Barriers to the implementation of WMP were assessed. When involving staff, 58% state not have enough staff to implement and maintain a water safety plan. Furthermore, 64% agreed that having a WMP is time-consuming. For additional current resources, 68% agreed that they lack the knowledge of ASHRAE Standard 188 and the CDC Water Management Plan Toolkit. In relation to enforcement, 66% of the participants stated that they don't have a WMP because it is not mandatory. When asked if the lack of financial support for maintaining a WMP was an issue, 52% agreed. Lack of training for staff to maintain a WPM was 62% agreed. Seventy-two percent agreed that the lack of explanation of concepts and the need for more guidance on the public health aspect of water safety plan as a barrier. Twenty-two % believed that there is no benefit to having a WMP. See table 7 for results.



Table 7. Perceived barriers preventing implementation of a WMP

ITEM	RESPONSE	FREQUENCY (N)	PERCENTAGE (%)
I DON'T HAVE ENOUGH STAFF TO IMPLEMENT AND MAINTAIN A WATER SAFETY PLAN	Strongly Agree	14	28.0
	Agree	15	30.0
	Neither	13	26.0
	Disagree	5	10.0
	Strongly Disagree	3	6.0
IMPLEMENTING WATER SAFETY PLAN IS TIME CONSUMING	Strongly Agree	18	36.0
	Agree	14	28.0
	Neither	7	14.0
	Disagree	4	8.0
	Strongly Disagree	7	14.0
WE LACK UNDERSTANDING OF ASHRAE STANDARD 188 AND THE CDC WATER MANAGEMENT PLAN TOOLKIT?	Strongly Agree	19	38.0
	Agree	15	30.0
	Neither	8	16.0
	Disagree	5	10.0
	Strongly Disagree	3	6.0
I DON'T HAVE A WATER SAFETY PLAN BECAUSE IT IS NOT MANDATORY	Strongly Agree	14	28.0
	Agree	19	38.0
	Neither	1	2.0
	Disagree	8	16.0
	Strongly Disagree	8	16.0
WE LACK THE FINANCIAL SUPPORT TO MAINTAIN A WATER MANAGEMENT PLAN	Strongly Agree	14	28.0
	Agree	12	24.0
	Neither	14	28.0
	Disagree	5	10.0
	Strongly Disagree	5	10.0
WE LACK TRAINING FOR STAFF TO EFFECTIVELY MAINTAIN WATER SAFETY PLAN	Strongly Agree	19	38.0
	Agree	12	24.0
	Neither	8	16.0
	Disagree	6	12.0
	Strongly Disagree	5	10.0
WE LACK AN EXPLANATION OF CONCEPTS AND MORE GUIDANCE NEEDED ON THE PUBLIC HEALTH ASPECT OF THE WATER SAFETY PLAN.	Strongly Agree	21	42.0
	Agree	15	30.0
	Neither	7	14.0
	Disagree	3	6.0
	Strongly Disagree	4	8.0
THERE ARE NO BENEFITS TO IMPLEMENT A WATER SAFETY PLAN	Strongly Agree	6	12.0
	Agree	5	10.0
	Neither	9	18.0
	Disagree	14	28.0
	Strongly Disagree	16	32.0

**Cues to action**

To assess what triggers are needed for the decision-making process to start the implementation of a WMP, questions for cues to action were asked to the participants. See table 8 below. The following percentages are what participants stated they agreed/strongly agreed. Receiving more encouragement from the local health authority to implement a water safety plan is important (86%). Regular and frequent education on the importance of water safety plans will help with implementation (72%). Having a simple method to implement a water safety plan will increase my chances of maintaining one (90%). Provided training will encourage our facility to implement water safety plans (86%). I am interested in water safety plans because I do not want my staff and guest exposed to any waterborne diseases (90%).

Table 8. Cues to action for hotel employees to implement a WMP.

ITEM	RESPONSE	FREQUENCY	PERCENTAGE
		(N)	(%)
RECEIVING MORE ENCOURAGEMENT FROM THE LOCAL HEALTH AUTHORITY TO IMPLEMENT A WATER SAFETY PLAN IS IMPORTANT	Strongly	28	56.0
	Agree	15	30.0
	Agree	5	10.0
	Neither	2	4
	Disagree	0	0
	Strongly Disagree		
REGULAR AND FREQUENT EDUCATION ON THE IMPORTANCE OF WATER SAFETY PLANS WILL HELP WITH IMPLEMENTATION.	Strongly	27	54.0
	Agree	9	18.0
	Agree	12	24.0
	Neither	1	2.0
	Disagree	1	2.0
	Strongly Disagree		
HAVING A SIMPLE METHOD TO IMPLEMENT A WATER SAFETY PLAN WILL INCREASE MY CHANCES OF MAINTAINING ONE.	Strongly	31	62.0
	Agree	14	28.0
	Agree	5	10.0
	Neither	0	0.0
	Disagree	0	0.0
	Strongly Disagree		
PROVIDED TRAINING WILL ENCOURAGE OUR FACILITY TO IMPLEMENT WATER SAFETY PLANS	Strongly	22	44.0
	Agree	21	42.0
	Agree	7	14.0
	Neither	0	0.0
	Disagree	0	0.0
	Strongly Disagree		
I AM INTERESTED IN WATER SAFETY PLANS BECAUSE I DO NOT WANT MY STAFF AND GUEST EXPOSED TO ANY WATERBORNE DISEASES	Strongly	27	54.0
	Agree	18	36.0
	Agree	5	10.0
	Neither	0	0.0
	Disagree	0	0.0
	Strongly Disagree		

## **Self- Efficacy**

Self-efficacy questions were asked to the participant to gauge the level of maintaining a WMP at their respective facility. The participant agreed to the following questions: Once I receive more education on water safety plans, I will be more comfortable in implementing the program (80%). I am confident that maintaining a water safety plan will help prevent a waterborne illness outbreak at my facility (70%). I can train my staff to maintain records for water safety plans (60%). I am confident that I can manage the additional duty of implementing a Water Safety Plan (60%). It is our responsibility as hotel staff to provide safe potable water to our guests (92%). The results can be seen below in table 9.

Table 9. Self-efficacy of hotel employees to maintain a WMP.

ITEM	RESPONSE	FREQUENCY	PERCENTAGE
		(N)	(%)
ONCE I RECEIVE MORE EDUCATION ON WATER SAFETY PLANS, I WILL BE MORE COMFORTABLE IN IMPLEMENTING THE PROGRAM	Strongly Agree	20	40.0
	Agree	20	40.0
	Neither	9	18.0
	Disagree	0	0.0
	Strongly Disagree	1	2.0
I AM CONFIDENT THAT MAINTAINING A WATER SAFETY PLAN WILL HELP PREVENT A WATERBORNE ILLNESS OUTBREAK AT MY FACILITY	Strongly Agree	20	40.0
	Agree	15	30.0
	Neither	12	24.0
	Disagree	2	4.0
	Strongly Disagree	1	2.0
I CAN TRAIN MY STAFF TO MAINTAIN RECORDS FOR WATER SAFETY PLANS	Strongly Agree	17	34.0
	Agree	13	26.0
	Neither	13	26.0
	Disagree	6	12.0
	Strongly Disagree	1	2.0
I AM CONFIDENT THAT I CAN MANAGE THE ADDITIONAL DUTY OF IMPLEMENTING A WATER SAFETY PLAN.	Strongly Agree	16	32.0
	Agree	14	28.0
	Neither	14	28.0
	Disagree	4	8.0
	Strongly Disagree	2	4.0
IT IS OUR RESPONSIBILITY AS HOTEL STAFF TO PROVIDE SAFE POTABLE WATER TO OUR GUEST.	Strongly Agree	30	60.0
	Agree	16	32.0
	Neither	4	8.0
	Disagree	0	0.0
	Strongly Disagree	0	0.0

## **Results of Research Questions**

### **Is there a significant relationship between hotel facilities with no water management plans and perceived susceptibility to waterborne illness for hotels?**

The general linear regression model was used to assess if there was a significant relationship between whether hotel facilities with or without WMP and perceived susceptibility of contracting a waterborne illness in a hotel establishment. A significant relationship was found between the perceived susceptibility of contracting a waterborne illness and WMP for hotel personnel with the p-value resulting in less than 0.05. In this event, we can positively conclude that having no WMP is associated with the workers perceived susceptibility to a waterborne illness (Table 10). Compared to the baseline response, respondents who have a WMP is associated with larger perceived susceptibility scores, while respondents who answered “don’t know” is not significantly different from the reference group with a p-value of 0.43 greater than 0.05.

### **How do cues to action correlate with implementing water management plans in hotel establishments?**

The general linear model was conducted to analyze the relationship between cues to action and the implementation of having a WMP. As a result, a significant association was determined between cues to action and having a WMP, with the p-value less than 0.05. Increased cues to action is associated with an increased likelihood of WMP implementation (Table 11). The “NO” response is set as the comparison group; the “don’t know” response is not statistically significant because its p-value (0.7559) is greater than the significance level of 0.05. However, there is a statistically significant association between cues to action and hotel respondents with a WMPs, having a p-value of 0.0025.

Table 10. The General Linear Model showing the relationship between WMP and perceived susceptibility

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
<b>Model</b>	2	122.817	61.40	3.77	<b>0.0302</b>
<b>Error</b>	47	764.962	16.27		
<b>Corrected Total</b>	49	887.780			

  

Source	DF	Sum of Squares	Mean Square	F Value	Pr>F
<b>Model</b>	2	85.071	42.53	5.60	<b>0.0066</b>
<b>Error</b>	47	357.008	7.59		
<b>Corrected Total</b>	49	442.080			

Table 11. The General Linear Model showing the relationship between WMP and cues to action

Parameter	Estimate		Standard Error	t Value	Pr >  t
<b>Don't Know</b>	0.31818182	B	1.01774586	0.31	0.7779
<b>Yes</b>	2.84759358	B	0.88999294	3.20	0.0025
<b>NO</b>	0.00000000	B	-	-	-

  

Parameter	Estimate		Standard Error	t Value	Pr >  t
<b>Don't Know</b>	1.18181818	B	1.48977420	0.79	0.4316
<b>Yes</b>	3.56149733	B	1.30276975	2.73	0.0088
<b>NO</b>	0.00000000	B	-	-	-

**What are the perceived benefits and barriers identified by hotel workers for implementing water management plans? Do hotel workers feel it's necessary to have a water management plan to prevent the risk of microbial contamination in hotel water systems?**

Over 70% of the respondents responded favorably agreed to each perceived benefit question in the questionnaire. These results can be found in tables 12 and 13 found below. When combining disagree with strongly disagree results and combining agree and strongly agree results in the barrier questions, seven out of the eight barriers were over 50% agreed. The negative influences that are hindering the implementation of a WSP include: facilities not having enough staff to manage a WMP, time, lack of standard guidelines, lack of training, and WMP not being mandatory. However, 60% of respondents stated that there are benefits to having a WMP.



Table 12. Combined Benefits Response

<b>ITEM</b>	<b>RESPONSE</b>	<b>FREQUENCY (N)</b>	<b>PERCENTAGE (%)</b>
HAVING A WATER MANAGEMENT PLAN WILL HELP REDUCE THE RISK OF A WATERBORNE OUTBREAK FROM OCCURRING	Agree	35	<u>70.0</u>
	Neither	8	16.0
	Disagree	7	14.0
HAVING A WATER MANAGEMENT PLAN ENSURES THAT MY STAFF AND GUESS ARE NOT EXPOSED TO WATERBORNE CONTAMINATES	Agree	42	<u>84.0</u>
	Neither	7	14.0
	Disagree	1	2.0
THE IMPLEMENTATION OF A WATER SAFETY PLAN WILL BE BENEFICIAL TO MY FACILITY.	Agree	35	<u>70.0</u>
	Neither	8	16.0
	Disagree	7	14.0

Table 13 Combined barriers results for preventing implementation of a WMP

<b>ITEM</b>	<b>RESPONSE</b>	<b>FREQUENCY (N)</b>	<b>PERCENTAGE (%)</b>
I DON'T HAVE ENOUGH STAFF TO IMPLEMENT AND MAINTAIN A WATER SAFETY PLAN	Agree	29	<b><u>58.0</u></b>
	Neither	13	26.0
	Disagree	8	16.0
IMPLEMENTING WATER SAFETY PLAN IS TIME CONSUMING	Agree	32	<b><u>64.0</u></b>
	Neither	7	14.0
	Disagree	11	22.0
WE LACK UNDERSTANDING OF ASHRAE STANDARD 188 AND THE CDC WATER MANAGEMENT PLAN TOOLKIT?	Agree	34	<b><u>68.0</u></b>
	Neither	8	16.0
	Disagree	8	16.0
I DON'T HAVE A WATER SAFETY PLAN BECAUSE IT IS NOT MANDATORY	Agree	33	<b><u>66.0</u></b>
	Neither	1	2.0
	Disagree	16	32.0
WE LACK THE FINANCIAL SUPPORT TO MAINTAIN A WATER MANAGEMENT PLAN	Agree	26	<b><u>52.0</u></b>
	Neither	14	28.0
	Disagree	10	20.0
WE LACK TRAINING FOR STAFF TO EFFECTIVELY MAINTAIN WATER SAFETY PLAN	Agree	31	<b><u>62.0</u></b>
	Neither	8	16.0
	Disagree	11	22.0
WE LACK AN EXPLANATION OF CONCEPTS AND MORE GUIDANCE NEEDED ON THE PUBLIC HEALTH ASPECT OF THE WATER SAFETY PLAN.	Agree	36	<b><u>72.0</u></b>
	Neither	7	14.0
	Disagree	7	14.0
THERE ARE NO BENEFITS TO IMPLEMENT A WATER SAFETY PLAN	Agree	11	22.0
	Neither	9	18.0
	Disagree	30	<b><u>60.0</u></b>

## CHAPTER 5

### CONCLUSION

#### **Summary**

In summary, this study was used to further explain the use of water management plans in hotel facilities. Water management plans are a helpful tool to help prevent or reduce the risk of waterborne illnesses from occurring in a complex water system. Although water management plans exist many hotel personnel are not aware of such methods. Data was gathered by means of survey questionnaires where the respondents were asked a multitude of questions to assess their knowledge of WMP and key factors associated with their attitudes towards WMPs. Respondents were recruited within Fulton County, GA in which a total of 50 facilities participated. Questionnaires were administered via face-to-face interviews from November 2019 through January 2020.

The questionnaire consists of 50 total questions sectioned into two parts. In the first section of the survey, participants were asked about the makeup of their facility. For example, age of the facility, number of rooms, if the facility ever experienced a waterborne outbreak, years of experience, etc. Out of 50 responses, three stated that their facility experienced a waterborne outbreak. Furthermore 44% of the respondents stated that they have not heard of a WMP.

To assess how many facilities currently have a WMP, only 34% reported to have a WMP. It is also noteworthy that 22% answered “Don’t know” when asked if their facilities currently have a WMP. If the “don’t know” response is interpreted as a “no” response, that would accumulate to a staggering 66% of facilities with no WMP in place.

In the second section participants answered questions pertaining to the six constructs of the Health Belief Model. When assessing the perceived susceptibility of the participants in relation to waterborne illnesses, over 50% responded that they disagree with an outbreak occurring at their facility is high. In conjunction, over 50% does not worry about the staff and guests contracting a waterborne illness. Six out of the fifty respondents (12%) feel that there is a chance of contracting a waterborne illness in their careers. 60% agree that a waterborne illness can be prevented by developing proper maintenance procedures for their plumbing system.

Many respondents disagree with the thought their hotel causing a waterborne outbreak is a concerning matter to them. Though the thought of an outbreak occurring at their facility is low, the respondents agree (64%) that an outbreak occurring at their facility would ruin their reputation. The perceived benefits of WMPs scored highly among the participants. Seventy percent of the participants agreed that a WMP would be beneficial to their facility. Among the notable perceived barriers 58% stated that they do not have enough staff to sustain a WMP. Time, knowledge, and financial support were also barriers to WMPs in hotels. When assessing what triggers are needed for the decision-making process to start implementation, cues to action questions were asked. Ninety percent of respondents agreed that having a simple method to implement a WMP would increase the chances of maintaining the plan. For self-efficacy, 80% will be more comfortable in implementing WMP, once more education is received on WMPs. A significant relationship was found between cues to action and the implementation of having a WMP. Also, a significant relationship was found between the perceived susceptibility of contracting a waterborne illness and WMP for hotel personnel.

## Discussion

Waterborne outbreaks could be detrimental to one's health and for the company where the outbreak occurred. This study provides insight into the importance of water management plans and the risk factors associated with microbial contamination in a building's plumbing system. Research in this study concluded that many key personnel are not aware of WMPs. Many hotel facilities do not have a plan in place and some facilities are not aware if a current plan is in place.

There are several agencies that have developed resources and guidelines for WMPs. Such agencies as the CDC, ASHRAE, and WHO developed basic standards to help building owners be protected from the risk of microbial contamination. Some agencies will provide actual services to implement a WMP for the facility. However, according to this study, 68% of the respondents lack an understanding of what these agencies provide. With the lack of awareness of available resources and the general understanding of WMPs, this could also be a major contributor to having no WMP. These findings are closely similar to a study conducted by Eric Chan in 2007, where the study aimed to investigate barriers to implement environmental management systems (EMS) in the hotel industry in Hong Kong China. According to the study, six factors that hinder hotels from adopting formal EMS were identified and interpreted. Those factors include: (1) lack of knowledge and skills; (2) lack of professional advice; (3) uncertainty of outcome; (4) certifiers/verifiers; (5) lack of resources; and (6) implementation and maintenance costs (Chan, 2007). Lack of knowledge, lack of professional advice, lack of resources, and cost were all barriers also identified in this study sharing common results. The identified barriers also align with another similar study conducted in the UK where the researcher looks to identify the benefits and barriers of EMS for small enterprises (Hillary, 2004). The study too concluded the

lack of resources, understanding, attitudes, and company culture as perceived barriers for implementation of EMS. These similar findings help strengthen the need for further research to combat these barriers from the implementation of WMP.

There are other types of facilities that are required to have a WMP to prevent the risk of illness to the public. The Centers for Medicare & Medicaid Services (CMS) released a survey and certification memo in June 2017 indicating all healthcare facilities should develop and adhere to ASHRAE-compliant water management programs to reduce the risk for *Legionella* and other pathogens in their water systems (CDC.gov, 2018). This is due to the highly susceptible populations that are in healthcare facilities that are most vulnerable. Also, many of these healthcare facilities have risk factors similar to hotels such as having a large complex plumbing system that could potentially lead to pathogen growth. With tourism being a vital component to our economy many visitors young, old, sick, and healthy often travel and occupy tourist accommodations such as hotels. Like healthcare facilities, hotel facilities should follow similar guidelines the CMS has required for the healthcare system. As identified in the study, 66% of respondents stated that they would not have a water safety plan because it is not mandatory. However, with a positive association for cues to action and implementation of WMPs, health authorities should consider collaborating on ways to develop a simple but effective plan to ensure the safety of the public's health. As 86% agreed that receiving more encouragement from the local health authority to implement a water management plan is important and 90% agreed that having a simple method to implement a water management plan would increase their chances of maintaining one.

Overall, this study differs from other studies for WMPs as this research uses the HBM to help identify barriers and predict the change of a facility's behavior for the implementation of a

program. No other study has been found where the HBM is used in relation to WMPs. This is important due to the array of factors that are assessed not only at the broad company level but at the individual level. Key personnel are the driving force to implementation as these key individuals are responsible for creating and maintaining the program. This shows how leadership can impact how an organization could implement policy. If behavior change is done at the individual level through leadership, we hope to create change through an ecological effect.

### **Limitations**

There were a few possible limitations to the study. Response bias could have been a possibility for the study. Some of the respondents were familiar with the researcher's occupation for working with the health authority; therefore, bias response may have occurred. Consequently, non-response bias was found for the same reason. Though, the survey was introduced and explained as confidential, voluntary and for research purposes, many facilities were not comfortable with disclosing information to the researcher due to fear of job loss and negative publicity. Another limitation of the study was a low response rate of 33%. Receiving feedback to all hotels in the target population was difficult to achieve. Recruiting was conducted via in-person, email, and phone calls. The primary success in the recruiting process was the in-person visits but was limited due to travel and time consumption.

### **Recommendations**

Based on the finding of this study and the CDC, all facilities with large complex water systems should have their systems tested for *Legionella* and other potentially harmful pathogen growth 1 to 2 times a year. Facilities with less complex systems should, at a minimum create and maintain a maintenance plan to prevent the buildup of biofilm at all water fixture endpoints and

ensure water heaters are in working compliance. Currently, The Georgia Department of Public Health (DPH), has some regulations that may inversely prevent microbial contamination in tourist accommodations water systems. For example, all gas-fired equipment is required for inspections at least once every calendar year (Georgia Department of Public Health, 2014). The intent of the gas-fired equipment inspection is to ensure that non-regulated equipment such as a gas-water heater is inspected by a qualified individual. The inspection will identify and correct deficiencies that may potentially lead to harm to the public. This rule is effective because faulty, water heaters are a known risk factor for pathogen growth. If a water heater is faulty, it could possibly hold water at a mild temperature which could support the growth of pathogens. By monitoring this equipment, it can resolve any issue before occurring. Though this is a good measure to prevent contamination through faulty equipment, it is only for gas-powered water heaters and it does not apply to electrical water heaters. A potential future study could possibly examine aerosolized bacteria near cooling towers that are improperly maintained within Fulton County.

Regardless of the size of the building, water systems should have some type of water management plan to reduce the risk of water contamination through its plumbing system. Each facility must develop a WMP that is tailored to that specific building. Key hotel personnel who are responsible for implantation must consider:

- 1) Understanding the building's plumbing system
- 2) Identify all areas of the plumbing endpoints
- 3) Ensure all water equipment and fixtures are maintained and keep in good repair
- 4) Develop teams that are responsible for reducing stagnation of water, biofilm and mold buildup at water fixtures.



- 5) Create a maintenance log for all cleanings, checks, and services.
- 6) Develop an emergency plan in case of a water emergency such as a boil water advisory or do not drink advisory.

There are limited studies pertaining to WMPs for hotel facilities. There is hope that this literature can aid future findings. Overall, the results of this study have determined that the vast majority of hotel personnel are not aware of water management plans. As the surveys stated that many hotel facilities would implement a WMP if they knew more about it. This study shows that if awareness for the program is provided, the more likely it is for the facility to implement the program.

Resources are available for the hotel industry, but the key is to raise the awareness of the available resources. Ensuring guests and staff alike are protected from danger comes in many facets. However, the public's health can be compromised unintentionally through neglect of the building's water systems and lack of knowledge. It is vital to create comradery among industry and the health authority to combat against potential outbreaks. With WMPs not being a requirement to have, the need to raise awareness about the potential risk of microbial contamination with no WMP is needed. Ultimately it is the building owner's responsibility to ensure safe water to its guests. This may be done by helping and guiding the facilities with simple but effective plans to set in place.

The importance of future research and potential law change should be emphasized due to employees' and owners' lack of knowledge and the continuation of waterborne outbreaks in hotel facilities. As stated previously in this chapter, there was a significant relationship found between cues to action and the implementation of having a WMP. Identifying the triggers to what can encourage these facilities to adopt a WMP is crucial. Also, a significant relationship

was found between the perceived susceptibility of contracting a waterborne illness and WMP for hotel personnel. The results conclude that if hotel personnel believe that they are susceptible to an outbreak the more likely they will be to implement a WMP. This solidifies the need for the research to continue to ensure the health of our larger communities. The meaning of this study was to ultimately shed light on the risk of microbial contamination in unregulated building water systems and the importance of mandatory water management programs. In an article written by Meillier and colleagues, they looked to evaluate cues to action in health behavior and in which cues produce changes and how the process of change is proceeded (Meillier et al., 1997). The article later revealed that a strategy to initiate changes in health behavior could be to create cues to action through personal experiences in the context of a specific health behavior or to establish contact with people when they are experiencing new life circumstances (Meillier et al., 1997). As we enter a world forever transformed from the current pandemic, health and safety programs will no longer be an afterthought. For example, new guidelines to help slow the spread of COVID19 will be in place for the foreseeable future as awareness of the severity of the disease has risen, hence it can be done at the same time for waterborne illnesses in hotels.

This study and along with many others, mentioned above, will serve as guidelines to show how our hotels and other service industries can win the trust of Georgians and the American people that their health is safe. This study exposed the lack of WMPs through the Health Belief Model. Another model that potential could be used for future research is the Community Readiness Model. This model is based on the community ready to take action on an issue (UNC 2020). This model comprises of 9 stages of readiness (No awareness, denial, vague awareness, preplanning, preparation, initiation, stabilization, expansion, high level of community ownership) (UNC, 2020). The tourist accommodations community may consider implementing a

standard for premise plumbing to ensure waterborne outbreaks are lessened. It was encouraging to see that many of the participants that were not aware of WMPs became interested in learning more about the program during the time of recruitment of this study. If there is no push for further research and raising awareness, people will continue to be susceptible to another waterborne outbreak while they may be vacationing with loved ones, at a conference, or other circumstances that involve hotel stays.

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## APPENDIX

## Assessing Water Management Plans for Hotel Facilities

Questionnaire (Please Circle One)

**Section I****1) Has a waterborne outbreak ever occurred at your facility?**

Y N

**2) What type of establishment is your facility?**

Hotel-Motel Bed &amp; Breakfast RV Park Cabins Campground

**3) What is the approximate age of your facility?**

0-10 11-15 16-20 21-30 31- older

**4) How many rooms does your facility provide?**

0-25 26-50 51-75 76-100 100- up

**5) What is the current ownership of facility?**

Individual Corporation/Chain Partnership LLC Association

**6) What is your designated work title?**

Owner Manager Engineer Lead Housekeeper

**7) How many years of experience do you have at your current position?**

0-5 6-10 11-15 16-20 21-up

**8) What type of water supply services your facility?**

Public (City/County) Private (well) Community well



- 9) **Have you heard of a water management plan?**  
Y N
- 10) **Does your facility have a water management plan?**  
Y N Don't Know
- 11) **Does your facility have emergency guidelines and or procedures in the event of a water outage?**  
Y N Don't Know
- 12) **Have you heard of a boil water advisory?**  
Y N
- 13) **Does your facility have emergency guidelines and or procedures during an event of a boil water advisory?**  
Y N Don't Know
- 14) **What are some barriers that are preventing you from developing a water management plan?**
- 
- 15) **Does your facility have a cooling tower?**  
Y N Don't Know
- If so, how often does the cooling tower gets serviced?
- Once a year, Every 2-5yrs, Every 6-10 years, Never, Don't Know
- 16) **Does your facility have designated personnel/staff for routine maintenance of your buildings water system?**  
Y N Don't Know
- 17) **Does your facility have any decorative water fountains?**  
Y N
- 18) **Does your facility have a hot tub (also known as a spa) that is not drained between each use?**  
Y N
- 19) **Does your facility have a swimming pool?**  
Y N

*If yes, how often are the chemicals checked?*

Once a day    Twice a Day    Once a week    Never

**20) Are there any sections of rooms in your facility that are not used year-round?**

Y    N

## **Section II**

5 — agree strongly

4 — agree

3 — neither agree nor disagree

2 — disagree

1 — disagree strongly

### **Perceived Susceptibility**

- I believe the chances of a waterborne outbreak occurring at my facility is great  
1    2    3    4    5
- I worry about my guest and staff getting a waterborne illness  
1    2    3    4    5
- I feel that there is a good chance of getting a waterborne illness during my career.  
1    2    3    4    5
- I know other hotel facilities that had a waterborne outbreak at their facility  
1    2    3    4    5
- I can prevent a waterborne illness by developing proper maintenance procedures for my facilities water/plumbing system  
1    2    3    4    5

### **Perceived Severity**

- The thought of my hotel causing a waterborne outbreak concerns me

1      2      3      4      5

- If a waterborne illness occurs at my facility, my facility reputation would be ruined

1      2      3      4      5

- Financial security would be endangered if a waterborne outbreak occurs at my facility

1      2      3      4      5

- I believe my staff and guess could die prematurely if they contract a waterborne illness at my facility

1      2      3      4      5

### **Perceived benefits**

- Having a water management plan will help reduce the risk of a waterborne outbreak from occurring

1      2      3      4      5

- Having a water management plan ensures that my staff and guess are not exposed to waterborne contaminants

1      2      3      4      5

- The implementation of a water safety plan will be beneficial to my facility.

1      2      3      4      5

### **Perceived barriers**

- I don't have enough staff to implement and maintain a water safety plan

1      2      3      4      5

- Implementing water safety plan is time consuming

1 2 3      4      5

- We lack understanding of ASHRAE Standard 188 and the CDC Water Management Plan Toolkit?  
1      2      3      4      5
- I don't have a water safety plan because it is not mandatory  
1      2      3      4      5
- We lack the financial support to maintain a water management plan  
1      2      3      4      5
- We lack training for staff to effectively maintain water safety plan  
1      2      3      4      5
- We lack explanation of concepts and more guidance needed on the public health aspect of water safety plan.  
1      2      3      4      5
- There are no benefits to implement a water safety plan  
1      2      3      4      5

### *Cues to Action*

- Receiving more encouragement from the local health authority to implement a water safety plan is important  
1      2      3      4      5
- Regular and frequent education on the importance of water safety plans will help with implementation.  
1      2      3      4      5
- Having a simple method to implement a water safety plan will increase my chances of maintaining one.  
1      2      3      4      5

- Provided training will encourage our facility to implement water safety plans  
1      2      3      4      5
- I am interested in water safety plans because I do not want my staff and guests exposed to any waterborne diseases  
1      2      3      4      5

### **Self-Efficacy**

- Once I receive more education on water safety plans I will be more comfortable in implementing the program  
1      2      3      4      5
- I am confident that maintaining a water safety plan will help prevent a waterborne illness outbreak at my facility  
1      2      3      4      5
- I can train my staff to maintain records for water safety plans  
1      2      3      4      5
- I am confident that I can manage the additional duty of implementing a Water Safety Plan.  
1      2      3      4      5
- It is our responsibility as hotel staff to provide safe potable water to our guest.  
1      2      3      4      5