PREDICTING AND EXPLAINING BEHAVIORAL INTENTION AND HAND SANITIZER USE AMONG U.S. ARMY SOLDIERS

by

NAIQING LIN

B.S., Royal Melbourne Institute of Technology, 2005

A THESIS

submitted in partial fulfillment of the requirements for the degree

MASTER OF SCIENCE

Department of Hospitality Management and Dietetics
College of Human Ecology

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2015

Approved by:

Major Professor
Dr. Kevin R. Roberts

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Abstract

Many pathogenic microorganisms are spread by contaminated hands and may lead to foodborne illness. The use of hand sanitizers can significantly reduce bacterial contamination and is an efficient and inexpensive method to prevent infections and sickness. Previous researchers have found that the routine use of hand sanitizers allowed the U.S. Army to significantly reduce illness. However, few studies have been conducted within a U.S. Army dining facility, which is considered to be one of the primary sources of foodborne illness within the U.S. Army. Therefore, using the Theory of Planned Behavior, the purpose of this study was to identify the behavioral intention, attitudes, subjective norms, and perceptions of control of using hand sanitizer among military personnel.

The study targeted soldiers using a written survey during their lunch hour on the U.S. Army base at Fort Riley, KS. A total of 201 surveys were collected. All data were screened and entered into IBM SPSS for analysis.

Results indicated that attitudes, subjective norms, and perceived behavioral control explained 64% of the variance in behavioral intention. Attitude and subjective norms were found to be significant predictors of behavioral intention, with attitude being the strongest predictor.

In general, behavioral beliefs were positive among soldiers. Related to normative beliefs, soldiers did perceive negative social pressure from other soldiers not to use hand sanitizers. Analysis of control beliefs found soldiers perceived hand sanitizers were readily available, but disliked their smell and feel after application.

Food production managers and Army commanders can use these results to implement hand sanitation behavioral interventions within military dining environments. Practical

implications will likely translate to reduced healthcare costs, decreased absenteeism rates, and improved mission readiness.

Some of the limitations include commonly perceived social psychology bias. Further, clustered samples were collected within one military installation in a relatively short amount of time.

Keywords: Military foodborne illness, Theory of planned behavior, U.S. Army dining facility, Hand sanitizer behavioral intention

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Acknowledgements

First I would like to thank my lord and savior, Jesus Christ, for without his love and guidance I could not have accomplished this project. I would like to thank several people the lord placed in my life who provided invaluable assistance to me during this research.

Thank you to the following people:

Kevin R. Roberts, Ph.D., Kansas State University, for his patient guidance, valuable suggestions and enlightening comments during the period of my master programs in Kansas State University. His profound knowledge in food safety and applied social psychology has benefited me a lot. Working with him has always been an enjoyable and rewarding experience. This thesis would not be accomplished without his help.

Haijing Lin, for always being there when I needed, for her everlasting affection and support, for her patience and encouragement, for helping us get through the difficult times. If it wasn't for her love, I would have never finished this thesis.

Elizabeth B. Barrett, Ph.D., RD, Kansas State University, for her personal encouragement, time and effort to reading my work.

Jeannie Sneed, Ph.D., RD, Kansas State University, for her expertise and valuable suggestions to my work.

Junwei Lin and Xiu Xu, my parents, for all their love and support throughout this project.

Shawn Lin, for just being there.

I would also like to thank all the HM graduate students at Kansas State (especially, Xiaoye Li, Yue Yang, Chenwei Tao and Basem Boutros) for helping me with data collection and giving me the opportunity to grow and learn from them in all aspects of my master's program.

Dedication

I would like to dedicate this special research project to Specialist James Michael Murphy (1989-2013) who always was a benevolent co-worker, a trustworthy comrade and a closest friend, who has paid the ultimate sacrifice to ensure our freedom. So this will be remembered.

Chapter 1 - INTRODUCTION

Waterless hand sanitizers can effectively kill most organisms that cause acute illness (Girou, Loyeau, Legrand, Oppein, & Brun-Buisson, 2002), an important cause of lost duty time among military personnel. Absenteeism due to common infectious diseases, particularly respiratory and gastrointestinal infections, is a major problem in the military (Trivedi, Schlett, Triblle, Monteville, Sanders & Riddle, 2011). In 2007, the Centers for Disease Control and Prevention (CDC, 2009) estimated that approximately 628 million workdays are lost annually due to the common cold alone. On average, enlisted soldiers are absent from training four days per year and female soldiers are absent six days per year due to illness (Olsen, MacKinnon, Goulding, Bean, & Slutsker, 2000). Soldier and officer absenteeism due to illness significantly increases administration and healthcare expenditures and interferes with training, unit cohesiveness, and efficiency (Soltis, Sanders, Putnam, Triblle, & Riddle, 2009).

Hands are the primary mode of transmission for many infectious diseases, particularly among military personnel. Hand hygiene is a proven infection control measure in the military setting (Mott et al., 2007). According to the CDC (2009), Larson (1995), and the World Health Organization (2009) simple hand washing is one of the most effective methods to prevent the spread of infectious diseases. Numerous studies have indicated a strong and consistent association between personal hand hygiene and reduced gastrointestinal disease, respiratory illness, and absenteeism among working personnel (Butz, Larson, Fosarelli, & Yolken, 1990; CDC, 2011; Hall, Wikswo, Pringle, Gould, & Parashar, 2014; Sandora et al., 2005).

Approximately 69% of military personnel reported having at least one respiratory illness during their deployment to Iraq or Afghanistan (Sanders, Putnam, Frankart, Frenck, & Monteville, 2005). Overall, 39.5% of active duty soldiers reported having at least one acute

respiratory illness during the early part of their deployment. Of these, 18.5% sought medical care, and 33.8% reported having decreased job performance (Soltis, Sanders, Putnam, Tribble, & Riddle, 2009). The incidence of ambulatory visits caused by respiratory and infectious diseases among enlisted military personnel increased by 58.3% between 2004 and 2003 (Armed Forces Health Surveillance Center, 2014). The most important factor associated with increased respiratory infection was the limited availability of available latrine facilities and hand hygiene facilities (Ryan, Christian, & Wohlrabe, 2001).

The acute respiratory disease has become a major concern for military personnel (Kolavic et al., 2002). Moreover, military personnel are exposed to both biological and environmental agents that increase their disease susceptibility (Suppliet, Hankonen, & Jallinoja, 2014). This leads to an increased cost to the military as soldiers utilize outpatient clinics and seek medications for their treatment (Billings, 2004; Handerson 1994).

Even though hand hygiene is one of the primary methods used to reduce the fecal-oral transmission of infectious agents, conflicting hand hygiene recommendations often cause confusion among military personnel as to what products should be used or what is the best practice to follow for hand washing and hand hygiene. Barriers often hinder hand hygiene compliance within the military environment (Kaplan & McGuckin, 1986; Larson & Kretzer, 1995). Maintaining adequate hand washing facilities on military installations is often hindered by vandalism, inadequate resources, lack of sanitation workers, and general untidiness. In response to low hand washing compliance, 30-50% of the administrative buildings in the military have adopted an alcohol-based hand sanitizer program (Hospenthal & Crouch, 2009; Kaplan & McGuckin, 1986; Ryan, Christian, & Wohlrabe, 2001).

Hand sanitizers have proven to be useful in decreasing the transmission of some resistant microorganisms and preventing cross-transmission of bacteria from person-to-person (Antoniak, 2004). Even with the institution of alcohol-based sanitizers, compliance with hand hygiene remains problematic.

Therefore, the purpose of this study was to identify the cognitive stimulants and barriers of using hand sanitizers among military personnel in dining facility. Based on the Theory of Planned Behavior (TPB) (Ajzen, 1985), the study identified the behavioral intentions, attitudes, subjective norms, and perceived behavioral control toward hand sanitation behavior among military personnel.

Statement of the Problem

Many pathogenic microorganisms that cause foodborne diseases are spread by contaminated hands. Even with the use or introduction of alcohol-based sanitizers, compliance with hand hygiene remains a problem (Farr, 2000). This lack of hand hygiene has economic consequences for the military due to the increasing training time and the absentee rate among soldiers (Russell et al., 2006). The military has acknowledged the critical need to identify a cost-effective method to prevent communicable diseases in the military population (Altman & Fechter, 1967; Mott et al., 2007; Riddle, Murray, Cash, Pimentel, & Porter, 2013; Russell et al., 2006). Ideally, a proactive approach to the prevention of communicable diseases would allow the military to recover a significant amount of training time while reducing outpatient physician visits and medical costs. One effective approach to preventing communicable diseases in congregate settings is the implementation of hand sanitation programs. Implementation of such programs has shown significant reductions in communicable diseases in many congregate settings, including schools (Dyer, Shinder, & Shinder, 2000; Hilburn, Hammond, Fendler, &

Groziak, 2003), university campuses (White, Shinder, Shinder, & Dyer, 2001), healthcare facilities (Bischoff, Reynolds, Sessler, Edmond, & Wenzel, 2000; Doebbelin et al., 1992; Eaton, 2005; Hilburn, Hammond, Fendler, & Groziak, 2003; Larson et al., 2005; Park et al., 2010; White, Kolble, Carlson & Lipson, 2003), and military bases (Ryan & Christian 2001; Mott et al., 2007). Little research has been conducted to identify the cognitive stimulants and barriers of using hand sanitizers among military personnel in dining facilities.

Justification

Preventive medicine and food safety professionals have identified the need for an effective strategy to reduce illnesses under waterless environments within the U.S. military (Czerwinski, et al., 2001; Fein, Lin, & Levy, 1995). A previous study conducted with military personnel, found that a Purell® instant hand sanitizer regimen helped to reduce healthcare encounters by 39% ($p < 0.01$), respiratory illness by 40% ($p < 0.01$), gastrointestinal illnesses by 48% ($p < 0.02$), and lost training time by 44% ($p < 0.01$) (Mott et al., 2007).

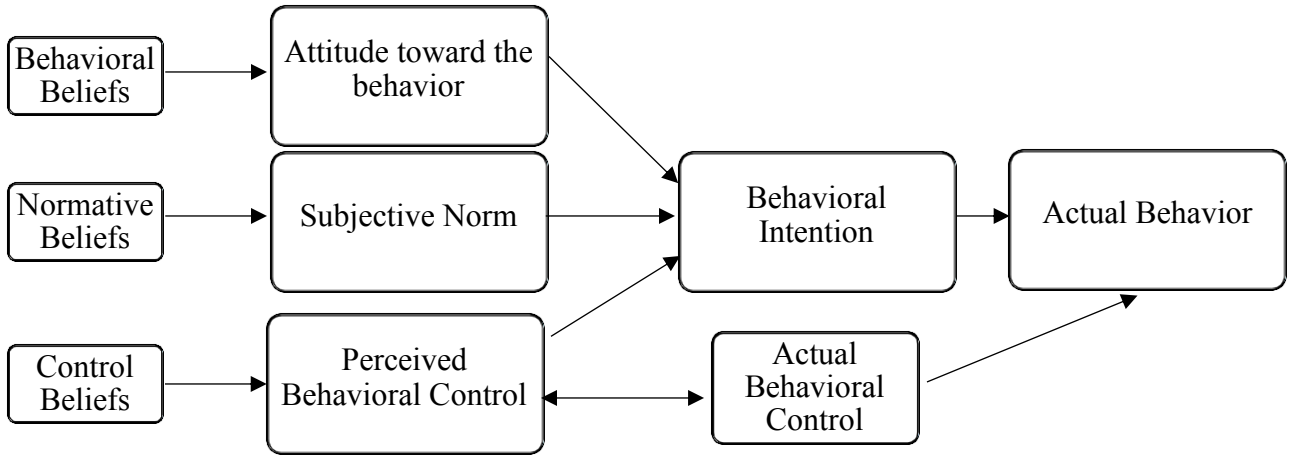
Most of the hand sanitizer research has been conducted within a congregate setting because viruses and bacteria are easily transmitted within a closed environment (Olsen, Mackinnon, Goulding, Bean & Slutsker, 2000; Todd, Greig, Bartleson, & Michaels, 2007, 2009). Very few studies on hand sanitizer use have been done within the military (Mott et al., 2007; Gibson, 1997). Proper hand sanitation has proven to be critical during distribution and consumption of food (Armed Forces Health Surveillance Center, 2014; Arness et al., 2000; Hedberg et al., 2006). No studies have been conducted within a U.S. Army dining facility.

Theoretical Framework -Theory of Planned Behavior

The Theory of Planned Behavior (TPB) proposes a model about how human action is guided. It predicts the occurrence of explicit behavior, provided that the behavior is intentional

(Ajzen, 1991; Ajzen, 2005). The model is depicted in Figure 1.1 and represents the three variables: attitudes, subjective norms, and perceived behavioral control, which the theory suggests will predict the intention to perform a behavior. Intentions are the precursors of actual behavior.

Figure 1.1. The Theory of Planned Behavior (Ajzen, 1991)



Purpose and Objective

The overall purpose of this study is to identify the cognitive stimulants and barriers of using hand sanitizers among military personnel in the dining facility. Specific objectives include:

1. Identify the attitudes and behavioral beliefs that U.S. Army personnel have about using hand sanitizers before dining in a dining facility.

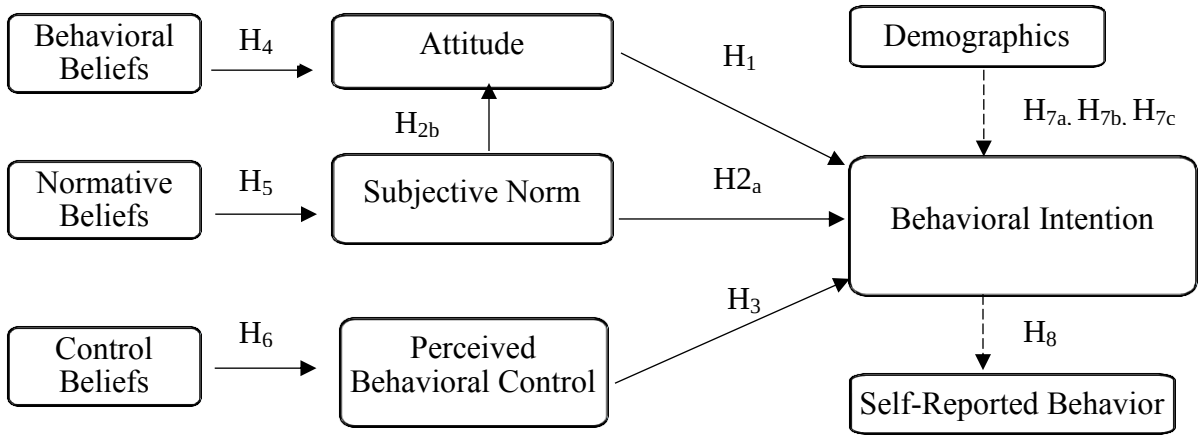
2. Identify the subjective norms and normative beliefs that U.S Army personnel consider when choosing to use hand sanitizers before dining in a dining facility.

3. Identify the perceived behavioral control and control beliefs that prevent U.S. Army personnel from using hand sanitizers before dining in a dining facility.

Hypotheses

Hypotheses one to six are depicted in Figure 1.2

Figure 1.2. Hypotheses



H_1. There is a significant positive relationship between soldiers' attitude about hand sanitizer and behavioral intention.

H_{2a}. There is a significant positive relationship between soldiers' subjective norm about hand sanitizer and behavioral intention.

H_{2b}. Military personnel's subjective norm positively predicts their attitude toward the hand sanitation behavior.

H_3. There is a negative relationship between soldiers' perceived behavioral control about hand sanitizer and behavioral intention.

H_4. Behavioral beliefs about hand sanitizer are significantly associated with attitudes about hand sanitizers.

H_5. Normative beliefs about hand sanitizer are significantly associated with subjective norms about hand sanitizers.

H_6. Control beliefs related are positively associated with perceived behavioral control about hand sanitizers.

H_{7a}. Female soldiers have a more positive intention to practice hand sanitation behavior than male soldiers.

H_{7b}. Soldiers with lower education have stronger intention to practice hand sanitation behavior.

H_{7c}. Soldiers with an annual income level less than $50,000 have stronger intention to practice hand sanitation behavior.

H_8. Behavioral intentions to use hand sanitizer are significantly associated with self-reported behaviors to use hand sanitizers.

Limitations

This study is limited to one military installation in the State of Kansas. Results should not be generalized to other military bases or public facilities such as schools, hospitals, or universities.

This study did not address non-response bias. Military personnel who choose to respond to the survey may have more positive attitudes and perceive fewer barriers in regards to the utilization of hand sanitizers when compared to those who elected not to participate in the study.

This study may be affected by commonly perceived social psychology bias, like Marlowe-Crowne's Social Desirability Bias (Crowne & Marlowe, 1960), Availability Heuristic Bias (Carroll, 1978), and inconsistency bias within Cognitive Consequences of Forced Compliance (Festinger & Carlsmith, 1959).

This research will not explore the relationship between behavioral intention and behavior. Further research is needed to explore this relationship in an attempt to fully understand the actual reasons behind hand sanitation behavior.

Definitions of Terms

Alcohol-based Hand Sanitizer: a rinse-free hand sanitizer containing 60-70% ethyl alcohol as its active ingredient. Alcohol-based hand sanitizers are currently the FDA approved and the CDC recommended form of rinse-free hand sanitizer commonly used in the hospital environment (Boyce & Pittet, 2002).

Attitude: an individual's evaluation of the likelihood that a particular behavior will lead to a desired outcome (Ajzen, 1971).

Behavior: Any behavior can be defined in terms of four elements: the action, the target at which the action is directed, the context in which it is performed, and its time of occurrence (Ajzen & Fishbein, 1977).

Behavioral beliefs: The perceived consequences of an action (Ajzen & Fishbein, 1980).

Behavioral Intention (BI): a person's perceived likelihood or "subjective probability that he or she will engage in a given behavior" (Ajzen & Fishbein, 1980).

Control Beliefs: Beliefs about the likelihood that one possesses the resources and opportunities thought necessary to execute a behavior (Ajzen & Fishbein, 1980).

Descriptive Norms: Perceptions about what important people do (Park & Smith, 2010).

Foodborne Illness: An illness that is transmitted to people by food (McCabe & Beattie, 2004).

Hand Sanitizer: supplement or alternative to hand washing with soap and water. The active ingredient in hand sanitizer may be isopropyl alcohol (isopropanol), ethanol, n-propanol, or

povidone-iodine. Inactive ingredients in alcohol rubs typically contain a thickening agent such as polyacrylic acid for alcohol gels, humectants such as glycerin for liquid rubs, propylene glycol, and essential oils of plants (Boyce & Pittet, 2002).

Injunctive Norms: Perceptions about what important people think a person should do (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007).

Motivation to Comply: The extent to which a person feels inclined to match his or her behavior to various sources of social pressure (Bearden, Netemeyer, & Teel, 1989).

Normative Beliefs: Perceptions of significant others' preferences about whether one should perform a behavior (Ajzen, 1971).

Outcome Evaluation: Evaluation of the perceived consequences of an action (Ajzen, 2002).

Perceived Behavioral Control (PBC): An individual's belief about the control that helps or hinders the implementation of that behavior (Ajzen, 1985).

Self-efficacy: The conviction that one can successfully execute a given behavior (Ajzen, 1991).

Subjective Norm (SN): A function of a set of beliefs concerned with the likelihood that important individuals, such as spouse, parents, or friend, would approve or disapprove of the behavior (Ajzen & Madden, 1986).

Theory of Planned Behavior (TPB): A theory that explains behavior as an antecedent of three variables: attitude, subjective norm, and perceived behavioral control (Ajzen & Fishbein, 1980).

Validity: A property of measuring instruments or of responses, indicating the extent to which they measure what they are supposed to measure (Feldman & Lynch, 1988; Lynn, 1986).

Chapter 2 - LITERATURE REVIEW

Hand Hygiene, Hand Washing, and Foodborne Disease

Personal hygiene practices have been identified as an important contributing factor to foodborne outbreaks (Porta, Greenland, Hernan, Silva, & Last, 2014; Todd, Greig, Bartleson, & Michaels, 2008, 2009). Many studies have examined the link between foodborne illness and poor hand hygiene (Bryan, 1988; Olsen, MacKinnon, Goulding, Bean, & Slusker, 2000). In a report of the factors contributing to foodborne disease outbreaks from 1993 to 1997, contaminated hand contact (26% of disease outbreaks), inadequate cleaning of processing or preparation equipment utensils (25% of disease outbreaks), and infection by an asymptomatic carrier (22% of disease outbreaks), were among the most important factors leading to outbreaks (Olsen et al., 2000; United States Federal Food and Drug Administration [FDA], 2000;). The only factor more important than those related to hand contact was allowing foods to remain at room or warm outdoor temperatures for several hours (29% of disease outbreaks).

Hand hygiene is essential in reducing the risks of foodborne illness. Proper hand sanitation is critical during preparation, distribution, and consumption of food, whether in the home or a congregate environment, such as a dining facility (Fein, Lin, & Levy, 1995; Greig, Todd, Bartleson, & Michaels, 2007; Hedberg et al., 2006). Proper hand washing with soap and water, then drying, is a proven and effective method of hand sanitation (Curtis & Cairncross, 2003; Todd, Michaels, Greig, Smith, & Bartleson, 2009).

Hand washing is one of the most efficient and inexpensive procedures for reducing infections and foodborne diseases (Hedberg, Smith, Kirkland, Radke, Jones, Selman, & EHS-Net Working Group, 2006; Park, Barclay, Macinga, Charbonneau, Pettigrew, & Vinje, 2010; Todd, Bartleson, & Michaels, 2007). Many foodborne diseases and pathogenic microorganisms are

spread by contaminated hands (World Health Organization, 2009). Reports indicate that the simple act of washing hands with soap and water reduces incidents of diarrhea from Shigella and other causes by up to 35% (Bartram, Osserian, & Schlein, 2001).

Previous studies have shown that barriers to hand washing compliance include the amount of time required for hand washing, skin irritation and dryness caused by frequent hand washing, and reduced accessibility to sinks and hand washing facilities (Boyce, Kelliher, & Vallande, 2000; FDA, 2003; Larson & Killien, 1982; Pittet, 2000; Voss & Widmer, 1997; Zimakoff, Kjelsberg, Larsen, & Holstein, 1992). If time and sink/facility limitations exist, instant hand sanitizers have shown a significant advantage over traditional antimicrobial soap (Dyer, Shinder, & Shinder, 2000; Dyer, Gerenratch, &Wadhams, 1998; Lee, Jordan, Sanchez, & Gaydos, 2005; White et al., 2001; White et al., 2005; FDA, 2003). Additionally, hand hygiene with the use of hand sanitizers will result in less skin irritation and will minimize time constraints (Boyce et al., 2000).

Hand Sanitizer History and Efficacy

Hand sanitizer is commonly used as a generalized or synonym term for hand antisepsis, which often refers to the application or use of hand rubs, gels, foams, or pre-moistened towelettes (or hand wipes) that use various chemicals as active ingredients (Larson, 1995). In 1966, Lupe Hernandez discovered that alcohol could be delivered via a gel for the purpose of sanitizing whenever soap and water were not available, or there was limited time for hand washing (Anonymous, 2012). After GOJO launched Purell® as the first commercial hand sanitizer in the late 1990s, even Hernandez could not have envisaged the explosion of the popularity in hand sanitizers. One industry report noted that in the United States (U.S.) market alone, the growth of hand sanitizers is overwhelming, valued at $28 million in 2002, and $80

million by 2006. It is predicted to be worth more than $402 million by 2015 (Deep Research Reports, 2014).

In the past few years, hand sanitizers have become increasingly common in the U.S., and most particularly among younger parents. Global threats such as Severe Acute Respiratory Syndrome (SARS), Avian Flu, and the more recent H7N9 Swine Flu or Ebola have led to a surge in demand for hand sanitizers (Frieden, Damon, Bell, Kenyon, & Nichol, 2014). Once considered a fad for only those concerned with germ control and bacteria contamination, hand sanitizers are now commonly found in hospitals, care homes, government buildings, restaurants, supermarkets, and public restrooms (Jarvis, 1996). Use of alcohol-based hand sanitizers can be considered as either a supplement to traditional hand washing or as a primary means of hand hygiene (Boyce & Pittet, 2002). These recommendations are based on well-designed experimental, clinical, and epidemiologic studies (Dyer et al., 2000; Dyer, Gerenratch, &Wadhams, 1998; Guinan et al., 2002; Lee et al., 2005; Storr & Clayton, 2004; White et al., 2001; White et al., 2005).

Various studies (Muto, Sistrom, & Farr, 2000; Larson, Gomez, Lee, Della, Kain, & Keswick, 2003; Liu et al., 2010) have questioned the effectiveness of alcohol-based hand antisepsis (e.g. sanitizers, foams, and wipers) compared to traditional soap-water hand washing. Larson et al. (2003) conducted a longitude study of 224 primary caretakers in households in northern Manhattan, New York to compare the difference between those who washed their hands with soap and water and those who used a commercial antimicrobial product. The researchers found no significant differences in the mean bacterial log counts either before or after hand washing between homemakers using the antimicrobial product or plain soap at baseline or after a year of use (all p-values > 0.28).

Other studies have shown the benefits of effective hand sanitation including reducing the spread of diarrhea and gastrointestinal illnesses by almost 50% (Hilburn et al., 2003; Sandora et al., 2005). Commercial hand sanitizers, which generally contain 60% to 70% ethanol or isopropanol, are one of the most effective agents for reducing the number of viable pathogens on the hands even with artificial fingernails (Guilhermetti, Hernandes, Fukushigue, Garcia, & Cardoso, 2001; McNeil, Foster, Hedderwick, & Kauffman, 2001; Rotter, 1999). Some researchers who recommend hand sanitizers over soap-water hand washing have pointed out that soap-water hand washing fails to remove biotic or living organisms, and the possibility exists for soap contamination (Cardoso, Pereiraa, Zequimb, & Guilhermettia, 1999). Other researchers have concluded that soap-water hand washing is less efficient than hand sanitizers (Johnson, et al., 2005; Michaels, Gangar, lin, & Doyle, 2003; Widmer, 2000). In 2002, the CDC revised their *Guidelines for Hand Hygiene in Health Care Settings* and stated that alcohol-based hand sanitizers are more effective for standard handwashing or hand antisepsis by healthcare workers than soap or antimicrobial soaps (Ayliffe, Babb, Davies, & Lilly, 1988; Boyce & Pittet, 2002; Cardoso, Pereiraa, Zequimb, & Guilhermettia, 1999; Larson, 1986; Ojajarvi, 1980; Paulson, Fendler, Dolan, & Williams, 1999; Rotter & Koller, 1992; Zaragoza, Salles, Gomez, Bayas, & Trilla, 1999).

Studies have also demonstrated the effectiveness of instant hand sanitizers in reducing illness (Doebbeling et al., 1992; Dyer et al., 2000; Guinan, McGuckin, & Ali, 2002; Larson, Cimiotti, Haas, Parides, Nesin, Della, & Saiman, 2005; Lee et al., 2005; White et al., 2001; White et al., 2005). The CDC (2002) has recommended that using alcohol-based hand sanitizers is acceptable if hands are not visibly soiled (Boyce & Pittet, 2002). Use of alcohol-based hand sanitizers, which are efficient against a variety of bacteria and viruses, can be considered as

either a supplement to traditional hand washing or as a primary means of hand hygiene. These recommendations are based on well-designed experimental, clinical, and epidemiologic studies (Dyer, Gerenratch, & Wadhams, 1998; Dyer et al., 2000; Guinan et al., 2002; Lee et al., 2005; Storr & Clayton, 2004; White et al., 2001; White et al., 2005).

Among the variety of bacteria and viruses encountered every day, human noroviruses are the most common (Hall et al., 2014). Norovirus is the leading cause of acute gastroenteritis and foodborne disease in the U.S., causing one in every fifteen Americans to become ill each year, resulting in 56,000 to 71,000 hospitalizations and 570 to 800 deaths (Hall et al., 2014).

Cannon, Aydin, Mann, Bolton, Zhao, and Doyle (2012) evaluated a sanitizer of levulinic acid plus the anionic detergent sodium dodecyl sulfate (SDS) against noroviruses. Due to the inability to custom human noroviruses in the laboratory, surrogate viruses such as murine norovirus and feline calicivirus were used. The combination of 0.5% levulinic acid plus 0.5% SDS inactivated both surrogates by 3 to 4.21 log after one minute of exposure. Similarly, murine norovirus inoculated onto stainless steel was reduced by > 1.50 log after one minute and by > 3.3 log PFU/ml after five minutes of exposure to a liquid or foaming solution of 5% levulinic acid plus 2% SDS. The presence of levulinic acid (up to 10%) in the virus inoculum did not significantly reduce sanitizer efficacy. The results of this study indicate the potential uses of levulinic acid plus SDS as a sanitizer in a variety of settings to reduce human norovirus (Cannon et al., 2012).

Another study tested the efficacy of a hand sanitizer on *Escherichia coli (E. coli)* from different food sources in a food service establishment. The results showed a hand sanitizer containing 70% ethanol achieved a 5.22-log reduction in *E. coli* while a non-antimicrobial soap-water washing method resulted in an only 3.10-log reduction. When hands were heavily soiled

from handling *E. coli* inoculated ground beef, a similar effect persisted, with a 4.60-log and 4.11-log reduction using a hand sanitizer and a soap-water method, respectively. This suggests that although the process of hand washing helped to remove pathogens from hands, the use of a hand sanitizer regimen was also effective for reducing organisms (Edmonds, Mccormack, Zhou, Macinga, & Fricker, 2012). Therefore, the authors suggest the use of a well-formulated alcohol-based hand rub as part of a hand-washing regimen to reduce the risk of infection and transmission in food service facilities.

Park, Barclay, Macinga, Charbonneau, Pettigrew, and Vinje (2010) evaluated the virucidal efficacy of seven commercial hand sanitizers containing various active ingredients, such as Ethanol, Triclosan, and Chlorhexidine. They then compared their effectiveness against mouse norovirus and feline calicivirus. Based on the outcomes of a quantitative suspension test, only one triclosan-based product (0.1% triclosan, pH 3.0) and one ethanol-based product (72% ethanol, pH 2.9) moderately reduced the infectivity of both mouse norovirus and feline calicivirus (by ≥ 3.4 and > 2.6 log units, respectively) (Park et al., 2010). The other four commercial hand sanitizers reduced the infectivity of both mouse norovirus and feline calicivirus only after five minutes of exposure. Ethanol and isopropanol concentrations $\geq 70\%$ reduced the infectivity of mouse norovirus by ≥ 2.6 log units, whereas 50 and 70% ethanol reduced the infectivity of feline calicivirus by ≥ 2.2 log units after exposure for five minutes. A significant reduction in both human noroviruses after exposure to ethanol or isopropanol indicates that both alcohols are effective.

It is clear that most of the essential ingredients contained within commercial hand sanitizers are effective against human noroviruses (Park et al., 2010). While these data supported the use of hand sanitizers, similar efficacy tests utilizing a 15-second exposure kill

test, found that alcohol-based hand sanitizers are effective against a broad spectrum of bacteria, including antibiotic resistant species, fungi, and other viruses (Table 2.1).

Table 2.1. In Vitro Antimicrobial Efficacy of Alcohol Gel Hand Sanitizer

Challenge Bacteria	Reduction Percent	Reduction Log10
Bacillus megaterium	> 99.998	> 4.68
Clostridium difficile	> 99.998	> 4.75
Corynebacterium diphtheriae	> 99.999	> 5.00
Enterococcus faecalis	> 99.999	> 5.00
Enterococcus faecium	> 99.999	> 5.00
Lactobacillus plantarum	> 99.999	> 5.00
Listeria monocytogenes	> 99.999	> 5.00
Staphylococcus aureus	> 99.999	> 5.00
Staphylococcus epidermidis	> 99.999	> 5.00
Streptococcus pneumoniae	> 99.994	> 4.20
Streptococcus pyogenes	> 99.999	> 5.00
Acinetobacter baumannii	> 99.999	> 5.00
Pseudomonas aeruginosa	> 99.999	> 5.00
Citrobacter freundii	> 99.999	> 5.00
Enterobacter aerogenes	> 99.999	> 5.00
Escherichia coli	> 99.999	> 5.00
Escherichia coli (O157:H7)	> 99.999	> 5.00
Klebsiella ozaenae	> 99.999	> 5.00
Klebsiella pneumoniae	> 99.999	> 5.00
Proteus mirabilis	> 99.999	> 5.00
Proteus vulgaris	> 99.999	> 5.00
Salmonella enteritidis	> 99.999	> 5.00
Salmonella typhimurium	> 99.999	> 5.00
Serratia marcescens	> 99.999	> 5.00
Shigella dysenteriae	> 99.999	> 5.00
Shigella sonnei	> 99.999	> 5.00

Table 2.1. In Vitro Antimicrobial Efficacy of Alcohol Gel Hand Sanitizer

(Continued)

Challenge fungi	Reduction Percent	Reduction Log10
Aspergillus flavus	> 99.999	> 5.00
Aspergillus niger	> 99.998	> 4.72
Candida albicans	> 99.999	> 5.00
Candida tropicalis	> 99.999	> 5.00
Epidermophyton floccosum	> 99.988	> 3.92
Penicillium citrinum	> 99.999	> 5.00
Trichophyton mentagrophytes	> 99.999	> 5.00
Challenge virus	**Reduction Percent**	**Reduction Log10**
Herpes simplex virus type 1	≥ 99.999	≥ 5.00
HIV type 1	≥ 99.993	≥ 4.14
Influenza virus type A2	≥ 99.999	≥ 5.25
Parainfluenza virus type 2	≥ 99.996	≥ 4.39
Parainfluenza virus type 3	≥ 99.993	≥ 4.14
Rhinovirus type 16	≥ 99.994	≥ 4.25

Note. Adapted from "The impact of alcohol hand sanitizer use on infection rates in an extended care facility", by Fendler, E. J., Ali, Y., Hammond, B. S., Lyons, M. K., Kelley, M. B., & Vowell, N. A. (2002). The impact of alcohol hand sanitizer use on infection rates in an extended care facility. *American journal of infection control*, *30*(4), 226-233.

Application of Hand Sanitizers in Congregate Settings

Hand hygiene has been cited to be one of the significant methods for preventing communicable diseases (Boyce & Pittet, 2002). Studies link hand hygiene to disease and infections in many congregate settings, including elementary schools, college and university campuses, healthcare, and military (Larson et., 2005; Ryan et al., 2001; White, et al., 2001; White, et al., 2005).

There has been a significant amount of research conducted on infection control and diseases within the elementary school environment using hand sanitizers (Dyer et al., 2000; Eagly & Chaiken, 1998; Gore & Lambert, 2001; Guinan et al., 2002; Hedstrom, Karlsson, & Kolkowska, 2013; Master, Hess, & Dickson, 1997; Morton & Schultz, 2004; Hammond et al., 2000; Thompson, 2004; Scott & Vanick, 2007; White et al., 2001). In 2000, one study compared

students using CleanHands® hand sanitizers with a control group of students using normal hand washing with soap and water. The study found 41.9% fewer illness-related absence days, representing a 28.9% and a 49.7% decrease in gastrointestinal- and respiratory-related illnesses, respectively. Likewise, absences decreased by 31.7% overall, consisting of a 44.2% reduction in gastrointestinal-related illnesses and 50.2% decrease in respiratory-related illnesses (Dyer et al., 2000). In 2002, another study was conducted with 16 individual schools, including more than 6,000 students in Delaware, Ohio, California, and Tennessee. Different schools from each district were paired into experimental and control groups. Alcohol-based hand sanitizers were used by the students and staff when entering and leaving the classroom in the experimental group, and absenteeism due to infection was recorded for both groups. A 19.8% reduction in absenteeism for the experimental group was achieved ($p < .05$). Data with the largest teacher population ($N = 246$) in the experimental group showed that teacher absenteeism also decreased 10.1% (Hammond, Fendler, Dolan, & Sandra, 2000).

Other experiments conducted within the elementary school setting included educational and promotional campaigns concerning hand sanitizer use. One study in Pennsylvania included 290 students from five independent schools with classrooms divided into experimental and control groups. The students in the experimental groups went through an educational program, which included a formal lecture, videos, and pamphlets. After the data were collected for three months, a 50.6% reduction in absences in the experimental group was noted ($p < .001$) (Guinan, McGuckin, & Ali, 2002).

Similar studies have been conducted among college students. A confidential, self-administered online survey included a total of 994 college students, including 49% undergraduates and 30% graduate students, of which 34% lived in residence halls.

Approximately 34% of respondents who lived on campus (N = 339) reported that their residence hall did not provide soap. The top five reasons reported for not washing were: forgetting (63%), too busy (52%), unnecessary (37%), soap was not in a convenient location (31%), and no soap was available (26%). Approximately 70% of all respondents indicated that they would use a hand sanitizer instead of hand washing if it was available on the campus and 42% indicated that they would use it on the residential campus. The authors recommended the implementation of hand sanitizers on campus to further improve hand hygiene compliance and reduce the rates of infection and absenteeism (Scott & Vanick, 2007).

Additional theory-based health promotion research has been conducted with students and staff from three chiropractic teaching colleges within the U.S. The researchers surveyed and observed students' attitude toward hand sanitation behavior. Both students and staff were instructed on how to use hand sanitizers properly through demonstrations of techniques. After the instruction, the perception of others and its effect on proper hand sanitation behavior increased from 39% to 50% ($p < 0.01$), and actual hand sanitation practice behavior increased from 78% to 83% ($p = 0.03$) (Evans, et al., 2009).

Another study conducted with 430 students who lived in residence halls achieved a 39.9% reduction in upper respiratory illnesses, a 20% reduction in overall illness, and a 43% reduction in absenteeism (White et al., 2001). A follow-up study used a pretest-posttest control group study to explore hand sanitizer attitude, knowledge, and perceived behavior for 391 participants in residence halls. After a health campaign, the experimental group reported 26% fewer illnesses and 40% fewer absences than the control group (White et al., 2005).

In the military setting, Gibson (1997) utilized a randomized double-blinded trial to determine the efficacy of antimicrobial hand wipes in reducing acute upper respiratory infections

among U.S. Air Force Basic Military trainees. The soldiers were randomly distributed into control and experimental groups. The control group utilized an antimicrobial hand soap (Triclosan) and the experimental group utilized hand sanitizers. The hand colony counts and sick-call visits were recorded during both phases. The findings showed that when compared to regular hand hygiene practices, the use of hand sanitizers produced a 71.4% reduction in hand colony counts ($p > 0.01$). The use of the antimicrobial hand soap did not significantly change hand colony counts ($p = 0.38$). In phase 2, the experimental group with hand sanitizer antisepsis reduced the incidence of initial sick-call visits for acute respiratory infection by 32.7% ($p = 0.02$) and upper respiratory infections by 40% ($p = 0.01$). While the amount of infections tripled in the control group (0.8% to 3.0%), the number of infections were unchanged (1.2%) for the experimental group who was assigned to use the hand sanitizer antisepsis.

The most recent study conducted with military training personnel at Fort Sill, Oklahoma investigated the impact of a customized alcohol-based instant hand sanitizer regimen in a basic training setting. The entire population of the training center participated in the 13-week study. Two training battalions were randomly assigned to either the control group or the intervention group. The primary intervention group received a customized Purell® Instant Hand Sanitizer regimen, classroom-based education, and reinforcement from the drill officer. The secondary intervention group was provided with the customized Purell® Instant Hand Sanitizer regimen only. After comparing the data with the control group, both intervention groups experienced a 40% reduction in respiratory illness ($p < 0.01$), 48% less gastrointestinal illness ($p < 0.02$), 44% less lost training time ($p < 0.01$), and 31% fewer health care encounters ($p < 0.01$) (Mott et al., 2007).

Fundamental Concepts Underlying Hand Sanitation Practices

Hand hygiene is the leading preventative measure to reduce the fecal-oral route of pathogen transmission (Boyce & Pittet, 2002). To reduce infection or illness, proper hand hygiene practices must be accepted and used (Larson & Kretzer, 1995). Poor hand hygiene compliance is common among hand sanitation studies (Hilburn et al., 2003; Storr & Clayton, 2004). Reported reasons for not cleaning hands include skin irritation, inaccessible hand sanitation supplies, wearing gloves, being too busy, or not thinking about it. However, people commonly believe they cleaned their hands when necessary even when observations indicated otherwise (Dubbert, Dolce, Richter, Miller, & Chapman, 1990).

Hand hygiene training can be efficient in improving knowledge, but is less effective for motivating people actually to use good hand hygiene practices (Glanz & Rimer, 1997; Manuel, Tam, Sameer, 2008; Martin, Knabel, & Mendenhall, 1999; Roberts et al., 2008). The Department of Health and Human Services recommended the incorporation of behavioral interventions to improve hand hygiene attitudes by targeting individuals' motivational systems (Glanz & Rimer, 1997). To increase the effectiveness of a promotional program, the designer must first understand how behavior interacts with beliefs and knowledge (Green, Ottoson, Garcia, & Robert, 2009). This understanding can be facilitated by using theory-based models when developing educational materials (O'Boyle, Henly, & Larson, 2001; Storr & Clayton, 2004).

Within the broad range of theory facilitated research, there have been several types of studies. One stream of research has focused on individual compliance with hand sanitation practices by using intention or practice as the dependent variable (Ejemot-Nwadiaro, Ehiri, Meremikwu, & Critchley, 2008; O'Boyle, Hanley, & Larson, 2001). Another stream of research has focused on implementation success at the organizational level (Burke & Ockene, 2001;

Hedstrom, Karlsson, & Kolkowska, 2013). Each of these approaches makes a significant and unique contribution to the literature. Compared to the other theories that focus more on external variables such as self-efficacy and outcome expectancy, this study will employ the use of the Theory of Planned Behavior to explore the intention behind hand sanitation behavior.

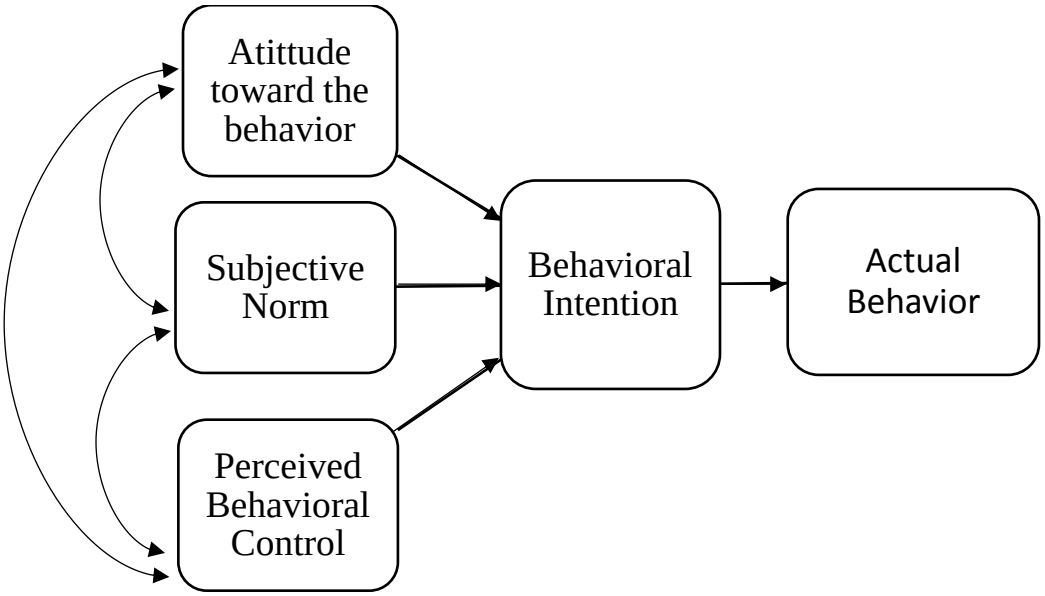
The Theory of Planned Behavior

Freedom of behavior is a valuable and pervasive aspect of human life. People continually survey their internal and external environment and make decisions about what, how, and when they will do things (Festinger, 1962). They consider their wants and needs, the dangers and benefits, and the ways in which they can accomplish various ends. It is not to say that behavior is always freely selected (Runkel & Macgrath, 1972). Frequently, individuals perform acts without quite knowing why, and conversely they perform actions because they knew they were not free to do otherwise (Festinger & Carlsmith, 1959). However, most of the time people are free to engage in a variety of different behaviors and can select among these as they please.

In applied social psychology, the Theory of Planned Behavior (TPB) is a theory that links beliefs and behavior. In 1969, Wicker noted that attitudes probably do not predict behavior (Wicker, 1969). Since then, social psychologists have been trying to improve the predictive power of attitudes. Later, Zanna, Olson, and Fazio (1980) included additional determinants of behavior, such as social norms or intentions, to further develop the prediction models of behavior. The most popular and widely researched models are the Theory of Reasoned Action (TRA) and the TPB (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). The TRA and TPB are the most fundamental and influential theories of human behavior (Ajzen & Fishbein, 1980; Sheppard, Hartwick, & Warshaw, 1988).

Derived from the TRA, the TPB (Figure 2.1) suggests three conceptually independent variables to determine behavioral intention. The first is the attitude, which refers to the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior. The second predictor is the subjective norm, referring to the perceived social pressure to perform or not to perform a behavior. The third antecedent of intention is perceived behavioral control (PBC), which refers to the perceived difficulty of performing the behavior and is assumed to reflect experience and anticipated impairments or obstacles. In general, the more approving the attitude and subjective norm toward a behavior, the weaker the perceived behavioral control, the greater an individual's intention will be to perform the behavior (Ajzen, 1971).

Figure 2.1. The Theory of Planned Behavior (Ajzen, 1991)



The TPB assumes that human social behavior is reasoned or planned in the sense that people take into account a behavior's likely consequences (behavioral beliefs), the normative expectations of important referents (normative beliefs), and factors that may facilitate or impede performance of the behavior (control beliefs) (Ajzen, 2011). These beliefs are considered to be

the prevailing determinants of a person's intentions and actions: behavioral beliefs, which are expected to influence attitudes toward the behavior; normative beliefs, which establish the underlying determinants of subjective norms; and control beliefs, which deliver the basis for perceptions of behavioral control (Ajzen, 1989). Although these beliefs are sometimes inaccurate, unfounded, or biased, the attitudes, subjective norms, and perception of behavioral control are thought to go along automatically and reasonably from these beliefs, producing a corresponding behavioral intention that can facilitate or inhibit the performance of the behavior (Ajzen, 1991).

Behavioral Belief and Attitude

Attitude is defined as the evaluation of the likelihood that a particular behavior will lead to the desired outcome (Ajzen, 1971). Attitude toward a behavior is assumed to have two components: beliefs (or cognitions) and evaluations (or effect) that work together to be a function of behavioral beliefs or behavior's likely consequences. For example, sending people to wash their hands will decrease bacterial infections; therefore, washing hands is strongly desirable.

A behavioral belief is a person's subjective probability that performing a behavior of interest will lead to a particular outcome (Ajzen & Fishbein, 1980). The behavioral beliefs are theorized to produce a positive or negative attitude toward the behavior. Both results contribute to the overall attitude in direct proportion to the subjective probability that the behavior will produce the outcome in question (Zanna, Olson, & Fazio, 1980). For example, a person might believe that it is extremely likely (subjective probability) that hand washing (the behavior) will improve physical health (a positive outcome). This same individual may also believe it is unlikely that regular hand washing will increase skin irritation and dryness (a negative result).

Then, the presumed likelihood of experiencing positive consequences from a practice outweighs the presumed likelihood of negative consequences from hand washing. Under an expectancy-value model of attitude (Feather, 1982), this person should hold a positive attitude toward regular hand washing.

Because attitude is an evaluative response ranging from in favor to unfavored, Ajzen indicates the calculation of attitude can be described as Attitude = $\sum_i bb_i\ be_i$; that the strength of each behavioral belief (bb_i) is multiplied by the evaluation of its consequence (be_i), and attitude is a summation of the cross products (Ajzen & Fishbein 1980; Eagly & Chaiken, 1998; Taylor & Pham, 1998).

Normative Belief and Subjective Norm

Normative beliefs constitute the basis for perceived social pressure, also known as subjective norms. The term subjective norm refers to a particular behavioral prescription or proscription attributed to a generalized social agent. It is a person's perception that important others prescribe, desire, or expect the performance or nonperformance of a specific behavior (Ajzen, 1991; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). However, normative beliefs represent only one source of perceived normative pressure. According to the Social Norm Approach, relevant norms can be categorized into two types: injunctive norms that refer to social approval of the act and descriptive norms that relate to the popularity of an individual act (Axelrod, 1986). For example, injunctive norms describe other peoples' shared morals or beliefs regarding hand sanitation behavior, compared to descriptive norms, which represent the frequency of hand sanitation behavior that is primarily formed from observations of others' hand sanitation behavior. Some researchers equate subjective norms from the TPB with injunctive norms from the Social Norm Approach (Lapinski & Rimal, 2005). Ajzen (2005) noted that the

measure of subjective norms should include items that are designed to capture descriptive norms. For example, do the people who are important to us sanitize their hands or not?

Even if there are injunctive and descriptive norms within a certain group or association, individuals can still vary in their perception of those norms at both the personal and the social level. The personal level of descriptive norms refers to an individual's beliefs regarding the behavior itself, those who are significant to the respondent or whose opinion the respondent values. Societal norms explain why individuals from different cultures and societies perceive different social expectations (Axelrod, 1986; Ryan & Deci, 2000).

The overall strength of the subjective norm is determined by the personal or societal levels of motivation to comply with the related individual or group. For example, an individual might believe it is extremely likely that one's family would approve of him using hand sanitizers, but only somewhat likely that his friends would approve of the same behavior. Related to the motivation to comply with family, if the motivation to comply with one's friends is higher, then this individual will only experience a moderate amount of social pressure to use hand sanitizer. So the subjective norm can be summarized as follows: Subjective Norm = $\sum_i nb_i\ bc_i$; that each important individual (nb_i) to the person is multiplied by his/her motivation to comply with this person (mc_i). Then all the cross products are summarized for all important individuals (Ajzen & Fishbein, 1980).

Control Beliefs and Perceived Behavioral Control

A control belief is defined as a person's estimation of the likelihood that a given facilitating or inhibiting factor will be present (Ajzen, 1985). For example, one might believe that it is extremely unlikely that he/she will have enough time to sanitize his/her hands before lunch. At the same time, that person might be extremely confident that he/she has the necessary

hand sanitation skills. Each control belief contributes to perceived behavioral control, or a sense of self-efficacy, in direct proportion to the perceived power of the factor to facilitate or impede the performance of the behavior (Ajzen, 1985). For example, despite a high competence of one's hand sanitation capability, time pressures at work may exercise more power to hamper hand sanitation behavior, thereby, reducing perceived control over the behavior.

PBC can also be traced to a set of underlying beliefs that deals with the presence or absence of requisite resources and opportunities or even past behavior. These control beliefs may be based on past experiences with the behavior, but are often influenced by the experiences of acquaintances and friends (or social norm), and by other factors that increase or reduce the perceived difficulty of performing the behavior. The more resources and opportunities individuals believe they possess, and the fewer obstacles or impediments they anticipate, the greater their perceived control over the behavior (Ajzen, 1991). To estimate the perceived behavioral control, each control belief (cb_i) is multiplied by the perceived power of the control factor (pp_i), and then the perceived behavioral control is a summation of the cross products, illustrated as $PBC = \sum_i cb_i\ pp_i$ (Ajzen & Fishbein, 1980).

Behavioral Intention

The TPB has constructed the behavioral intention (BI) as an immediate antecedent of behavior and an indication of an individual's readiness to perform a given behavior. It is based on the summation of a person's attitude toward the behavior, subjective norm, and perceived behavioral control, illustrated as $BI = \sum_i = ATT_i\ SN_i\ PBC_i$ (Figure 2.1) (Ajzen & Fishbein, 1980; Gollwitzer, 1999). Although, the TPB has been used extensively in health belief and health behavior research to uncover beliefs, other researchers have also used these beliefs to implement

interventions within the restaurant environment (Godin & Kok, 1996; York et al., 2009a; York et al., 2009b). Once these primary beliefs have been identified, they can be targeted for change.

Predictive Validity of Theory of Planned Behavior

A meta-analysis of 185 independent studies published up to the end of 1997 noted that the TPB accounted for 27% and 39% of the variance in behavior and intention, respectively. When behavior measures were self-reported, the TPB accounted for 11% more of the variance in behavior than when behavior measures were objective or observed (R^2 = .31 and .21, respectively) (Armitage & Conner, 2001).

Demographic Factors

Demographic factors have been found to play a major role in the behavior of individuals in several studies. Past hand hygiene research has shown women are more likely to practice hand hygiene compared to men (Guinan, McGuckin, & Ali, 2002; Johnson, Sholcosky, Gabello, Robert, & Ogonosky, 2003; Monk et al., 2005). One recent study conducted by the American Society for Microbiology (2010) used both telephone surveys (N = 3020) and observations of behaviors (N = 6028) and found that women are more likely to report and practice hand hygiene than man, regardless of what activity they just did. Other studies have discovered that women report hand hygiene intention and behavior more frequently than men due to greater acceptance of, and pressure from, social norms (Nichols, 2014; Schultz et al., 2007). Similar studies conducted among college students have reported similar findings (Taylor, Basco, Zaied, & Ward, 2010; White et al., 2005).

Surprisingly, those with lesser education or lower income levels (below $50,000) are more likely to practice proper hand hygiene compared to people who have higher education (i.e. some college and post-graduate) or higher income ($50,000 and above). People with high school

education or less are more likely to practice proper hand hygiene after petting a dog and/or cat (47% vs 37%), after coughing and/or sneezing (45% vs 33%), and after handling money (32% vs 23%) than those with higher levels of education. A comparable situation with people who have an income level below $50,000 are more than likely to practice proper hand hygiene after petting a dog and/or cat (47% vs. 37%), after handling and/or eating food (82% vs 73%), after coughing and/or sneezing (46% vs 30%), and after handling money (35% vs 17%) (American Society for Microbiology, 2010).

Using Behavioral Intention to Predict Actual Behavior

According to the principle of compatibility, any behavior is defined by four elements: action, target, context, and time (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975). If the measure of intention involves exactly the same action, target, context, and time elements as the measure of behavior, then intention is compatible with a behavior (Ajzen, 2005).

Many studies have determined the predictive validity of behavioral intentions in different settings (Giles, McClenahan, Cairns, & Mallet, 2004; Hrubes, Ajzen, & Daigle, 2001; Mcmillan & Conner, 2003; Milne, Orbell, & Sheeran, 2002). When behavioral intentions are appropriately measured, they can account for a substantial proportion of the variance in actual behavior. This is supported by meta-analyses of empirical findings and other systematic reviews. The mean correlations between behavior and intention ranged from 0.45 to 0.62 in several of the meta-analyses (Notani, 1998; Randall & Wolff, 1994; Sheppard et al., 1988). Other studies have found the intention-behavior correlations range from 0.44 to 0.56 (Armitage & Conner, 2001; Downs & Hausenblas, 2005a, 2005b; Godin & Kok, 1996; Hagger, Chatzisarantis, & Biddle, 2002; Hausenblas, Carron, & Mack, 1997; Johnson et al., 2003; Sheeran & Orbell, 2000; Webb

& Sheeran, 2006). Sheeran (2002) has concluded an overall correlation of 0.53 between intention and behavior in all meta-analyses.

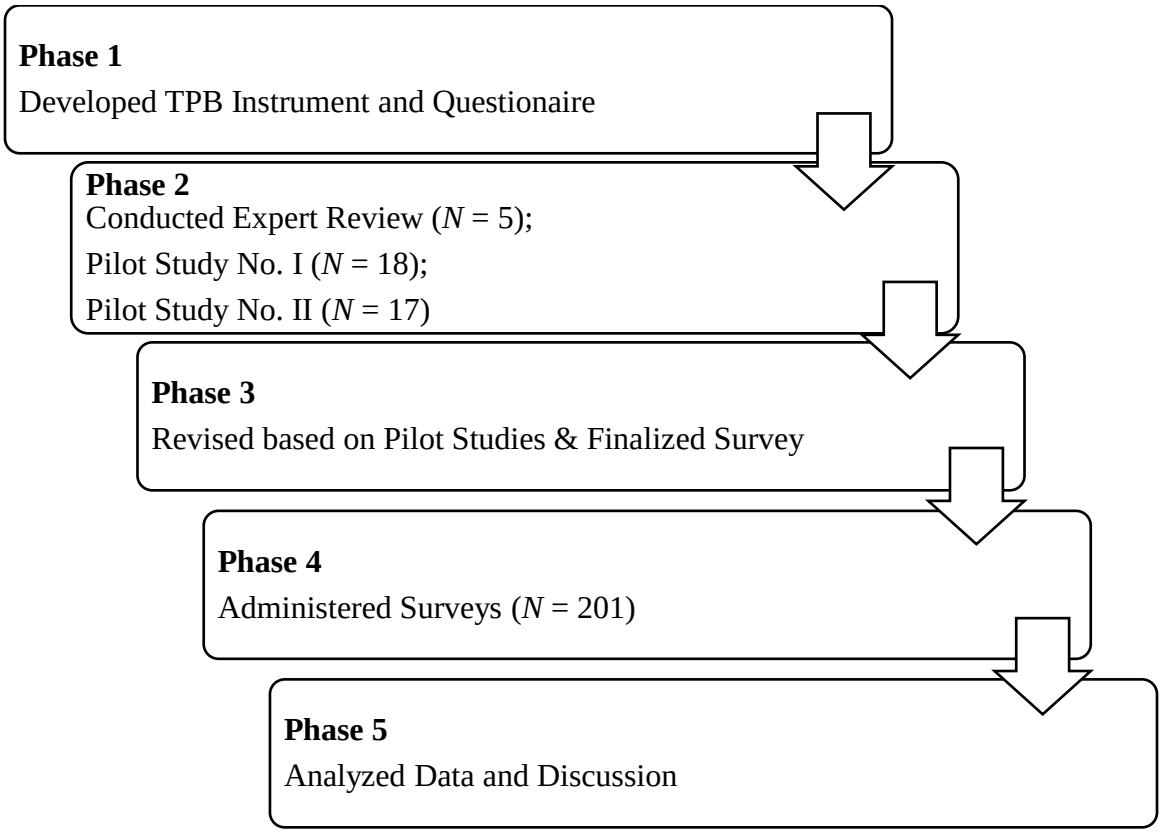
Chapter Summary

This chapter discussed the importance of hand hygiene, hand washing and the correlation with foodborne diseases, and reviewed the previous history and efficacy data about hand sanitizer and hand sanitation antisepsis as it applies to different congregated settings. After validating this research with the theoretical foundation of human behavior prediction, this research focuses on the application of the Theory of Planned Behavior to the hand sanitation behavioral intention within the military dining environment.

Chapter 3 - METHODOLOGY

Multiple studies utilizing the Theory of Planned Behavior (TPB) demonstrate that the theory has value in predicting hand sanitation behavior (Ajzen & Fishbein, 1980; Gibson 1997; Mott et al., 2007; Sheppard et al., 1988). Using guidance developed by previous researchers (Francis et al., 2004), this chapter covers the research methods utilized in this study, including the population and sample, the research design, pilot studies, protection of human rights, data collection process, and statistical analysis. A flow chart of the research methods utilized is presented in Figure 3.1.

Figure 3.1. Summary of Research Methods



Population & Sample Size

The population of interest in this study was non-trainee soldiers stationed at Fort Riley, Kansas. There are three main dining facilities available on Fort Riley: Cantigny, Demon's Diner, and Devil's Den. Devil's Den was recommended by the Fort Riley foodservice advisor because it is the largest dining facility on Fort Riley with typical headcounts over the lunch period of 400 soldiers.

Previous statistical power analysis determined the required sample size. It is reasonable to assume at least a moderate effect size (Multiple R of approximately 0.3) for TPB studies using multiple regression approaches (Cohen, 1988). Thus, a sample size of 80 would be considered acceptable by Cohen's study.

Using the sampling error equation developed by statistician Dillman (2000) from previous sample size studies, $Ns = \frac{(Np)(p)(1-p)}{(Np-1)(\frac{B}{C})^2+(p)(1-p)}$, where *Ns* = 96 (completed sample size needed); N_p = 18176 (size of population); p = 0.5 (proportion expected to answer a certain way); B = 10 (acceptable level of sampling error); C = 1.96 (Z statistic associate with confidence interval). Based on the data gathered from DOD and U.S Army Garrison Command, Ft. Riley has an estimated population of 18,176 military personnel, the majority of which are 18 to 34 years old (Plans, Analysis and Integration Office, 2014). For a question with a high heterogeneity (a 50/50 split) in a population of 18,176, a completed sample size of 96 is needed to be sure that the estimate of interest was within ±10% percentage points 95% of the time (Dillman, 2010).

To reach a lower margin of error, with a given target population of 18,176, to achieve a 95% confidence level with medium heterogeneity (an 80/20 split) based on literature review, a

sample size of 200 or above would achieve a 95% confidence level with ± 5.5% of margin of error, with a minimum confidence level of 89.5% (De Vaus, 2002; Dillman, 2000).

To achieve a sample size of 200, approximately 400 soldiers coming into the dining facility before and after their meal period were targeted with a goal of achieving at least 200 completed questionnaires (De Vaus, 2002; Dillman, 2010).

The Research Design

The initial questionnaire for this study included both direct belief measures (attitudes, subjective norms, and perceived behavioral control) and indirect belief measures (behavioral beliefs, normative beliefs, and control beliefs), which have been identified through the review of the literature. The initial version of the survey (Appendix A) included 41 scaled questions and demographic items. All questions for the survey were derived from pre-developed measurements from reliable sources (Francis et al., 2004).

Pilot Studies

Two pilot studies were conducted. Prior to pilot study I, the face validity of the research questionnaire was assured through a panel of five experts, including three U.S. Army veterans with military backgrounds and two foodservice management experts. The group made minor recommendations for questionnaire wording and layout.

Pilot Study I

The first pilot study was conducted at Devil's Den Dining Facility, utilizing two researchers on July 23, 2015. Soldiers were targeted during the lunch period from 12:00 AM to 12:40 PM. A total of 40 copies were handed out, 23 were collected. Of the 23 copies returned, two were incomplete, and three were removed because participants selected the same answer in

all questions. Therefore, the pilot study I yielded 18 responses with valid responses, for a response rate of 45%.

During the first pilot study, researchers identified a struggle of non-responses due to the lack of material incentives. Moreover, soldiers made comments to the researcher that the questionnaire was long and difficult to read. The average completion time was between five to 25 minutes.

Pilot Study II

The second pilot study was conducted at Demon's Diner, on July 27, 2015, during the lunch period (11:30 AM to 13:00 PM) with the help of two researchers. For pilot study II, the survey was modified into a stapled booklet. A short section with open-ended questions about content clarity was added at the end of the survey to obtain specific feedback and suggestions. A question to gather completion time was also added.

A total of 50 surveys was handed out, 22 surveys were returned. Three were incomplete, and two were removed due to participants selecting the same response on all questions. Therefore, pilot study II yielded 17 copies with valid answers, for a response rate of 30.9%. After analyzing the descriptive data on the survey for clarity and suggestions, the researchers simplified the wording of the demographic questions. One behavioral belief question "*My hands will be clean if I use hand sanitizer before meals*" was removed due to a low response rate on that specific question. Additionally, a website link and a quick response code (QR code) that directed the user to an electronic version of the survey was added to provided more accessibility and convenience.

Questionnaire

The initial version of the questionnaire is included in Appendix A. Based on the feedback from the soldiers and results of the pilot tests, the final version of the instrument included 41 questions to measure eight constructs and the demographic information of the respondents (Appendix B). A cover letter with a three-page questionnaire printed on light blue paper folded to an 8.5" x 11" size was distributed to soldiers as they arrived at the dining facility. The cover letter introduced the purpose of the study and included instructions on how to complete the survey. The cover letter also noted that participation in this research was strictly voluntary and that completion of the survey would take no longer than 10 minutes. Surveys were distributed to soldiers as they arrived at the dining facility. A website link and a quick response code (QR code) directing the user to the electronic version of the survey was provided for convenience.

Direct Measurements

In the implementation of TPB research, the target behavior should be carefully defined regarding its target, action, context, and time (Ajzen, 1988, 1991). In this study, the behavior was described as "*I have the intention (target) to use (action) hand sanitizer (context) every day before having lunch in the dining facility (time)*". Direct measures of attitudes, perceived behavioral control, subjective norms, and the behavioral intention was measured on a seven-point Likert scale ranging from (1) strongly disagree to (7) strongly agree.

Attitude

Three direct measures of attitudes were drawn from the literature review. These questions included endorsement ("*Using hand sanitizer is a good idea*"), likeliness ("*I like using*

a hand sanitizer"), and provability ("*Overall, I think using hand sanitizer is the right thing to do*").

Subjective Norm

Three direct measures of the subjective norm were drawn from the literature. These questions included influence from important people ("*People who are important to me think that I should use hand sanitizer before and after each meal*"), social pressure ("*I feel social pressure to use hand sanitizer before and after each meal*"), and general expectation ("*It is expected that I will use hand sanitizer before and after each meal*").

Perceived Behavioral Control

Three direct measures of perceived behavioral control were drawn from the literature. These questions included confidence ("*I am confident that I can use hand sanitizer whenever I want to*"), self-efficacy ("*It is my choice whether I use a hand sanitizer*"), and ease of use ("*Using a hand sanitizer is easy*").

Indirect Measurements

Indirect belief measures were identified through the review of the literature. Each construct is outlined below.

Behavioral Beliefs

Six behavioral belief questions were drawn from the literature. These included three questions from the belief strength ("*If I use hand sanitizer, I will feel that I am doing something positive", "It causes a lot of worry and concern for me to use hand sanitizer", and "If I use hand sanitizer every day, I will be less likely to become ill.*"). The other three questions address outcome evaluation *("Doing something positive for myself is desirable", "Causing a lot of worry and concern for me is desirable",* and *"It is very important for me to avoid illness"*).

Normative Beliefs

Eight normative belief questions were drawn from the literature. These included four questions focused on the belief strength (*"Other soldiers think that I should use hand sanitizer", "Doctors and nurses would encourage me to use hand sanitizer", "The leaders in the Army think that I should use hand sanitizer", and "My family and friends encourage me to use hand sanitizer"*). The other four are focused on motivation to comply (*"Doing what other soldiers do is important to me", "Doing what healthcare professionals think I should be doing is important to me", "The Army leadership's approval of my actions is important to me", and "My family and friends approval of my actions is important to me"*).

Control Beliefs

Six control beliefs questions were drawn from the literature review. These included three control belief strength questions (*"The hand sanitizer dispenser is difficult to find", "I do not like the smell of hand sanitizer", and "The use of hand sanitizers dries out my hands*). The other three questions address the control belief power *("I am more likely to use hand sanitizer if it is easily available", "I am more likely to use hand sanitizer if it does not cause dry skin",* and *"I am more likely to use hand sanitizer if my hands feel good"*).

Behavioral Intention

The behavioral intention, or the likelihood that soldiers' intent to utilize hand sanitizer every day before lunch, was measured with four questions distributed throughout the questionnaire to avoid the questions appearing repetitions. These four questions included: "*I want to use hand sanitizer every day before lunch*", "*I will use hand sanitizer every day*", "*I intend to use hand sanitizer every day*", and "*I want to use hand sanitizer every day*".

Self-reported Behavior

Soldiers were asked whether they have utilized hand sanitizers every day, using two questions. These questions include: "*I use a hand sanitizer every day before meals",* and "*I use a hand sanitizer after I use the restroom*".

Demographics

Six questions were asked to assess demographic information. The questions requested information about participants' gender, age, approximate annual household income, education, marital status, and active duty status.

Project Approval and Human Subject Protection

Prior to data collection, the study protocol was approved by the Kansas State University Institutional Review Board (IRB # 7769). The IRB approval letter is included in Appendix C. The study also approved by the military, the approval letter is included in Appendix D.

Data Collection

Data were collected from August 3 to August 7, 2015 between 11:00 AM to 1:00 PM at Devil's Den Dining facility. A cover letter indicating the purpose of the study was distributed and verbal consent of participation was obtained. In order to ensure the quality of the responses, two reverse coded questions, including "*It causes a lot of worry and concern for me to use hand sanitizer*" and "*Causing a lot of worry and concern for me is desirable*", were embedded into the survey. Moreover, a question in the demographics section "*Are you currently active duty?*" was used to ensure our sampling was strictly targeting active duty soldiers.

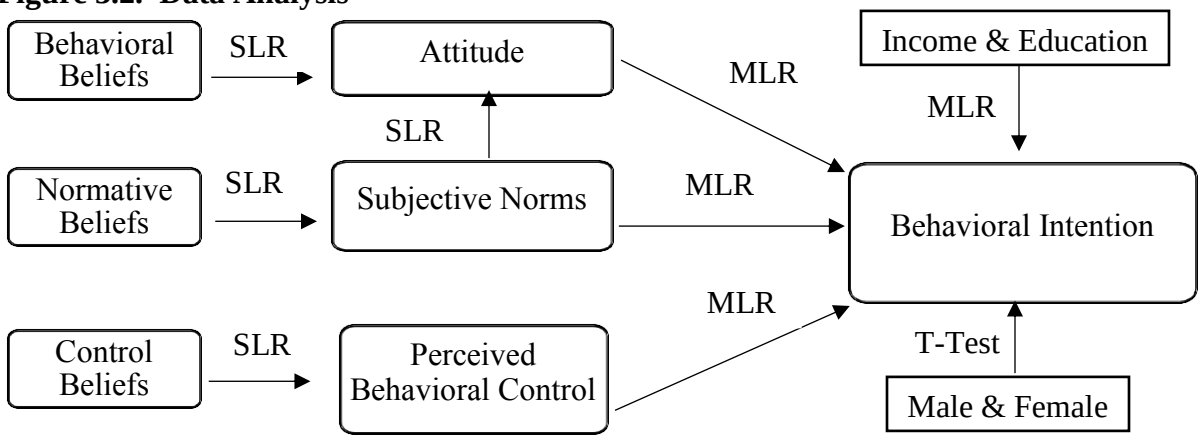
During the time of the distribution, a total of four researchers helped to distribute the questionnaire. Two researchers handed out the questionnaires at the main entrance of the facility, a third researcher distributed surveys at a side entrance, and the remaining researcher

collected surveys at the plate return. Snack bars were utilized to increase attention and participation. A total of 330 snack bars were used as incentives at a cost $269.14.

Statistical Analysis

All data were analyzed with the Statistical Package for the Social Sciences (SPSS) (version 22.0, 2015, SPSS, Inc., Chicago: IL). Descriptive statistics were used to explain the mean and standard deviation of all direct and indirect beliefs. Cronbach's alpha (1951) was used to determine the internal consistency of all seven constructs. A threshold of 0.7 was used to demonstrate internal consistency. A multiple linear regression (MLR) was used to regress the TPB direct measure variables (attitude, subjective norms, and perceived behavioral control) on behavioral intention. Simple linear regression was used to regress each of the TPB indirect measure variables (behavioral belief, normative belief, and control beliefs) toward its related TPB direct measure variables (attitude, subjective norms, and perceived behavioral control), and to emplace the relationship between attitudes and subjective norm. Furthermore, another multiple linear regression was used to assess differences in income and age on behavioral intention toward hand sanitizers. An independent t-test was conducted to test the gender hypothesis. Figure 3.2 outlines the statistical analysis methods utilized.

Figure 3.2. Data Analysis



Note. SLR = Simple Linear Regression; MLR = Multiple Linear Regression

Chapter 4 - DATA ANALYSIS AND DISCUSSION

During the data collection period, a total of 500 surveys were distributed, and 225 were collected. Among these, 21 were returned blank or incomplete, and 11 were removed because participants selected the same response on all questions. Two surveys were returned by non-active duty soldiers and were removed, leaving 191 valid surveys. Another ten surveys were collected online, so the final number of surveys collected was 201, for a response rate of 40%.

Demographic Characteristics of Sample

Characteristics of soldiers participating in this study are presented in Table 4.1. All participants were active duty soldiers; all others were manually screened out. Of 201 respondents, 186 were male (92.5%), and the majority of the respondents were 18 to 34 years of age (92.5%). When compared to a 2013 Department of Defense report, the men to women ratio of the military was almost 5:1 and 43.1% were 25 years of age or younger. This study had a significantly higher proportion of males 12:1 and 49.4% younger than average military demographics in 2013 (Office of the Deputy Assistant Secretary of Defense [ODASD], 2013). The sample in this study had a higher proportion of younger males mainly because Ft. Riley is home to an infantry division with large combat-arm force (Plans, Analysis and Integration Office, 2014).

Compared to the average household income for Fort Riley CDP (census-designated place) of $34,459, the majority (72%) of the respondents' household income was below $30,000 a year (U.S. Census Bureau, 2015). With average income below $30,000 a year, the population in this sample yielded a significantly lower average household income. Single soldiers are more prone to utilize military dining facilities because they are eligible to receive meals and housing

Table 4.1. Characteristics of Respondents (*N* = 201)

Characteristic	*n*	%[a]	Characteristic	*n*	%[a]
Gender			***Education***		
Male	186	92.5	Some high school, no diploma	10	5.0
Female	15	7.5	High school graduate or GED	139	69.2
Age			Associate or Technical degree	39	19.4
18 - 34	186	92.5	Bachelor's degree	8	4.0
35 - 54	15	7.5	Graduate degree	5	2.5
> 55	0	0	***Marital Status***		
Annual Household Income			Single, never married	168	83.6
< $29,999	144	71.6	Married or domestic partnership	20	10.0
$30,000 - $49,999	44	21.9	Widowed	1	0.5
$49,999 - $74,999	5	2.5	Divorced/ Separated	12	6.0
$75,000 – or more	5	2.5			

[a] Responses may not equal 100% due to non-response to a question.

for free at the cost of subsistence from the Department of Defense, which does not count toward their annual taxable income (Regulation, 1988).

Almost 70% of the sample graduated from high school, and approximately 26% of the population prossessed an Associate's degree or higher. In this study, the educational level of the sample population is approximately the same as the 2013 Defense Demographic Report of the Military that indicated that an average of 77.8% held a high school/ GED diploma (ODASD, 2013).

The majority (83.6%) of the respondents were single soldiers (n = 168), 10% were married, and 6.5% were divorced or separated. This sample population had a significantly higher proportion of single soldiers than the population of the military overall, where 55.2% were married, 40.3% were single, and 4.3% were divorced (ODASD, 2013).

Internal Consistency

Cronbach's alpha (1951) was used to determine internal reliability among all the Theory of Planned Behavior (TPB) items. A threshold of 0.7 or above was used to demonstrate internal consistency. The Cronbach's alpha is displayed in Table 4.2 for direct measure constructs, and Table 4.3 for indirect measure belief items. Results indicated that all direct measures had reliabilities above 0.7 and were acceptable.

Initial results for the two behavioral belief items showed that removing the following items "*It causes a lot of worry and concern for me to use hand sanitizer*" and "*Causing a lot of worry and concern for me is desirable*", would increase the alpha for behavioral beliefs from 0.56 to 0.75. Therefore these items were removed from further analysis. All the other reliability coefficients on belief measurements were greater than 0.70, indicating that the scales used in the items can successfully measure the direct and indirect strength of the constructs.

Table 4.2. Summary of Direct Measurement Scales (*N* = 201)

Item	Mean ± SD [a]	Frequency [b] (%) [c]						
		1	2	3	4	5	6	7
Attitudes (a = 0.90)								
Overall, I think using a hand sanitizer is the right thing to do.	5.8 ± 1.2	5 (2.5)	6 (3.0)	7 (3.5)	26 (12.9)	36 (17.9)	60 (29.9)	61 (30.3)
Using a hand sanitizer is a good idea.	5.5 ± 1.5	1 (0.5)	1 (0.5)	4 (2.0)	26 (12.9)	35 (17.4)	68 (33.8)	65 (32.3)
I like using hand sanitizers.	5.2 ± 1.6	9 (4.5)	8 (4.0)	7 (3.5)	43 (21.4)	35 (17.4)	46 (22.9)	52 (25.9)
Composite Score	5.5 ± 1.3							
Subjective Norms (a = 0.82)								
People who are important to me think that I should use hand sanitizer before each meal.	4.4 ± 1.6	17 (8.5)	8 (4.0)	13 (6.5)	69 (34.3)	39 (19.4)	36 (17.9)	19 (9.5)
It is expected that I will use hand sanitizer before each meal.	4.1 ± 1.8	30 (14.9)	10 (5.0)	20 (10.0)	56 (27.9)	43 (21.4)	23 (11.4)	19 (9.5)
I feel social pressure to use hand sanitizer before each meal.	3.4 ± 1.8	44 (21.9)	21 (10.4)	23 (11.4)	62 (30.8)	22 (10.9)	16 (8.0)	13 (6.5)
Composite Score	4.0 ± 1.5							
Perceived Behavioral Control (a = 0.70)								
I am confident that I can use hand sanitizers whenever I want to.	6.1 ± 1.3	6 (3.0)	4 (2.0)	8 (4.0)	31 (15.4)	42 (20.9)	49 (24.4)	61 (30.3)
Using a hand sanitizer is easy.	6.0 ± 1.3	6 (3.0)	0 (0.0)	2 (1.5)	10 (5.0)	21 (10.4)	59 (29.4)	102 (50.7)
It is my choice whether I use a hand sanitizer.	5.4 ± 1.5	5 (2.5)	2 (1.0)	2 (1.0)	7 (3.5)	21 (10.4)	69 (34.3)	94 (46.8)

Composite Score	5.9 ± 1.1

Table 4.2. Summary of Direct Measurement Scales (*N* = 201) (Continued)

Item	Mean ± SD [a]	Frequency [b] (%) [c]						
		1	2	3	4	5	6	7
Behavioral Intention (a = 0.93)								
I want to use hand sanitizer every day.	5.2 ± 1.6	4 (2.0)	12 (6.0)	10 (5.0)	41 (20.4)	41 (20.4)	38 (18.9)	54 (26.9)
I want to use hand sanitizer every day before lunch.	5.1 ± 1.8	9 (4.5)	19 (9.5)	3 (1.5)	26 (12.9)	44 (21.9)	45 (22.4)	55 (27.4)
I will use hand sanitizer every day.	4.9 ± 1.7	10 (5.0)	19 (9.5)	8 (4.0)	34 (16.9)	40 (19.9)	48 (23.9)	42 (20.9)
I intend to use hand sanitizer every day.	4.7 ± 1.8	10 (5.0)	7 (3.5)	9 (4.5)	28 (13.9)	44 (21.9)	57 (28.4)	46 (22.9)
Composite Score	4.9 ± 1.6							
Self-reported Behaviors (a = 0.77)								
I use a hand sanitizer after I use the restroom	4.8 ± 1.8	16 (8.0)	14 (7.0)	13 (6.5)	27 (13.4)	54 (26.9)	37 (18.4)	40 (19.9)
I use a hand sanitizer every day before meals.	3.8 ± 1.8	28 (13.9)	27 (13.4)	20 (10.0)	51 (25.4)	32 (15.9)	27 (13.4)	16 (8.0)
Composite Score	4.3 ± 1.6							

[a] Standard Deviation
[b] Responses were coded on a 7-point scale with 1 = strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither disagree or agree, 5 = somewhat agree, 6 = agree, 7 = strongly agree.
[c] Responses may not equal 100% due to non-response to a question.

Treatment and Analysis of Data

Direct Measurement of Theory of Planned Behavior Constructs

The mean and standard deviation of direct measurement variables of each of the Theory of Planned Behavior (TPB) constructs including, attitudes, subjective norms, perceived behavioral control, behavioral intention, and self-reported behaviors are presented in Table 4.2.

The direct measure of attitude had a mean composite score of 5.5 with a standard deviation of 1.3, ranging from the lowest score of 3.6 to the highest score of 7.0. The highest mean score was obtained for the question "*Overall, I think using a hand sanitizer is the right thing to do*" (5.8 ± 1.2) and the lowest mean score resulted from the question "*I like using hand sanitizers*" (5.2 ± 1.6).

The direct measures of subjective norms have a mean composite score of 4.0 with a standard deviation of 1.5. The highest mean score was obtained from the question "*People who are important to me think that I should use hand sanitizer before each meal*" (4.4 ± 1.6) and the question "*I feel social pressure to use hand sanitizer before each meal*" (3.4 ± 1.8) yielded the lowest mean score.

The mean composite score of perceived behavioral control was high (mean = 5.9, standard deviation = 1.1), ranging from the highest mean score of 7.4 to the lowest of 3.9. The highest mean score was obtained for the question "*I am confident that I can use hand sanitizers whenever I want to*" (6.1 ± 1.3) and the question "*It is my choice whether I use a hand sanitizer*" (5.4 ± 1.5) yielded the lowest mean score.

The direct measurement of the behavioral intention had a slightly higher mean score (4.9 ± 1.6) compared to the direct measurement of self-reported behavior (4.3 ± 1.6). Higher behavioral intentions indicate a strong leaning toward hand sanitizer behavior. The highest mean score in the behavioral intention factor was obtained from the question "*I want to use hand sanitizer every day*" (5.2 ± 1.6) and the lowest mean score was from question "*I intend to use hand sanitizer every day*" (4.7 ± 1.8).

Indirect Measurement of Theory of Planned Behavior Constructs

The mean and standard deviation of each indirect measurement is presented in Table 4.3. Each variable was measured with a seven-point Likert scale, from (1) strongly disagree to (7) strongly agree. After initial data analysis, the internal reliability of the two reverse-coded questions was low and both were removed from further analysis.

As identified in the previous literature, salient beliefs for an individual are a function of their perceived likelihood or importance of the beliefs multiplied by the relevant outcome evaluation (Ajzen, 1991; Ajzen & Fishbein, 1980). Therefore, each indirect measurement of behavioral beliefs, normative beliefs, and control beliefs was multiplied by the relevant evaluation score. The data were summed to create a composite score for each respective construct of attitude, subjective norm, and perceived behavioral control in Table 4.4.

All of the evaluation scores in this study were recoded into a bipolar scale (-3 to +3) for easy interpretation. This is important so that positive numbers reflect a positive attitude to the target behavior. In a previous meta-analysis, the bipolar scoring of both belief items was superior to unipolar scoring (McEachan, Conner, Taylor, & Lawton, 2011). The interpretation of scores is easier when the midpoint of the scale is zero, and it is clear whether the final score represents an influence for (positive) or against (negative) enacting the behavior.

Table 4.3. Summary of Indirect Measurement Scales (*N* = 201)

Item	Mean ± SD [a]	Frequency [b] (%) [c]						
		1	2	3	4	5	6	7
Behavioral Beliefs								
If I use hand sanitizer, I feel that I am doing something positive for myself.	5.2 ± 1.6	10 (5.0)	7 (3.5)	9 (4.5)	28 (13.9)	44 (21.9)	57 (28.4)	46 (22.9)
If I use hand sanitizer every day, I will be less likely become ill.	4.9 ± 1.6	7 (3.5)	12 (6.0)	17 (8.5)	33 (16.4)	51 (25.4)	47 (23.4)	34 (16.9)
It causes a lot of worry and concern for me to use hand sanitizer.*	3.0 ± 1.9	57 (28.4)	44 (21.9)	16 (8.0)	37 (18.4)	16 (8.0)	18 (9.0)	13 (6.5)
Outcome Evaluations								
Doing something positive for myself is desirable.	5.9 ± 1.2	2 (1.0)	4 (2.0)	2 (1.0)	15 (7.5)	33 (16.4)	60 (29.9)	85 (42.3)
It is very important for me to avoid illness.	5.8 ± 1.5	9 (4.5)	1 (0.5)	4 (2.0)	18 (9.0)	22 (10.9)	55 (27.4)	92 (45.8)
Causing a lot of worry and concern for me is desirable.*	2.6 ± 2.0	98 (48.8)	26 (12.9)	8 (4.0)	31 (15.4)	12 (6.0)	15 (7.5)	11 (5.5)
Normative Beliefs								
Doctors and nurses would encourage me to use hand sanitizers.	5.5 ± 1.4	5 (2.5)	3 (1.5)	3 (1.5)	36 (17.9)	40 (19.9)	63 (31.3)	51 (25.4)
The leaders in the army think that I should use hand sanitizers.	4.9 ± 1.5	8 (4.0)	5 (2.5)	13 (6.5)	59 (29.4)	35 (17.4)	47 (23.4)	34 (16.9)
My family and friends encourage me to use hand sanitizer.	4.5 ± 1.6	12 (6.0)	14 (7.0)	13 (6.5)	62 (30.8)	41 (20.4)	35 (17.4)	24 (11.9)
Other soldiers think that I should use hand sanitizer.	4.3 ± 1.6	12 (6.0)	15 (7.5)	19 (9.5)	80 (39.8)	27 (13.4)	25 (12.4)	23 (11.4)

Table 4.3. Summary of Indirect Measurement Scales (*N* = 201) (Continued)

Item	Mean ± SD [a]	Frequency [b] (%) [c]						
		1	2	3	4	5	6	7
Motivation to Comply								
My family and friends approval of my actions is important to me.	5.2 ± 1.6	9 (4.5)	10 (5.0)	6 (3.0)	23 (11.4)	51 (25.4)	58 (28.9)	44 (21.9)
Doing what doctors and nurses think I should be doing is important to me.	5.0 ± 1.5	10 (5.0)	6 (3.0)	12 (6.0)	31 (15.4)	55 (27.4)	58 (28.9)	29 (14.4)
The Army leadership's approval of my actions is important to me.	4.8 ± 1.8	21 (10.4)	6 (3.0)	13 (6.5)	32 (15.9)	34 (16.9)	58 (28.9)	37 (18.4)
Doing what other soldiers do is important to me.	3.6 ± 1.8	41 (20.4)	24 (11.9)	14 (7.0)	56 (27.9)	35 (17.4)	21 (10.4)	10 (5.0)
Control Belief Strength								
The hand sanitizer dispenser is difficult to find.	3.7 ± 1.9	33 (16.4)	32 (15.9)	28 (13.9)	37 (18.4)	28 (13.9)	21 (10.4)	22 (10.9)
The use of hand sanitizers dries out my hands.	3.5 ± 1.8	31 (15.4)	40 (19.9)	22 (10.9)	46 (22.9)	33 (16.4)	18 (9.0)	11 (5.5)
I do not like the smell of hand sanitizer.	3.0 ± 1.7	45 (22.4)	53 (26.4)	17 (8.5)	50 (24.9)	17 (8.5)	12 (6.0)	7 (3.5)
Control Belief Power								
I am more likely to use hand sanitizer if it is easily available.	5.4 ± 1.5	5 (2.5)	8 (4.0)	9 (4.5)	28 (13.9)	43 (21.4)	55 (27.4)	53 (26.4)
I am more likely to use hand sanitizer if my hands feel good.	4.9 ± 1.6	9 (4.5)	12 (6.0)	9 (4.5)	47 (23.4)	38 (18.9)	51 (25.4)	35 (17.4)
I am more likely to use hand sanitizer if it does not cause dry skin.	4.4 ± 1.7	14 (7.0)	20 (10.0)	16 (8.0)	61 (30.3)	34 (16.9)	32 (15.9)	24 (11.9)

[a] Standard Deviation

[b] Responses were coded on a 7-point scale with 1=strongly disagree, 2 = disagree, 3 = somewhat disagree, 4 = neither disagree or agree, 5 = somewhat agree, 6 = agree, 7 = strongly agree.

c Responses may not equal 100% due to non-response to a question. *Questions removed for future analysis

It is clearly presented in Table 4.4 that in this study the final score represents a positive influence toward the behavior. Presented in Table 4.4, the behavioral beliefs were measured based on two items. The possible range of total scores for behavioral belief factors ($\sum_i bb_i\ be_i$) is (7 x ± 3) x 2 = ± 42. The mean attitude score for behavioral beliefs was 24.0, reflecting a moderate to strong positive attitude for hand sanitizer use. This indicates that soldiers generally accept hand sanitizer use.

The normative beliefs were measured based on four items. The possible range of total scores for normative belief factors ($\sum_i nb_i\ mc_i$) is (7 x ± 3) x 4 = ± 84. The mean attitude score for normative beliefs was 17.4, reflecting a fairly weak to moderate positive social pressure in favor of hand sanitizer use. Specifically among normative beliefs, the social pressure from other soldiers is negative (mean = -0.8), indicating a negative social pressure from other soldiers to use hand sanitizer.

The control beliefs were measured based on three items. The possible range of total scores for the control belief factor ($\sum_i cb_i\ pp_i$) is (7 x ± 3) x 3 = ± 63. The mean attitude score for control beliefs was 11.0, reflecting a weak positive control in regards to hand sanitizer use. The detailed descriptions are listed in Table 4.4, although all control beliefs strength scored positively toward the perceived behavioral control factors, among these "*availability of hand sanitizers*" (mean = 5.7) still created the strongest perception of control toward hand sanitation behavior.

Table 4.4. Descriptive Summary of Belief Items (*N* = 201)

Belief Items	Strength Mean ± SD[a]	Evaluation Mean ± SD[b]	Overall Beliefs Mean ± SD[c]
Behavioral Beliefs (a = 0.75)	bb_i*	be_i*	bb_ibe_i *
To do something positive for myself	5.2 ± 1.6	2.0 ± 1.2	10.9 ± 7.7
To avoid illness	4.9 ± 1.6	1.9 ± 1.5	10.3 ± 8.0
Do not cause worry and concerns[d]	3.0 ± 1.9	0.4 ± 1.3	2.9 ± 6.0
Composite Score	10.1 ± 3.2	3.9 ± 2.7	24.0 ± 16.2
Normative Beliefs (a = 0.82)	nb_i*	mc_i*	nb_imc_i *
My family and friends	4.5 ± 1.6	1.2 ± 1.6	6.6 ± 7.5
Doctor and nurses	5.5 ± 1.4	1.0 ± 1.5	6.4 ± 9.0
Army leadership	4.9 ± 1.5	0.9 ± 1.8	5.2 ± 9.7
Other soldiers	4.3 ± 1.6	-0.4 ± 1.8	-0.8 ± 8.5
Composite Score	19.2 ± 6.1	2.7 ± 6.7	17.4 ± 28.0
Control Beliefs (a = 0.73)	cb_i*	pp_i*	cb_ipp_i *
Availability of hand sanitizers	3.7 ± 1.9	1.4 ± 1.5	5.7 ± 7.0
Dries out my hands	3.5 ± 1.8	0.4 ± 1.7	3.2 ± 5.5
Smell after wash	3.0 ± 1.7	0.9 ± 0.9	2.1 ± 6.5
Composite Score	10.2 ± 5.4	2.7 ± 4.1	11.0 ± 15.4

[a] Strength means were measured on a 1 to 7 scale, SD = Standard Deviation.
[b] Evaluation means were measured on a -3 to -3 scale.
[c] Overall belief mean represents the mean of each strength item multiplied by each of the responding evaluation items, total score possible (- 21 to + 21).
[d] Item removed for further analysis
[*] Note: *bb* = Behavioral Beliefs, *be* = Behavioral Beliefs, *nb* = Normative Beliefs, *mc* = Motivation to Comply, *cb* = Control Beliefs, *pp* = Perceived Power

Factor Analysis

Principal component factor analysis with varimax rotation was conducted on all major TPB constructs to minimize the effects of multicollinearity and to ensure that each factor did not have any underlying constructs. Based on a minimum eigenvalue of 1.0, the direct measurements of attitude, subjective norm, perceived behavioral control, behavioral intention, self-reported behavior, and the indirect measurements of normative, behavioral, and control beliefs all yield one factor. The details of the factor loadings for direct measurement scales are presented in Table 4.5, ranging from the lowest cumulative variances of 63.1% to 85.0%.

The factor loadings for indirect measurement scales are displayed in Table 4.6. The lowest cumulative variance was 55.7% to the highest of 67.0%. According to Podaskoff, MacKenzei, Lee, and Podsakoff (2003), if a single factor emerges, or one general factor accounts for most of the covariance in the independent and dependent variables, a significant common method variance is present.

Table 4.5. Factor Analysis of TPB Direct Measurement Scales (*N* = 201)

Scale Item	Factor Loadings	Cumulative % of Variance
Attitudes (a = 0.90)		**85.0%**
Overall, I think using a hand sanitizer is the right thing to do.	0.87	
Using a hand sanitizer is a good idea.	0.90	
I like using hand sanitizers.	0.80	
Subjective Norms (a = 0.82)		**73.8%**
People who are important to me think that I should use hand sanitizer before each meal.	0.75	
It is expected that I will use hand sanitizer before each meal.	0.82	
I feel social pressure to use hand sanitizer before each meal.	0.64	
Perceived Behavioral Control (a = 0.70)		**63.1%**
I am confident that I can use hand sanitizers whenever I want to.	0.60	
Using a hand sanitizer is easy.	0.62	
It is my choice whether I use a hand sanitizer.	0.68	
Behavioral Intentions (a = 0.93)		**82.3%**
I want to use hand sanitizer every day.	0.78	
I want to use hand sanitizer every day before lunch.	0.83	
I will use hand sanitizer every day.	0.86	
I intend to use hand sanitizer every day.	0.82	
Self-reported Behaviors (a = 0.77)		**81.6%**
I use a hand sanitizer after I use the restroom	0.82	
I use a hand sanitizer every day before meals.	0.82	

Table 4.6. Factor Analysis of TPB Indirect Measurement Scales (*N* = 201)

Scale Item	Factor Loadings	Cumulative % of Variance
Behavioral Beliefs (a = 0.75)		**55.7%**
To do something positive for myself	0.76	
To avoid illness	0.76	
Do not cause worry and concerns [a]	0.16	
Normative Beliefs (a = 0.82)		**65.4%**
My family and friends	0.76	
Doctor and nurses	0.60	
Army leadership	0.68	
Other soldiers	0.58	
Control Beliefs (a = 0.73)		**67.0%**
Availability of hand sanitizers	0.54	
Dries out my hands	0.66	
Smell after wash	0.80	

[a] Item removed for further analysis

Simple Bivariate Correlations

A series of simple bivariate correlations between direct and indirect constructs were utilized to confirm the validity of the indirect measures (Francis et al., 2004). Therefore the means, standard deviations, and intercorrelations for all study variables are listed in Table 4.7. These data indicates there is a strong correlation between the attitudes, subjective norms, perceived behavioral control and behavior, normative, and control beliefs items. High correlations between direct and indirect constructs are likely to confirm a well-constructed

indirect measurement with adequately covered breadth of the measured construct (Francis et al., 2004).

Table 4.7. Means, Standard Deviations, and Intercorrelations for All Study Variables (*N* = 201)

Variable	1	2	3	4	5	6	7	8	M	SD
1. Behavioral beliefs	1.0	0.4**	0.2*	0.6**	0.3**	0.3**	0.5**	0.4**	24.0	16.1
2. Normative Beliefs		1.0	0.2**	0.5**	0.5**	0.3**	0.4**	0.5**	17.4	28.0
3. Control Beliefs			1.0**	0.4**	0.2**	0.4**	0.4**	0.3**	11.0	15.0
4. Attitude				1.0	0.5**	0.3**	0.8**	0.6**	16.5	3.9
5. Subjective Norms					1.0	-0.1	0.5**	0.7**	12.0	4.5
6. PBC						1.0	0.2**	0.2*	17.7	3.2
7. BI							1.0	0.7**	20.0	6.2
8. SRAB								1.0	8.7	3.3

Note: **P < 0.01; and *P < 0.05 (all two-tailed). BI = Behavioral Intention; PBC = Perceived Behavioral Control; M = Mean; SD = Standard Deviation; SRAB = Self-reported Behavior

Simple Linear Regression Models

A series of regression analyzes was utilized to test the predictive power of the TPB constructs. The regression of the summative score of behavioral beliefs ($\sum_i bb_i\ be_i$) on the attitude composite score ($R = 0.6$, $p < 0.01$, Table 4.8, Hypothesis 4), summative score of normative belief ($\sum_i nb_i\ mc_i$) on subjective norm composite score ($R = 0.5$, $p < 0.01$, Table 4.9, Hypothesis 5), and summative score of control belief ($\sum_i cb_i\ pp_i$) on perceived behavioral control ($R = 0.1$, $p < 0.01$, Table 4.10, Hypothesis 6) were all significant. All of the indirect belief

constructs were positively related to the direct measurement constructs of the TPB model, thus the indirect belief constructs were good indicators of the direct behavioral measures.

Table 4.8. Simple Linear Regression Model of Behavioral Belief Factors on Attitude

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	1226.5	1	1226.5	129.8	0.00
Residual	1871.2	198	9.5		
Total	3097.7	199			

Standardized Coefficients			
Model	**Beta**	**t**	**Sig.**
(Constant)		32.9	0.00
Behavioral Belief Factors	0.6	11.4	0.00

Note: Dependent Variable, Attitude; df = degree of freedom; F = F-statistic; Sig = Significance; T = T-statistic

Table 4.9. Simple Linear Regression Model of Normative Belief Factors on Subjective Norm

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	989.5	1	989.5	66.2	0.00
Residual	2976.5	199	15.0		
Total	3966.0	200			

Standardized Coefficients			
Model	**Beta**	**t**	**Sig.**
(Constant)		33.1	0.00
Normative Belief Factors	0.5	8.1	0.00

Note: Dependent Variable, Subjective Norm; df = degree of freedom; F = F-statistic; Sig = Significance; T = T-statistic

Table 4.10. Simple Linear Regression Model of Control Belief Factors on Perceived Behavioral Control

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	274.1	1	274.1	30.5	0.00
Residual	1778.1	198	9.0		
Total	2052.2	199			

Standardized Coefficients			
Model	**Beta**	**t**	**Sig.**
(Constant)		64.5	0.00
Control Belief Factors	0.4	5.5	0.00

Note: Dependent Variable, Perceived Behavioral Control; df = degree of freedom; F = F-statistic; Sig = Significance; T = T-statistic

The linear regression model of the subjective norms on attitude ($R = 0.5$, $p < 0.01$, Table 4.11, Hypothesis 2b), indicates the moderating process that subjective norms can positively affect the behavior attitude. Thus, targeting soldiers' perceived social pressure to perform the hand sanitation behavior can improve the soldiers' attitude toward hand sanitizer use.

The linear regression of the behavioral intention on self-reported behavior ($R = 0.7$, $p < 0.01$, Table 4.12, Hypothesis 8) was a congruent with the previous review with an overall mean correlation of 0.53 (Sheeran, 2002). This study has an even higher correlation between behavioral intention and actual hand sanitation behavior.

Despite the known issues with self-reported behaviors, our results show that intentions can indeed be used to predict self-reported behaviors with a considerable degree of accuracy. Therefore, of all five simple linear regression models testing hypotheses 4, 5, 6, 2b, and 8 were supported.

Table 4.11. Simple Linear Regression Model of Subjective Norm on Attitude

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	634.2	1	634.2	51.0	0.00
Residual	2463.4	198	12.4		
Total	3097.7	199			

Standardized Coefficients			
Model	**Beta**	**t**	**Sig.**
(Constant)		16.3	0.00
Subjective Norm	0.5	7.14	0.00

Note: Dependent Variable, Attitude; df =degree of freedom; F = F-statistic; Sig = Significance; T = T-statistic

Table 4.12. Simple Linear Regression Model of Behavioral Intention on Self-reported Behavior

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	226.5	1	226.5	145.7	0.00
Residual	307.7	198	1.6		
Total	534.1	199			

Standardized Coefficients			
Model	**Beta**	**t**	**Sig.**
(Constant)		3.0	0.00
Behavioral intention	0.7	12.1	0.00

Note: Dependent Variable, Self-reported Behavior; df = degree of freedom; F = F-statistic; Sig =Significance; T = T-statistic

Multiple Regression Analysis

For the TPB, one multiple regression model was used to examine the predictive validity of the direct TPB constructs towards hand sanitation behavioral intention including attitude, subjective norms, and perceived behavioral control. As presented in Table 4.13, attitude (β= 0.70, $p < 0.00$, Hypothesis 1) and subjective norms ($\beta = 0.18$, $p < 0.00$, Hypothesis 2a) had a significant positive relative effect on behavioral intention excluding perceived behavioral control ($\beta = -0.01$, $p = 0.92$, Hypothesis 3). These indicate that hand sanitation behavioral intention can be predicted from attitudes and subjective norms ($R^2 = 0.64$), and has explained 80.2% of the variances in hand sanitation behavioral intention. It can reasonably be argued that attitudinal and normative considerations outweigh control considerations as the most influencing factors in hand sanitation behavioral intentions. Compared to the previous meta-analysis ($R^2 = 0.31$), this study ($R^2 = 0.64$) has a higher coefficient of determination in the prediction of intentions (Armitage &

Conner, 2001), which indicates that attitude and subjective norms are strong predictors compared to the studies of other behaviors. In conclusion, a higher coefficient of determination from the multiple linear regression tests indicates the TPB model has contributed significantly to the prediction of hand sanitizer behavioral intention among soldiers.

Table 4.13. Multiple Regression Model for Predicting Behavioral Intention Based on Direct Measures

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	4953.3	3	1651.1	117.1	0.00
Residual	2748.7	195	14.1		
Total	7702.0	198			

Standardized Coefficients			
Model	**Beta**	**t**	**Sig.**
(Constant)		-0.70	0.49
Attitude	0.70	13.49	0.00
Subjective Norm	0.18	3.84	0.00
Perceived Behavioral Control	-0.01	-0.10	0.92

Note: Dependent Variable, Behavioral Intention; df =degree of freedom; F = F-statistic; Sig = Significance; T = T-statistic

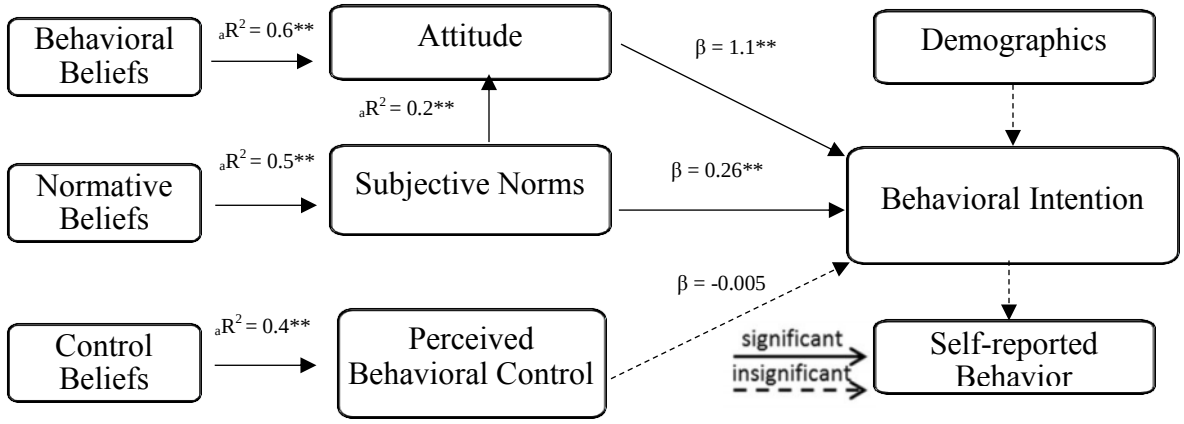
Demographics

Hypotheses 7a, 7b, 7c were addressed using a one-way Analysis of Variance (ANOVA) with a Tukey's Honestly Significant Difference test, however there were no significant differences found for gender ($F = 3.7$, $p = 0.9$), education composition ($F = 0.4$, $p = 0.8$), or household income ($F = 3.2$, $p = 0.3$). In contrast to the previous observational study from the American Society for Microbiology (2010), the demographic hypotheses could not be supported by this study. With hand sanitation behavior that is considered to be socially desirable, a specific population might feel threatened because of self-presentation, thus might choose not to report it accurately (Tourangeau & Yang, 2007).

Conclusion

According to the statistical guidelines for the TPB studies (Hankins, French, & Horne, 2000), the best measure of explained variance is not R^2 but the adjusted R^2, because the adjusted R^2 takes the population overestimate bias into account and produces an estimate that is closer to the population value. Therefore, we adjusted the overall regression analysis data with adjusted R^2, which is presented in Figure 4.1.

Figure 4.1. Multiple Regression of Hand Sanitizer Usage on Attitude, Subjective Norms, Perceived Behavioral Control, and Behavioral Intention



Note. $_aR^2$ = Adjusted R Square; β = Standardized Coefficients; **P < 0.01

Chapter 5 - CONCLUSIONS & SUMMARY

Despite the extent of hand sanitizer research that has been conducted in congregate settings (Olsen, Mackinnon, Goulding, Bean & Slutsker, 2000; Todd, Greig, Bartleson, & Michaels, 2007, 2009), there has been limited research in the military and none within a U.S. Army dining facility. Preventive medicine and food safety professionals have identified a need to develop an effective strategy to reduce illnesses within the U.S. Army (Fein, Lin, & Levy, 1995). For prevention programs to be successful, it is necessary to identify the factors that influence and predict hand sanitation behavior. Therefore, the overall purpose of this study was to identify the behavioral intention, attitude, subjective norms, and perceived behavioral control (PBC) toward hand sanitation behavior among military personnel. Results were consistent with other behavioral studies that demonstrated that attitude and subjective norms were strong predictors of behavioral intention to use hand sanitizer. There was limited support for PBC variables as predictors in the model of behavior, because of the availability and easy access to hand sanitizers within the U.S. Army facilities.

Results of Hypotheses Testing

Principal axis factor analysis with varimax rotation and multiple linear regressions were used to test hypotheses H_1, H_{2a}, and H_3. Simple bivariate correlations and simple linear regressions were used to analyze hypotheses H_{2b}, H_4, H_5, H_6, and H_8. A one-way analysis of variance (ANOVA) with Tukey's Honestly Significant Post-hoc test was used to study hypotheses H_{7a}, H_{7b}, and H_{7c}. The results of the hypotheses testing are presented in Table 5.1.

Table 5.1. Results of Hypotheses Testing

Hypotheses	Path	Correlation	Result
H_1	Attitude → BI	$\beta = 0.70^{**}$	Supported
H_{2a}	SN → BI	$\beta = 0.5^{**}$	Supported
H_{2b}	SN → Attitude	${}_aR^2 = 0.20^{**}$	Supported
H_3	PBC → BI	$\beta = -0.005^{*}$	Not Supported
H_4	Behavioral Belief→ Attitude	${}_aR^2 = 0.40^{**}$	Supported
H_5	Normative Belief→ SN	${}_aR^2 = 0.25^{**}$	Supported
H_6	Control Beliefs→ PBC	${}_aR^2 = 0.13^{**}$	Supported
H_{7a}	Gender→ BI	$F = 3.7^{*}$	Not supported
H_{7b}	Education→ BI	$F = 0.4^{*}$	Not supported
H_{7c}	Income→ BI	$F = 3.2^{*}$	Not supported
H_8	BI→ SRB	$R = 0.7^{**}$	Supported

Note: BI = Behavioral Intention; SN = Subjective Norm; PBC = Perceived Behavioral Control; SRB = Self-reported Behavior; **P < 0.01; *P > 0.5; ${}_aR^2$ = Adjusted R Square

Discussion of Hypotheses

Hypothesis 1: There is a significant positive relationship between soldiers' attitude about hand sanitizer and behavioral intention.

Hypothesis one was supported. Results indicated that soldiers' behavioral intention was strongly correlated with the attitude soldiers have ($\beta = 0.70$, $r_c = 0.64$, $p < 0.01$). Based on the previous meta-analysis of TPB research, utilizing self-reported health behaviors (N = 20,343), the average correlation corrected between attitude and behavioral intention was 0.31 (McEachan,

Conner, Taylor, & Lawton, 2011). Compared to the meta-analysis, soldiers yield a stronger positive attitude toward using hand sanitizers and attitude is the best predictor of hand sanitation behavior.

Hypothesis 2a: There is a significant positive relationship between soldiers' subjective norm about hand sanitizer and behavioral intention.

Hypothesis 2a was supported. Results indicated that soldiers' behavioral intention was positively related to their subjective norms ($\beta = 0.5$, $r_c = 0.64$, $p < 0.01$). The previous meta-analysis has concluded the average correlation corrected between behavioral intention and self-reported health behaviors ($N = 20{,}284$) was 0.19 (McEachan et al., 2011). Compared to the meta-analysis, soldiers in this study yielded significant stronger positive subjective norms toward using hand sanitizers in the dining facility. Fishbein and Ajzen (2011) have reiterated the consistency with previous findings by stating the important consideration of subjective norms in predicting behavioral intention.

Hypothesis 2b: Military personnel's subjective norm positively predicts their attitude toward the hand sanitation behavior.

Hypothesis 2b was supported. Results indicated that soldiers' subjective norms positively influence their attitude toward the use of hand sanitizer (Adjusted $R^2 = 0.20$, $p < 0.01$). In other words, those who are significant to the respondent or whose opinion the respondent values, had signnificant positive influence on how their attitude formed toward the use of hand sanitizer (Ryan & Deci, 2000).

Hypothesis 3: There is a negative relationship between soldiers' perceived behavioral control about hand sanitizer and behavioral intention.

Hypothesis 3 was not supported. Results indicated that soldiers' perceived behavioral control about hand sanitizer were not related to soldiers' behavioral intention (β= -0.01, r_c = 0.64, p = 0.92). This research found that behavioral intention is not strongly related with PBC. This could indicate that soldiers do not perceive many barriers that hinder them in sanitizing their hands, which is consistent with the finding from Ajzen and Madden (1985) who indicated that PBC is less likley to be related to intention when compared to attitude and subjective norm.

Hypothesis 4: Behavioral beliefs about hand sanitizer are significantly associated with attitudes about hand sanitizers.

Hypothesis four was supported. Results indicated that soldiers' attitudes about hand sanitizer use were related to the overall behavioral beliefs of soldiers (Adjusted R^2 =0.40, β = 0.63, $p < 0.01$).

Hypothesis 5: Normative beliefs about hand sanitizer are significantly associated with subjective norms about hand sanitizers.

Hypothesis 5 was supported. Results indicated that soldiers' subjective norms about hand sanitizer use were correlated to the overall normative beliefs soldiers have (Adjusted R^2 = 0.20, β = 0.45, $p < 0.01$).

Hypothesis 6: Control beliefs are positively associated with perceived behavioral control about hand sanitizers.

Hypothesis 6 was supported. Results indicated that soldiers' perceived behavioral control about hand sanitizer use were correlated with the overall control beliefs soldiers have (Adjusted $R^2 = 0.13$, $\beta = 0.37$, $p < 0.01$).

Hypothesis 7a: Female soldiers have a more positive intention to practice hand sanitation behavior than male soldiers.

Hypothesis 7a was not supported. Results indicated that soldiers' behavioral intention to use hand sanitizer was not affected by gender differences ($F = 3.7$, $p = 0.9$). Due to the small sampling size of female soldiers ($n = 15$), the lack of females within the sample was not sufficient to support the gender difference hypothesis. Thus, this potential variable could not serve as a significant predictor of hand sanitation behavioral intention within this study.

Hypothesis 7b: Soldiers with lower education have stronger intention to practice hand sanitation behavior.

Hypothesis 7b was not supported. Results indicated that soldiers' behavioral intention to use hand sanitizer was not affected by educational level ($F = 0.4$, $p = 0.8$). Due to our sampling method, the majority of our data were collected at an infantry base with a large combat force. Thus, a greater number of younger soldiers with primarily high school education was included in the sample (Plans, Analysis and Integration Office, 2014).

Hypothesis 7c: Soldiers with an annual income level less than $50,000 have stronger intention to practice hand sanitation behavior.

Hypothesis 7c was not supported. Results indicated that soldiers' behavioral intention to use hand sanitizer was not affected by income differences ($F = 3.2$, $p = 0.3$). In contrast to another study conducted by the American Society for Microbiology (2010), our results did not support this hypothesis. Single soldiers who were eligible to receive meals and housing for free were more prone to utilize military dining facilities, which does not count toward their annual taxable income (Regulation, 1988). Thus, the majority of our sample (71.6%) have an annual household income below $30,000.

Hypothesis 8: Behavioral intentions to use hand sanitizer are significantly associated with self-reported behaviors to use hand sanitizers.

Hypothesis 8 was supported. Results indicated that behavioral intention is correlated with the soldiers' self-reported hand sanitation behavior (Adjusted $R^2 = 0.42$, $\beta = 0.65$, $p < 0.01$). Consistent with the suggestions from Ajzen and Madden (1985) and Sheeran (2002), behavioral intention is a strong predictor of behavior. Based on our results, hand sanitation behavioral intention is a strong predictor of hand sanitation behavior within military environment.

Conclusions of Major Findings

Research Question 1: Identify the attitudes and behavioral beliefs that U.S. Army personnel have about using hand sanitizer before dining in a dining facility.

This study measured the relationship among behavioral beliefs of attitude, positive/negative evaluations of attitude attributes, direct measurement of attitude, and the hand sanitation behavioral intention. Researchers discovered that attitude toward the use of hand

sanitizer was related to hand sanitation behavioral intention ($F = 117.1$, $\beta = 0.70$, $p < 0.01$). The study also established a positive relationship between overall behavioral beliefs and the attitude toward the use of hand sanitizer ($F = 129.8$, $\beta = 0.63$, $p < 0.01$). By identifying and measuring the salient beliefs in the military population, we gain insight into the important considerations that guide soldiers' decision making toward the use of hand sanitizer. Although two of the behavioral belief items "*to do something positive for myself*" (mean = 10.9 ± 7.7) and "*to avoid illness*" (mean = 10.3 ± 8.0) was rated highly within the attitudinal beliefs that hold soldiers' attitude toward the behavior, it should be noted that these beliefs could still be strengthened. Compared with the previous health behavior meta-analysis on the TPB, which yielded a correlation corrected of 0.31 (McEachan et al., 2011), the examination of this relationship in our study ($R_c = 0.64$) suggested that soldiers have a more positive attitude toward the use of hand sanitizers, and attitude is the best predictor of hand sanitation behavior within our model.

Research Question 2: Identify the subjective norms and normative beliefs that U.S. Army personnel consider when choosing to use hand sanitizers before dining in a dining facility.

This study measured the relationships concerning normative beliefs of subjective norms, positive/negative evaluations of motivation to comply, direct measurement of subjective norms, and hand sanitation behavioral intention. The results specified that soldiers' perceived social norms were associated with hand sanitation intention ($F = 117.1$, $\beta = 0.18$, $p < 0.01$). The results also demonstrated that overall normative beliefs positively related with subjective norms toward the use of hand sanitizer ($F = 50.98$, $\beta = 0.45$, $p < 0.01$).

By identifying and measuring the normative beliefs in the military population, we understand more about the important social influences that stimulate soldiers' decisions and

actions toward the use of hand sanitizer. Three of the normative belief influences: family and friends (mean = 6.6 ± 7.5), medical providers (mean = 6.4 ± 9.0), and the Army leadership (mean = 5.2 ± 9.7), positioned highly within our results. It is anticipated that changing these normative beliefs that hold soldiers' perceived social norms will effectively change their intention towards the hand sanitation behavior.

Compared to average correlation coefficient from the meta-analysis ($r_c = 0.19$) (McEachan et al., 2011), our study yielded a significantly higher correlation coefficient of subjective norms toward the hand sanitation behavioral intention ($r_c = 0.64$). The examination of the relationship suggested that soldiers have positive subjective norms toward the use of hand sanitizers and is one of the strong predictors of hand sanitation behavior.

Research Question 3: Identify the perceived behavioral control and control beliefs that prevent U.S. Army personnel from using hand sanitizers before dining in a dining facility.

This study measured the relationship among beliefs of perceived behavioral control, positive/negative evaluations of perceived power, direct measurement of perceived behavioral control, and the hand sanitation behavioral intention. The researchers discovered that soldiers' perceived behavioral control was not associated with hand sanitation intention ($F = 117.1$, $\beta = -0.01$, $p = 0.92$). However, the findings revealed that perceived behavioral control positively associated with overall control beliefs toward the use of hand sanitizer ($F = 30.53$, $\beta = 0.37$, $p < 0.01$).

By assessing and recognizing the control beliefs within the military population, we gain valuable insight toward the perceived behavioral control obstructions that hinder soldiers' decisiveness and activities toward the use of hand sanitizers. Among all control beliefs,

accessibility of hand sanitizers (mean = 5.7 ± 7.0) was the most significant control belief restricting hand sanitation behaviors. Among all control beliefs items, soldiers do not perceive many barriers that hinder them in performing hand sanitation.

Theoretical Implications

This research serves as a conceptual framework for future food safety behavioral change studies within the military population. Furthermore, our study has some distinct characteristics. First, this study explicitly targeted the determinants of hand sanitation behavior. The discrete actions that made up various food safety behavioral categories will call for different sets of behavioral interventions and implementations, thus providing insight for future researchers to promote the actual hand sanitation behavior. This research was the first attempt to develop a comprehensive measure of food safety behaviors within the military population using just hand sanitation behavioral intention. Several sets of the significant discrete salient beliefs that entail assorted groups of hand sanitation behavioral actions were reviewed through an extended literature review. Several of the key individual attitudes, subjective norms, perceived behavioral control, and behaviors were identified, and the most applicable behaviors were chosen to explore in an attempt to ascertain soldiers' behavioral salient beliefs.

Second, instead of focusing on various amounts of behavioral constructs that can cause hand sanitation behavior among soldiers, our study has focused on a relatively small number of variables that are based on the TPB. Specifically, the major determinants that must be considered are an attitude toward the behavior, perceived social norm, and perceived behavioral control and their underlying cognitive foundations that are reflected in behavioral, normative, and control beliefs. Our results indicated that the TPB provided a sufficient amount of the determinants of hand sanitation behavioral intention among soldiers and explained 64% of the

variance with a significant correlation among soldiers' attitude, subjective norms, and behavioral intention.

Third, because personal beliefs represent the information people have about a behavior, to change personal beliefs, different behavioral intervention methods will be needed. Thus providing new information on hand sanitation behavioral beliefs will help us identify these beliefs, yielding an effective way of developing intentions to target actual behavior change.

As we saw in the previous literature, other variables may help to explain hand sanitation behavior. However, this study has provided an adequate amount of variables that determine hand sanitation behavioral intention. The theory posits that if we can bring change to one or more of the significant belief constructs from the TPB, we can improve hand sanitation intentions, and in front of reasonable volitional control, we can change the behavior.

Finally, our study provides a set of proven methods and procedures for measuring the TPB component variables and for identifying the significant elements that must be targeted to effectively improve hand sanitation behavior among soldiers. Therefore, these methods also provide a means for evaluating the effectiveness of theoretical behavior change for future studies as well.

Practical Implications

Generally speaking, the goal of our study was to help reduce foodborne infectious diseases that are common among military populations during deployments when traditional hand washing with running water and soap is not available (Sanders, Putnam, Frankart, Frenck, & Monteville, 2005). Ideally, a proactive approach to implementing a hand sanitation program to prevent communicable diseases would allow the military to recover a significant amount of training time and medical costs. Food safety professionals and U.S. Army commanders can use

the result from this study to help military leaders become more aware of the need to promote consumer food safety behaviors among soldiers. Many health-related infection problems are not only caused by distribution and production of food but also how we practice hand hygiene behavior before consumption (Hedberg et al., 2006). Moreover, should a foodborne-related outbreak occur in the military setting, the foodservice environment will be closely investigated and analyzed, even if they are not the source of the outbreak. Our study has identified the need to promote hand sanitation behavior within military dining facilities. The results have provided the basic parameters for healthcare providers and military leaders to implement hand sanitation behavioral interventions that targets and promotes actual behavior.

Based on the results of this study, specific intervention programs should target attitude-related beliefs and social pressure-related beliefs among soldiers. Overall, the use of hand sanitizers are commonly accepted by soldiers, and soldiers had positive attitudes about hand sanitizer use. Exclusively, soldiers had positive beliefs that use hand sanitizer is positive for them and can help them to avoid illness. Therefore, we should use these beliefs to further strengthen their attitude and intention towards hand sanitizer use before meals in the dining facilities. For example, using positive messaging with visual signaling that reinforced the efficacy and positivity about the hand sanitation behavior will effectively target their attitude beliefs, thus effectively promoting hand sanitation behavior.

Soldiers normally considered the social pressure of others when using hand sanitizers before lunch. They placed the greatest importance on the opinions of family and friends, doctors and nurses, and the Army leadership. All of these referent groups could be utilized in creating persuasive messages to soldiers that stress the importance of hand sanitizing and that the referent groups (for example, friends and family) would support that behavior and would want and need

them to remain healthy. Doctors and nurses could be included in military safety training to create more positive emotional pressures for soldiers. The Army leadership could emphasize the importance and expectations of hand sanitizer use in their training. Among all of these normative beliefs, the social pressure from other soldiers is negative, indicating the negative inferences from other soldiers not to use hand sanitizer. Strategies such as facilitated communications and group discussions among soldiers could greatly decrease the effect of negative influences and the likelihood of promoting healthy hand sanitation behavior.

Soldiers do not perceive many barriers that hinder actual hand sanitation behavior. Our results indicated that soldiers' perceived the availability of hand sanitizers, feeling of hand sanitizers and smell after using the hand sanitizer is important barriers that have to be considered.

This study was among the very first to systematically explore hand sanitation behavior in a military environment. With the response rate above 40%, this study has applied all necessary manipulations adapted from previous sample studies that help minimized the non-response error, thus improved the validity of the questionnaire (Dillman, 2000).

Limitations

Some of the limitations of this study should be addressed. First, all data clustered within one military installation in the state of Kansas. Thus, we could not verify if there are any geographic differences within different locations. Consequently, results have to be cautiously generalized to other military bases or public facilities such as schools, hospitals, and universities.

Second, this study was conducted in a relatively short period, and the current instruments could not accurately measure the past and actual behavior of hand sanitizer use due to the common method bias resulting from the respondent's recall (hindsight) bias, social desirability bias and errors in self-observation.

Third, this study did not address non-response bias and some of the commonly perceived social psychology bias. Military personnel who choose to respond to the survey may have more positive attitudes and perceive fewer barriers in regards to the utilization of hand sanitizers when compared to those who elected not to participate in the study. Commonly perceived social psychology bias, including Marlowe-Crowne's Social Desirability Bias (Crowne & Marlowe, 1960), Availability Heuristic Bias (Carroll, 1978), and inconsistency bias within Cognitive Consequences of Forced Compliance (Festinger & Carlsmith, 1959) still pose threats towards the assessment accuracy of the survey instrument compared to an actual observation study.

Recommendations for Future Studies

Previous meta-analysis research has been dedicated to the differences between behavioral intention and behavioral expectation, also known as self-prediction (Sheppard, Hartwick, & Warshaw, 1988). Compared with an average correlation of 0.49 between behavioral intentions and actual behavior, using behavior expectations has achieved an average correlation of 0.57 between behavioral expectation and actual behavior (Sheppard et al., 1988). One interesting factor regarding hand sanitation research is that the compliance rate of hand sanitizer use is significantly higher within the healthcare environment, where compliance with hand sanitation behavior is expected (Larson, Kretzer, 1995; Larson, Killien, 1982). Future researchers were encouraged to investigate the mediating role of behavioral intention and behavioral expectation of hand sanitation behavior in promoting hand sanitation behaviors within military populations.

There is a great deal of evidence that consumer food safety behaviors are indeed associated with demographic characteristics. Our study attempted to explore possible differences among demographic variables but did not find significant differences within our sample. It is important to note that background factors other than commonly addressed demographics, which

include: personality differences, individual intelligence gaps, and individual coping skills will have possible irrational influences on behaviors (Gibbons, Gerrad, Blanton, & Russell, 1998). While there is limited research exploring the behavior and its contextual factors within the military, future researchers are encouraged to explore and measure these mediating variables on both beliefs and behaviors.

According to Hankins, French, & Horne, 2000, structural equation modeling is recommended when a study has many individual variables involved at the same time. When compared with multiple linear regressions, structural equation modeling allows the examination of latent variables and exploration about the extent to which variables are related to each other. Thus, future researchers are encouraged to use structural equation modeling programs to assist with cross influences of variables.

Finally, the previous research has indicated past behavior to be a strong predictor of actual behavior (N = 5857, R_c = 0.57) (McEachan, Conner, Taylor, & Lawton, 2011). Future researchers are encouraged to measure past and actual behaviors, rather than using self-reported indicators. As a result, we can further explore the relationship between past hand sanitation behavior and the hand sanitation behavioral intentions toward the actual hand sanitation behavior.

Conclusions

The three core components of this study – attitudes, perceived social norms, and perceived behavioral control, accounted for a considerable proportion of the non-random variance in hand sanitation behavioral intentions. Furthermore, intentions and perceived control are found to explain a sizable proportion of the variance in hand sanitation behavior.

This study was among the very first to systematically explore hand sanitation behavior among soldiers within a military dining facility. The U.S. military places a high value on the health of its personnel as soldiers are involved with physically demanding missions, worldwide. The results from this study can help food safety educators and military leaders develop guidelines to target behavioral interventions. Practical implications will likely translate to reduce healthcare costs, decrease absenteeism rate, and improve mission readiness, and overall health of the military.

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Appendix A - Initial Survey

KANSAS STATE UNIVERSITY | Department of Hospitality Management and Dietetics

Dear Soldiers,

As a graduate student in the Department of Hospitality Management and Dietetics at Kansas State University and an honorably discharged U.S. Army Soldier, I am exploring the use of hand sanitizers within the U.S. Army. Your responses are critical to the success of the study, and will help researchers identify solders' behavioral intention to use hand sanitizers and completion of the questionnaire involves no known risk to participants. It should only take you approximately ten minutes to complete this survey.

Your participation in this research is strictly voluntary. You can stop participating at any time with no penalty. Submission of a completed questionnaire indicates your willingness to participate. All survey responses will remain anonymous. Only aggregate responses will be used. A summary of results will be available at K-State Research Exchange (http://krex.k-state.edu/) when the study is completed.

The Committee on Research Involving Human Subjects at Kansas State University has approved this study (IRB #7769). If you have any questions regarding this study, please feel free to contact me (nlin@ksu.edu or 917.517.2347) or Dr. Kevin Roberts (kevrob@ksu.edu or 785.532.2399).

For questions about your rights as a participant, or the manner in which the survey is conducted, you may contact Dr. Rick Scheidt, Chair of the Committee on Research Involving Human Subjects, (785) 532-3224, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506.

We appreciate your time and effort in taking part in this study.

Cordially,

Naiqing Lin
Graduate Student
Kansas State University
Dept. of Hospitality Management & Dietetics

Kevin R. Roberts, PhD
Associate Professor
Kansas State University
Dept. of Hospitality Management & Dietetics

152 Justin Hall, Manhattan KS 66506-1404 | (785) 532-5521 | fax: (785) 532-5522

Section I: Attitude
Please answer each of the following questions by circling the number that best describes you. Please read each question carefully.

	Strongly Disagree	Disagree	Somewhat Disagree	Neither	Somewhat Agree	Agree	Strongly Agree
1. My overall experience with using hand sanitizer has been good, and I would recommend using hand sanitizer every day before lunch.	1	2	3	4	5	6	7
2. I expect that I will use hand sanitizer every day.	1	2	3	4	5	6	7
3. If I use hand sanitizer, I will feel that I am doing something positive.	1	2	3	4	5	6	7
4. It causes a lot of worry and concern for me to use hand sanitizer.	1	2	3	4	5	6	7
5. I want to sanitize my hands before meals.	1	2	3	4	5	6	7
6. If I use hand sanitizer every day, I will be less likely become ill.	1	2	3	4	5	6	7
7. Using hand sanitizer is very positive.	1	2	3	4	5	6	7
8. Generally, hand sanitizers are very effective.	1	2	3	4	5	6	7
9. I intend to use hand sanitizer every day.	1	2	3	4	5	6	7
10. My hands will be clean if I use hand sanitizer before meals.	1	2	3	4	5	6	7
11. Practicing hand sanitation is very important to avoid illness.	1	2	3	4	5	6	7
12. Overall, I think using a hand sanitizer is the right thing to do.	1	2	3	4	5	6	7
13. Using hand sanitizer is a good idea.	1	2	3	4	5	6	7
14. I want to use hand sanitizer every day.	1	2	3	4	5	6	7
15. I like using hand sanitizer.	1	2	3	4	5	6	7

Section II: Peer Influence
Please answer each of the following questions by circling the number that best describes you. Please read each question carefully.

16. Other soldiers think that I should use hand sanitizer.	1	2	3	4	5	6	7
17. Doctors and nurses would encourage me to use hand sanitizers.	1	2	3	4	5	6	7
18. The leaders in the army think that I should use hand sanitizers.	1	2	3	4	5	6	7
19. My family and friends encourage me to use hand sanitizer.	1	2	3	4	5	6	7
20. Doing what other soldiers do is important to me.	1	2	3	4	5	6	7
21. Doing what doctors and nurses think I should be doing is important to me.	1	2	3	4	5	6	7
22. The Army's approval of using hand sanitizer is important to me.	1	2	3	4	5	6	7
23. My friends' approval of using hand sanitizer is important to me.	1	2	3	4	5	6	7
24. People who are important to me think that I should use hand sanitizer before each meal.	1	2	3	4	5	6	7
25. I feel social pressure to use hand sanitizer before each meal.	1	2	3	4	5	6	7
26. It is expected that I will use hand sanitizer before each meal.	1	2	3	4	5	6	7
27. I use hand sanitizer every day before meals.	1	2	3	4	5	6	7
28. I want to use hand sanitizer before meals.	1	2	3	4	5	6	7
29. I want to use hand sanitizer after I use the restroom.	1	2	3	4	5	6	7

Section III: Barriers
Please answer each of the following questions by circling the number that best describes you. Please read each question carefully.

	Strongly Disagree	Disagree	Somewhat Disagree	Neither	Somewhat Agree	Agree	Strongly Agree
30. The hand sanitizer dispenser is difficult to find.	1	2	3	4	5	6	7
31. The smell of hand sanitizer is disgusting.	1	2	3	4	5	6	7
32. Use of hand sanitizer makes my skin itch and sore.	1	2	3	4	5	6	7
33. Hand sanitizer is for people who are ill.	1	2	3	4	5	6	7
34. I am more likely to use hand sanitizer if it is easily available.	1	2	3	4	5	6	7
35. I am more likely to use hand sanitizer if it does not cause any discomfort.	1	2	3	4	5	6	7
36. I am more likely to use hand sanitizer if my hands feel good.	1	2	3	4	5	6	7
37. I am less likely to use hand sanitizer if other people think I am ill.	1	2	3	4	5	6	7
38. I am confident that I can use hand sanitizer whenever I want to.	1	2	3	4	5	6	7
39. Whether I use hand sanitizer or not is entirely up to me.	1	2	3	4	5	6	7
40. Using hand sanitizer is easy.	1	2	3	4	5	6	7

Section IV: Demographics
Please answer each of the following questions by circling the letter that best describes you.

1. **What is your gender?**
   a. Male
   b. Female

2. **What is your age range?**
   a. 18 - 34
   b. 35 - 54
   c. > 55

3. **What is your approximate annual household income range?**
   a. < $29,999
   b. $30,000 – $49,999
   c. $49,999 – $74,999
   d. $75,000 – or more

4. **What is the highest degree or level of school you have completed? If currently enrolled, highest degree received.**
   a. Some high school, no diploma
   b. High school graduate or GED
   c. Associate or Technical degree
   d. Bachelor's degree
   e. Graduate degree

5. **What is your marital status?**
   a. Single, never married
   b. Married or domestic partnership
   c. Widowed
   d. Divorced/ Separated

6. **Are you currently Active Duty Enlisted, or Non-commissioned Officer, or Active Duty Officer?**
   a. Yes
   b. No

Appendix B - Final Survey

KANSAS STATE UNIVERSITY | Department of Hospitality Management and Dietetics

Dear Soldiers,

As a graduate student in the Department of Hospitality Management and Dietetics at Kansas State University and an honorably discharged U.S. Army Soldier, I am exploring the use of hand sanitizers within the U.S. Army. Your responses are critical to the success of the study, and will help researchers identify solders' behavioral intention to use hand sanitizers and completion of the questionnaire involves no known risk to participants. It should only take you approximately ten minutes to complete this survey.

Your participation in this research is strictly voluntary. You can stop participating at any time with no penalty. Submission of a completed questionnaire indicates your willingness to participate. All survey responses will remain anonymous. Only aggregate responses will be used. A summary of results will be available at K-State Research Exchange (http://krex.k-state.edu/) when the study is completed.

The Committee on Research Involving Human Subjects at Kansas State University has approved this study (IRB # 7769). If you have any questions regarding this study, please feel free to contact me (nlin@ksu.edu or 917.517.2347) or Dr. Kevin Roberts (kevrob@ksu.edu or 785.532.2399).

For questions about your rights as a participant, or the manner in which the survey is conducted, you may contact Dr. Rick Scheidt, Chair of the Committee on Research Involving Human Subjects, (785) 532-3224, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506.

You can participate this survey either online at
https://kstate.qualtrics.com/SE/?SID=SV_1IciOWuNtHjUc1n

Or scan the QR Code on the right on your mobile device.

We appreciate your time and effort in taking part in this study.

Cordially,

Naiqing Lin
Graduate Student
Kansas State University
Dept. of Hospitality Management & Dietetics

Kevin R. Roberts, PhD
Associate Professor
Kansas State University
Dept. of Hospitality Management & Dietetics

152 Justin Hall, Manhattan KS 66506-1404 | (785) 532-5521 | fax: (785) 532-5522

Section I: Attitude
Please answer each of the following questions by circling the number that best describes you. Please read each question carefully.

	Strongly Disagree	Disagree	Somewhat Disagree	Neither	Somewhat Agree	Agree	Strongly Agree
1. I want to use hand sanitizer every day before lunch.	1	2	3	4	5	6	7
2. I will use hand sanitizer every day.	1	2	3	4	5	6	7
3. If I use hand sanitizer, I feel that I am doing something positive for myself.	1	2	3	4	5	6	7
4. It causes a lot of worry and concern for me to use hand sanitizer.	1	2	3	4	5	6	7
5. If I use hand sanitizer every day, I will be less likely become ill.	1	2	3	4	5	6	7
6. Doing something positive for myself is desirable.	1	2	3	4	5	6	7
7. Causing a lot of worry and concern for me is desirable.	1	2	3	4	5	6	7
8. I intend to use hand sanitizer every day.	1	2	3	4	5	6	7
9. It is very important for me to avoid illness.	1	2	3	4	5	6	7
10. Overall, I think using a hand sanitizer is the right thing to do.	1	2	3	4	5	6	7
11. Using a hand sanitizer is a good idea.	1	2	3	4	5	6	7
12. I want to use hand sanitizer every day.	1	2	3	4	5	6	7
13. I like using hand sanitizer.	1	2	3	4	5	6	7

Section II: Peer Influence
Please answer each of the following questions by circling the number that best describes you. Please read each question carefully.

14. Other soldiers think that I should use hand sanitizer.	1	2	3	4	5	6	7
15. Doctors and nurses would encourage me to use hand sanitizers.	1	2	3	4	5	6	7
16. The leaders in the army think that I should use hand sanitizers.	1	2	3	4	5	6	7
17. My family and friends encourage me to use hand sanitizer.	1	2	3	4	5	6	7

	Strongly Disagree	Disagree	Somewhat Disagree	Neither	Somewhat Agree	Agree	Strongly Agree
18. Doing what other soldiers do is important to me.	1	2	3	4	5	6	7
19. Doing what doctors and nurses think I should be doing is important to me.	1	2	3	4	5	6	7
20. The Army leadership's approval of my actions is important to me.	1	2	3	4	5	6	7
21. My family and friends approval of my actions is important to me.	1	2	3	4	5	6	7
22. People who are important to me think that I should use hand sanitizer before each meal.	1	2	3	4	5	6	7
23. I feel social pressure to use hand sanitizer before each meal.	1	2	3	4	5	6	7
24. It is expected that I will use hand sanitizer before each meal.	1	2	3	4	5	6	7
25. I use a hand sanitizer every day before meals.	1	2	3	4	5	6	7
26. I use a hand sanitizer after I use the restroom.	1	2	3	4	5	6	7
Section III: Barriers Please answer each of the following questions by circling the number that best describes you. Please read each question carefully.							
27. The hand sanitizer dispenser is difficult to find.	1	2	3	4	5	6	7
28. I do not like the smell of hand sanitizer.	1	2	3	4	5	6	7
29. The use of hand sanitizers dries out my hands.	1	2	3	4	5	6	7
30. I am more likely to use hand sanitizer if it is easily available.	1	2	3	4	5	6	7
31. I am more likely to use hand sanitizer if it does not cause dry skin.	1	2	3	4	5	6	7
32. I am more likely to use hand sanitizer if my hands feel good.	1	2	3	4	5	6	7
33. I am confident that I can use hand sanitizers whenever I want to.	1	2	3	4	5	6	7

	Strongly Disagree	Disagree	Somewhat Disagree	Neither	Somewhat Agree	Agree	Strongly Agree
34. It is my choice whether I use a hand sanitizer.	1	2	3	4	5	6	7
35. Using a hand sanitizer is easy.	1	2	3	4	5	6	7

Section IV: Demographics
Please answer each of the following questions by circling the letter that best describes you.

1. **What is your gender?**
   a. Male
   b. Female
2. **What is your age range?**
   a. 18 - 34
   b. 35 - 54
   c. > 55
3. **What is your approximate annual household income range?**
   a. < $29,999
   b. $30,000 – $49,999
   c. $49,999 – $74,999
   d. $75,000 – or more
4. **What is your highest degree received?**
   a. Some high school, no diploma
   b. High school graduate or GED
   c. Associate or Technical degree
   d. Bachelor's degree
   e. Graduate degree
5. **What is your marital status?**
   a. Single, never married
   b. Married or domestic partnership
   c. Widowed
   d. Divorced/ Separated
6. **Are you currently Active Duty?**
   a. Yes
   b. No

Appendix C - Kansas State University Human Research Approval

KANSAS STATE UNIVERSITY | University Research Compliance Office

TO: Kevin Roberts
HMD
106 Justin

Proposal Number: 7769

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

DATE: 07/06/2015

RE: Approval of Proposal Entitled, "Predicting and Explaining Hand Sanitation Behavioral Intention within the U.S. Army."

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: 07/06/2015

EXPIRATION DATE: 07/06/2016

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.

203 Fairchild Hall, Lower Mezzanine, Manhattan, KS 66506-1103 | 785-532-3224 | fax: 785-532-3278 | k-state.edu/research/comply | comply@ksu.edu

Appendix D - Military Written Approval

DEPARTMENT OF THE ARMY
ARMORED BRIGADE COMBAT TEAM, 1ST INFANTRY DIVISION
7232 NORMANDY DRIVE
FORT RILEY KANSAS 66442

REPLY TO
ATTENTION OF:

AFZN-BA

June 29, 2015

MEMORANDUM FOR RECORD

SUBJECT: KANSAS STATE UNIVERSITY SUPPORT

1. I, CW2 Carmelo Albinodiaz, 1st Armored Brigade Combat Team Food Service Advisor, Fort Riley, Kansas support the research project entitled "Predicting and Explaining Behavioral Intention of Hand Sanitizer Use within U.S. Army Soldiers at Dining Facility".

2. SFC Dorcas Crawford, 1st Armored Brigade Combat Team dining facility manager, will serve as the military liaison. SFC Dorcas Crawford will assist with subject enrollment by identifying appropriate military units, establishing a line of communication with key military leaders, and providing guidance to insure efficient data collection. She will not be involved in obtaining informed consent, data collection, or data analysis. She will be provided a copy of the study results, but will not be provided data containing personally identifiable information.

3. Neither my support for this study, nor SFC Dorcas Crawford's role as research liaison make the 1st Armored Brigade Combat Team Dining Facility engaged in human subject's research, and there is no military member recruiting military personnel into this research, as defined by the United States Department of Health and Human Services Office for Human Research Protections.

4. The point of contact for this action is SFC Dorcas Crawford at duty phone (785) 239-1623, or via email at dorcas.d.crawford.mil@mail.mil

Carmelo Albinodiaz
CW2, 1st ABCT
Food Service Advisor