Variables affecting hand sanitizer use in public facilities

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THESIS APPROVAL

VARIABLES AFFECTING HAND SANITIZER USE IN PUBLIC FACILITIES

By

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A Thesis Submitted in Partial
Fulfillment of the Requirements
for the Degree of
Master of Science
in the field of Behavior Analysis and Therapy

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Southern Illinois University Carbondale
July 9, 2010
AN ABSTRACT OF THE THESIS OF

AMY K. LOUKUS, for the Master of Science degree in Behavior Analysis and Therapy, presented on July 9, 2010, at Southern Illinois University Carbondale.

TITLE: VARIABLES AFFECTING HAND SANITIZER USE IN PUBLIC FACILITIES

MAJOR PROFESSOR: Dr. Mark R. Dixon

The following research was conducted to contribute to the greater understanding of the impact that most often utilized methods of public awareness and education have on behaviors relative to sickness and disease for the general public in terms of action toward prevention behaviors within a healthcare setting. The psycho educational approach is often considered an effective means to promote behavior change as it relates to preventative behavior, and in the clinical therapeutic setting has shown some relevance as an effective procedure. Unfortunately, no research as of yet speaks to the comparative effectiveness this approach may have over other approaches often thought to enhance preventative behavior, such as the more empirically based behavior analytic methods. This study provides such an analysis of the effectiveness each methodology has on changing the behavior of the public at large.

Based on a study conducted in the academic setting to increase hand-sanitizing behavior of facility patrons (Loukus & Dixon, in review), this study utilizes the most effective form of prompting found to increase sanitizer use in a public facility. Because healthcare facilities often rely on psycho educational methodologies to influence sanitizer use amongst visitors and employees by placing "sanitizing stations" at the main entrance to the facility, this setting provides an appropriate venue for scientific manipulation of prompting variables to determine effectiveness on public preventative
behavior towards sickness and disease, while a simple reversal design enhances the comparative value of effects obtained on behavior through observation and implementation of the two approaches within the setting.
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CHAPTER 1

INTRODUCTION

Each year in the United States on average, more than 200,000 people are hospitalized due to respiratory and heart conditions associated with viral infections such as seasonal influenza (Center for Disease Control and Prevention [CDC], 2010a). Of those infected with influenza, an estimated 36,000 people die of flu-related causes or secondary complications associated with the flu, with 90% of deaths occurring in individuals aged 65 years and older (CDC, 2010a). Reportedly, actual estimates are often difficult to assess due a variety of reasons, and numbers tend to be under-representative of actual deaths and incidences of flu in the United States (CDC, 2010a). Plausible explanations for the under-representative nature of reported statistics include a lack of individuals who seek medical care for presenting symptoms, a lack of those who seek treatment actually being tested for specific strains, and inconsistent testing methods yielding inconsistent results for diagnoses (CDC, 2010a).

Common viral infections including the seasonal influenza are easily spread and are contracted at increasing rates than in previous years and prove to have devastating results for certain populations. Those younger than five years old, people 65 years and older, pregnant women, as well as those adults with predisposition toward illness or a weakened immunity are especially at risk during high periods of increased incidence (CDC, 2009a; CDC, 2010a; CDC, 2010b). In a study conducted by the CDC in 2003 on the annual prevalence of hospitalizations resulting from influenza-related complications, results indicated that in 1979, roughly 121,000 individuals were hospitalized for such complications. During the 1990s, yearly hospitalization counts increased to an annual
average of over 200,000 (CDC, 2010a). This increase is suspected to have occurred not only as a result of the increasing population rates, but also due to increased traffic between states and other countries, as well as the increased daily mobility of the general public amongst other inherent factors including the dependence on chemicals, industrialization of food production and processing, and globalization of distribution and marketing of primary products (CDC, 2010a; WHO, 2007).

The CDC suggests that there are two main ways to contract any of the common viral illnesses. Contracting may occur through coughing or sneezing with airborne illness (known as “droplet spread”), or through direct contact with germs spread through touching of contaminated items. (CDC, 2010d). Coughing and sneezing of infected individuals propel respiratory droplets of infection through the air and deposit on the mouth or nose of people in the surrounding vicinity, spreading the ailment often without notice (CDC, 2010d). Oftentimes, influenza germs may remain on object surfaces affected by infected individuals, leaving those surrounding persons vulnerable to the second most common form of disease contraction, direct contact. Direct contact may occur in two ways, including through contact with an infected individual through touching and sharing of personal items such as food or silverware, or through surface contact, meaning that an uninfected individual becomes exposed to the harmful bacteria left behind on objects touched, coughed on, or sneezed on by infected individuals post interaction with the object or surface (CDC, 2010d). Most often, individuals make contact with surfaces tainted with respiratory droplets, and touch the eyes or mouth before properly disinfecting, resulting in the spread of disease (CDC, 2010d). Once infected, presenting symptoms of viral and respiratory disease include coughing,
sneezing, fever, fatigue, muscle or body aches, weakness, headaches, and sore throat (CDC, 2010c).

With today’s increased rates of flu and sickness, government officials push for the continual use of preventative techniques employed to reduce the spread of disease. First and foremost, officials stress the importance of receiving proper immunizations to protect the body from harmful disease, especially those aged 65 and older (CDC, 2009c; CDC, 2010a; Adonis-Rizzo & Jett, 2006). Research agendas conducted within the CDC’s National Institute of Allergy and Infectious Diseases (NIAID) focuses on how influenza viruses replicate, then interact with the infected host, and stimulate immune responses to evolve into new strains (CDC, 2009b). Continued influenza research aids in more highly effective forms of immunization, as well as more reliable diagnostic tools and drugs suppressing influenza-like symptoms (CDC, 2009b).

Immunization consistently remains the most effective means of prevention as indicated by CDC officials (CDC, 2009c; CDC, 2010d). Even still, annual rates of immunization remain well below the recommended goal of 90% immunized for Americans aged 65 and older (Adonis-Rizzo & Jett, 2006). Due to low rates of adherence to immunization recommendations, the CDC identified specific other preventative techniques to contain the spread as adoption by those infected and those not yet exposed to germs. Other preventative measures include active avoidance of close or direct contact with infected individuals by staying home from work, school, and errands, etc.; increased use of protective measures and equipment (i.e., covering mouth and nose with a tissue when coughing or sneezing, utilizing protective barriers such as gloves and face respirators during high incidence of disease, etc.); and continual
practice of proper hand washing to eliminate the harmful bacteria encountered (CDC, 2009c).

For even the most disease-cautious individuals, the included preventative methods hold certain limitations in practicality with today’s world. For example, complete avoidance of infected individuals within the environment is hardly possible due to the ignorance of, and lack of public knowledge surrounding identifying factors of various infectious diseases. Individuals in the work or school environment may carry harmful germs that lead to an even more harmful ailment, but symptoms may not be readily apparent to the naked eye (i.e., muscle or body aches, headaches, fatigue, etc.) (CDC, 2010c). Although avoiding interaction seems the most effective method to eliminate exposure to the harmful germs, it is highly unlikely that all contact will be eliminated given the mobile nature of the general public and non-detection of possible symptoms just described.

The second method of prevention in the fight against sickness and disease stresses the necessity of using personal protective equipment when engaging in interaction with, or sharing public facilities with infected individuals. Specific equipment identified as effective in stopping the spread of disease includes gloves, facial respirators, sanitizing wipes, and most common, tissues (CDC, 2009c). Gloves are commonly found in healthcare or human service settings where health care professionals frequently interact with consumers. The presence of the protective rubber barrier may stop the spread of disease by eliminating possibility of contact between the infected individual and the uninfected individual’s skin. The American Federation of State, County, and Municipal Employees (AFSCME) recommends latex, rubber or
gloves made of other materials that keep fluids off the skin (AFSCME, 2010).

Fortunately, most gloves are manufactured to be cost-effective for consumers, and durable enough to prevent the spread of illness, yet disposable to help prevent further contact upon exposure to the harmful bacteria and germs (AFSCME, 2010).

Obvious limitations with assuming the use of gloves in any setting include the sometimes limited availability of gloves in public facilities, the stigma associated with use of additional protective gear outside of settings in which one may commonly find them (such as the described healthcare facilities), and response cost experienced by individuals for using gloves. Response cost may include the need to continually change glove attire, which may become bothersome and limit the work an individual may accomplish when required to properly and effectively eliminate germs from gloves and hands following direct contact with exposed individuals. Because of punitive consequences or costs commonly associated with taking extra time to prevent the spread of germs, individuals may likely avoid changing gloves between interactions, or simply choose not to wear gloves at all, both of which increase potential risk of infection for that person.

Face respirators, as a second form of protective equipment are commonly spotted in use by patrons in public facilities such as airports, schools, and hospitals, all areas identified as sites where germs are likely to breed due to continually high traffic (CDC, 2010c). Using a respirator by individuals carrying infectious disease inhibits the spread of germs when unexpected coughing or sneezing may occur, and may also prevent infectious germs from entering the body of uninfected individuals utilizing the device. Airborne illness oftentimes spreads without the potential victim’s awareness of
the contamination (CDC, 2010d). Unfortunately, limitations with this approach are indeed apparent, and include the inconvenience and discomfort associated with the wearing of face respirators, as well as diminished social appearance when entering public facilities donning the protective device. Again, the cost of use oftentimes exceeds the potential benefit of only probable prevention; therefore, use is sporadic and inconsistent at best.

Disinfecting wipes and sprays are also noted as protective equipment found effective in environments where disease spread is highly probable. Grocery stores, airports, healthcare facilities and schools often supply these agents free of cost to consumers, and though research is limited on effectiveness of such agents in identified facilities to stop germ spread over times, the assumed use and discarding of sanitizing wipes enables the germs to be killed immediately and spread of such germs goes prevented (CDC, 2010d).

The third and final form of prevention most widely accepted widely by officials in the fight against disease includes the use of disinfecting agents such as disinfecting wipes and sprays, as well as habitual hand washing. The CDC defines hand washing as, “vigorously rubbing hands together with soap and water for at least 15 seconds” (CDC, 2009a). The procedure involves eliminating harmful bacteria from skin on hands left behind by surface contact of infected areas through use of soap and water or alcohol-based hand sanitizers, and the CDC recommends that individuals engage in hand washing immediately following potential exposure for maximum prevention (CDC, 2010d).

According to Larson, Quiros, & Lin (2007) the specific guidelines for hygiene
amongst hospital staff have changed since inception in 1981 to today (like most regulated guidelines are known to do with increasing amounts of information provided by extended research on a given topic). In 1981, the only recommendations provided to healthcare employees suggested that “hand hygiene should occur before invasive procedures or while taking care of susceptible patients and touching wounds; that plain soap “unless otherwise specified” should be used or antimicrobial hand washing product utilized pre-interaction with newborns, high-risk patients, and immunocompromised patients” (Larson et al., 2007). Beyond these recommendations, nothing further was specified for surgical hand preparation, skin care, fingernail treatment, education and motivation, or administration measures to increasing hand hygiene (Larson et al., 2007).

Today, the guidelines provide a thorough account of proper hand hygiene methods that are thought to provide healthcare workers and consumers the best protection against the spread of sickness and disease. According to Larson et al., officials now suggest the following: “cleaning hands when dirty or contaminated; after contact with any patient’s skin, body fluids, nonintact skin, or inanimate objects in patient vicinity; while moving from a contaminated body site to a clean body site; before caring for neutropenic patients, donning sterile gloves, and inserting catheters” (2007). Methods of hygiene include soap and water as well as waterless methods provided through alcohol based solutions. Additionally, specification of hygiene recommendations is thoroughly outlined for those topics once neglected as listed above (Larson, 2007) and waterless methods are becoming more readily available as suggested for employee and visitor use within healthcare facilities with the public sector catching on and offering free waterless agents and wipes in a variety of public facilities.
Though hesitation surrounds the general public opinion regarding the effectiveness of such waterless methods, results of a recent study conducted by Pickering, Boehm, Mwanjali, & Davis (2010) suggest that waterless sanitizers are not only as effective, but in the case of eliminating harmful levels of E. coli and streptococci (especially fecal streptococci) from the body, such waterless sanitizers prevailed against washing with soap and water in geographic regions with limited supplies of soap and high incidence of infectious disease. Effects of this research alone suggest more realistic ways to eliminate bacteria in these regions that do not break the bank, so to speak amongst citizens with already-limited resources (Pickering et al., 2010). Further efficacy studies such as that conducted by Kampf and Ostermeyer (2005) continually provide data supporting specific types shown more effective than competing brands and alcohol-based solutions.

Smith (2009) conducted a full review of hand-washing techniques in primary care and community settings published in various libraries and online sources between June 2007 and February 2008. Results of this review indicate that although hand washing is highly supported by the research, the policy surrounding current hand washing is weak. This means that one may find a plethora of efficacy studies on waterless hand washing versus soap, publicity, as well as studies on education surrounding hand washing behavior, yet little to no research has been conducted in primary care settings or have targeted behavior known to reduce spread and incidence during times of breakout. Interestingly enough, such studies targeting behavior change are minimal, even though research suggests reductions in infectious disease is known to result from proper hand hygiene (Smith, 2009). Smith included the most common dependent variable in
research agendas aimed at hand hygiene and infection control to be number of bacteria left on the skin (2009). Implications that may be concluded from this review suggest that most studies target the ability of individuals prompted to wash their hands, rather than focusing on methodology proven to increase hand washing behavior in general (Smith, 2009).

In the study conducted by Larson et al. (2007), methodology was utilized to analyze actual compliance in healthcare facilities to posting and regulation of hand hygiene guidelines. According to these results, within all participating hospitals, nearly 90% of employees reported familiarity with described guidelines; however, nearly half of participating hospitals showed no inception of any multidisciplinary program aimed at compliance with the regulations. Though benefits were identified in those hospitals adopting compliance and providing proper regulation, compliance rates remained low amongst all sites, suggesting the wide dissemination of guidelines and education regarding disease containment was not enough to change actual behavior (Larson et al., 2007). Considering the less-than mediocre compliance rates obtained in healthcare facilities where spread of disease and likelihood of contraction is highly apparent, identification of the problem and education regarding the issue does not seem sufficient to change behavior, and more empirical research is needed on increasing actual use of sanitizer.

Most recently, the 2009 pandemic of swine flu has prompted the need for research on preventative interventions. Hand washing behavior has become of public interest and various campaigns have been arranged to promote behavior aimed at disease prevention. In public facilities worldwide, posters and signs present the harmful
effects of failing to sanitize, and increasing numbers of automatic sanitizer dispensers may be found upon entering such facilities. The general assumption adopted by government officials regarding this matter is that when provided with enough information, the materials required to act, and an opportunity to act, human behavior will change in accordance to the information provided (Kalili, 2000). The approach adopted by ensuing such methodology is referred to as the psycho educational approach to preventative behavior, and is widely accepted by the general public and health officials as effective at promoting proper hygiene, though proper experimentation and measurement of directly observable effects have not yet been conducted due to the lack of literature on such methods.

In the healthcare sector, the most recent and notable example of the psycho educational approach adopted by officials occurred during the 2009 pandemic outbreak of the novel influenza A (H1N1). According to the U.S. Agency for International Development (USAID), within three days following the World Health Organization (WHO) announcement of pandemic alert on June 11, 2009, over 3 million copies of posters and brochures were distributed within public and private sectors throughout the U.S. and other world countries (USAID, 2009). Additionally, educational materials including pertinent H1N1 information were posted on buses and subways, hung in aisles of supermarkets, and placed on pharmacy counters (USAID, 2009). Seminars were conducted at summer camps, on college campuses, and within private workplaces to disseminate knowledge and materials to ensure preventative measures would follow (USAID, 2009).
The psycho educational approach is defined by the Association for Specialists in Group Work (ASGW) as an approach that addresses the importance of educational and prevention goals in groups aimed at educating those facing potential threat [as in illness prevention] or a developmental life event (Brown, 1998). This approach utilizes the power of workshop, group, and classroom settings to assist in teaching all people new skills that will allow for what is thought to be quick, social change (Brown, 1998). Incidentally, this approach relies on style, not profession for results. In other words, no matter whether the training is conducted by non-professional therapists or peers, authors Kolko, Loar, and Sturnick (1990) suggest that as long as the leader shows warmth, understanding, and support, this approach may be successful, even if the leader identifies as nothing more than the mass media.

In *Psychoeducational Groups*, Brown (1998) outlines the basic history, assumptions, inferred (yet unproven) effectiveness, and definitions of psycho educational methods. One basic assumption is that groups will be provided for individuals in all settings, educational levels, and ages, and all groups will emphasize education and learning, with minimal reliance on self-awareness and self-understanding (Brown, 1998). Brown suggests that groups amenable to psycho educational techniques include those affiliated with hospitals, businesses, universities, government, social service agencies and the military (1998). The methods described by the USAID in response to WHO’s declared pandemic status of the H1N1 virus provide a clear indication of how the psycho educational model may be carried out with the public at large (USAID, 2009).
Empirical research remains untapped, so to speak, in the way of behavioral effectiveness for preventative behavior toward illness and disease when utilizing the psycho educational approach to increase preventative behavior; however certain research conducted in the therapeutic setting demonstrates some change in targeted outcomes, though through methods utilizing subjectively measured outcomes. Kolko et al. (1990) taught social skills to family, friends, and supervisors of children diagnosed with autism using group sessions and workshops with results indicating socially validated results, though reported no concrete measures on actual behavior change (i.e., actual minutes spent interacting, frequency of interaction, etc.). Other social skills researchers have targeted populations including clinically depressed adolescents, cancer patients (Fine, Forth, Gilbert, & Haley, 1991), and the chronically mentally ill (Douglas and Mueser, 1990).

Devine (1992) conducted a meta-analysis of 191 studies evaluating the effects of psycho educational training on surgical patients on emotional disturbance post-surgery. The authors determined that post-surgery, all patients confirmed the ability to cope better with surgery-related emotional side effects. Conclusions drawn from these various studies suggest that various populations may be subject to benefits of psycho educational programs dealing with periods of potential danger (Kallil, 2000).

Additional application of the psycho educational approach has been demonstrated with prevention of issues in families dealing with divorce. Gray, Verdieck, Smith, & Freed (1997) showed that psycho educational workshops resulted in positive effects on attitudes of parents, as well as their ability to adjust to divorce and resolve issues regarding the situation. Parents that utilized the workshops had success with
keeping children away from being the center of divorce conflict. Again, researchers relied on subjective judgment for efficacy of intervention. Due to the varying use of groups, Kamps, Leonard, Vernon & Dugan (1992) researched ability of children with autism to practice new behaviors related to contrived situations. Results indicated that those who were provided the opportunity to practice appropriate behaviors, whether through role-play situations, or in-situ practice, were most successful and maintained ability to demonstrated learned behavior (Kamps et al., 1992).

Kalill (2000) conducted a study within a middle school in which workshops were conducted with teachers, school administrators, students, and parents to identify early signs of violence and increase their abilities to implement the specified intervention program set in place at that school. Results of this study suggest that those subject to psycho educational learning techniques increased their ability to change their perceptions of any given situation and improve their lives, and that most successful training has a positive impact on families, professionals, and children in a variety of environments, especially when paired with effective follow-up systems (Kalill, 2000).

Though results are shown to have somewhat of a social impact as well as some impact on individual perception, the author identifies that the dependent measures remain quite subjective and may be easily influenced by factors surrounding the participants involved. Dependent measures within this particular study included assessment of participant opinion of training effect, and subjective rating of group satisfaction (Kalill, 2000). No overt behavior was measured nor results presented post-intervention in all of the aforementioned studies on behavior indicated for change.
Additionally, in many of the mentioned studies, the implementation was somewhat confusing due to a lack in strict procedural reliability, and results varied due to a variety of factors including, but not limited to: what materials were used; how many of each material was used; what time of the day the study was conducted; the latency between the initial occurrence of the problem and implementation of intervention; whom was present for training; and how many participants actually attended, and finally, for what percent of trainings were the participants present (Kalill, 2000). Critiques provided by participants in this study suggested that more intervention strategies, scenario exercises, school-specific issues, and legal issues needed to be provided to obtain more valuable results overall (Kalill, 2000).

Because of such substantial limitations, reported successes with those studies utilizing the psycho educational approach must be interpreted with hesitation due to the utility, cost, timeliness, and limited nature of the intervention targeted strategies. Kallil (2000) suggests that workshops provided important, concise and relevant information for the school in which workshop training was provided; however, reports from teachers and parents indicated a lack of appropriate material and relevance to the actual situation (Kalill, 2000). This alone suggests that in order to provide a concise, somewhat simple and cost effective approach to behavior change using this method, one must limit other relevant factors seemingly important to a successful program.

Additionally, with regards to indicated results, due to the subjective nature of the dependent variables commonly targeted for change, these approaches often fall short in terms of adhering to a strict experimental design (Hayes, Barlow, & Nelson-Gray, 1999), and effects should never lead to causal statements regarding true effect on the
determined variables, which would include behaviors related to personal change expected as a result of training. For this reason, follow-up results should be obtained and evaluated for maintenance across time and situation, as common to empirical accounts of research (Hayes et al., 1999). Unfortunately, these measures often remain un-assessed within a psycho educational framework (Kalill, 2000), so again, hesitation in interpretation of cause-effect results obtained by this approach is warranted. Adoption of a more concrete, empirically proven approach to obtaining such results may complement the current reported findings if implemented. A science of behavior is suggested to analyze and measure such variables, since technologies prove to be effective and rely on scientific methods to accurately determine conclusions (Cooper, Heron & Heward, 2007).

Behavior Analysis is a science devoted to the understanding and improvement of human behavior through the identification and manipulation of objectively defined targets that hold certain relevance or social significance (Cooper et al., 2007; Skinner, 1953). Like many of the natural sciences, the basic characteristics of a science of behavior include description of the subject matter (i.e., behavior), prediction of future behavior based on consequences of previous contingencies present in differing situations, and control (in terms of the ability to systematically manipulate and influence, to a certain degree) of the conditions surrounding behavior to increase or decrease occurrence (Cooper et al., 2007). These three factors comprise a science of behavior to solve individualized issues such as self-injurious behavior or tantruming in atypical populations, or performance issues in beings of various development levels, even the typically developing beings (Skinner, 1987). Analysis of behavior may be present at a
variety of levels starting with the individualized level, and expansion within the field has grown and technologies derived from the scientific sector of behavior analysis has become more able to influence behavior of entire groups and cultures in a similar manner applied to that of the individual (Malott, 1995).

The basic tenet underlying behavior analysis is the assumption of determinism, which states that the universe is an orderly place, and phenomena such as behavior do not just happen at random, but rather, occur due to a systematic relation between themselves and other factors amenable to scientific manipulation and investigation within the environment of the organism (Cooper et al., 2007; Chiesa, 2003, Rockwell, 1994). Critics lurke for determinism much the same way they do for the proposed theories of behavioral control of man (Skinner, 1988). Even so, it is not the intent of this review to compare the views, but rather provide a thoughtful analysis of how one may use these basic tenets to further investigation and shape behavior of individuals, and groups, including individuals and groups with whom hand washing behavior would benefit from an increase.

Throughout the years, the science of behavior has morphed, somewhat, and techniques once demonstrated to control behavior of rats and pigeons in B. F. Skinner’s scientific laboratory devoted to the study of operant, or learned behavior, have been applied and demonstrated effective for use on human beings, a considerably more complex being with highly complex behavioral repertoires (Skinner, 1987). The work of Skinner and professionals following his lead have shown the effectiveness and incredible power of the consequences surrounding behavior in its role in controlling future occurrence of that behavior. With increasing numbers of behavior analysts
throughout the world, techniques are being applied on all populations, typical and atypical of all ages and races (Malott, 1995).

In his monumental work describing the ability of a science of behavior to control the men of which are subjects, B.F. Skinner sets a goal for the science. A particular field devoted solely to the study of behavior, behavior analysis considers all organismic behavior, which is said to be the joint product of survival contingencies responsible for natural selection of species traits, contingencies of reinforcement responsible for behavior of individuals, and special contingencies maintained by evolved social environments (Skinner, 1981). Applied behavior analysis attempts to solve the issue of human behavior through the application of principles derived from an experimental analysis given certain environmental variables (Dinsmoor, 1992). Like the natural sciences, interventions applied to any given situation via adoption of the scientific method, are extracted from the study in a human operant research lab, and tested for efficacy under strict experimental research conditions (Skinner, 1981). Behaviorism has led the way to a greater understanding of human and animal behavior, much of it stemmed directly from the works of Skinner, and the scientists preceding him.

Behavior analysis has been applied to solve issues of human behavior at various levels and in various settings. Professionals working in applied behavior analysis tend to study the behavior of those individuals with disabilities, be it developmental or physical disabilities that result in problematic, or maladaptive behavior. Oftentimes, practitioners in the field work at an individual level, teaching a child diagnosed symptoms laying on the autism spectrum to speak, or perhaps, training individuals with intellectual or developmental disabilities to recite the alphabet, or conduct functional life activities such
as cooking, or cleaning laundry, while systematically identifying. Ultimately, the goal of applied behavior analysis is to teach skills to an individual that might replace maladaptive or undesirable behaviors with positive alternative behaviors that will aid in further personal development (Rockwell, 1994).

A second of application is at the organizational level. Organizational behavior management is a branch of behavior analysis devoted to the study of organizational behavior, and the impact of systematic intervention on larger groups of people all working toward common goals (Malott, 1995). Organizational behavior analysts work as consultants, to determine the best ways to enhance performance of employees in a large work setting, or simply eliminate maladaptive or unsafe work behaviors of individuals on the job to promote growth and foster success using contingencies of positive reinforcement as the basis for change (Malott, 1995).

At an even larger scale, behavior analysis has been applied to society at large, offering interventions to improve the behavior of residential citizens. In one particular study, the recycling behavior of an entire group of college dormitory residents was increased through reinforcement in the form of monetary incentives for recycling behavior. Such behavior change in individuals once unaware of their role in changing environmental conditions demonstrates the power principles discovered through behavior analysis can offer (Geller, 1995).

Skinner, often referred to as the “Father of Behaviorism” has suggested a multitude of theories of human behavior, supported by research for almost all claims made about human and animal behavior. Much of his research began in his operant lab, in which animals served as the subjects and were systematically exposed to a
variety of stimuli both naturally present in the environment, and artificially contrived for varied effect on behavior (Skinner, 1953). Skinner claimed that all behavior could be controlled, and therefore also could be predicted given specific set of governing contingencies. He, and those behaviorists following his lead, assume the basic tenets of determinism, a field of thought in which all behavior is predictable, and/or controllable (Chiesa, 2003).

As an illustration, in his fictional work, *Walden Two*, Skinner created a world in which human performance was maximized through contingencies utilizing the ever common positive reinforcement, environmental issues were non-existent due to regulations regarding consumption both in home and society as a whole, as well as expectations and societal pressure to conform to such rules (1976). Dinsmoor provides a seemingly accurate interpretation of the environmentally savvy genius that was Frazier, by creating a society could using knowledge of behavior to enhance citizen cooperation in terms of resource conservation, the reduction of personal competition, child education, freedom of burdening tasks expected of women, eliminating economic exploitation, ending class distinction and preventing nuclear war (1992). In short, individuals lived fulfilling, happy lives through the application of behavior analytic principles and methods all designed around Skinner’s experimental analysis of behavior (Skinner, 1976).

Though the novel was indeed fictional, and based on a non-existent world both physically and socially displaced from the rest of society, future behaviorists gained hope for the success of such control in the world at large. Various groups intended to implement the programs described by Frazier, the fictional leader of this revolutionary
world, much with limited success due to ignorance of other sciences or non-cooperation amongst designated leaders. Notable attempts include the Walden House, Lake Village, and Los Horcones. The latter being the only remaining functional Walden-like community persisting in operation today (Kuhlmann, 2005). Walden Two enthusiasts imagine a world in which behaviorism is ruler of all, and through practical application of the principles, following the tenets of determinism while negating the concepts of free will, some truly believe that the world may be saved.

Malott suggests that behavior analysis can solve or alleviate most human problems, even at various levels be it the individual level, organizational level, societal level, or global level (Malott, 1995). Through application of animal research, and further expansion, we study the human organism at the individual level, using vocal responses as conditioned operants, then sequentially expand the growth to organizational, then established cultural levels. Though many so called verbal operants are reinforced through the mediation of other people, to control for variable consequences we must establish an overall consensus of acceptability and disseminate the knowledge and provide direct contingencies for action using principles of behavior analysis (Skinner, 1953). With a targeted group behavior of disease prevention, and handwashing the main avenue for such prevention, it is not unsafe to assume that behavior analytic principles will foster growth and true behavior change toward a better, disease-free future. Because hand washing is a directly observable, concrete behavior, it should be measured, then exposed to various interventions, and testing for desired outcomes.

The current research provided by the behavioral sciences regarding hand washing is limited, and little is known about the direct effects various methods of
intervention will have on hand washing behavior specifically. Current methodology provided within the literature on hand hygiene utilized direct observation to determine specific trends across populations in regards to use of soap in pubic restrooms (Monk-Turner, Edwards, Broadstone, Hummle, Lewis, & Wilson, 2005; Botta, Dunker, Fenson-Hood, Maltarich, & McDonald, 2008).

Monk-Turner et al., found that when directly observed in a public restroom, women washed their hands more often than men, and also used more soap than men on average during individual observations (2005). In a study conducted on a university campus in the western U.S., Botta et al. demonstrated relative effectiveness of a hand washing campaign utilizing the posting of “gross” messaging, or statements related to the unsanitary nature of an individual who does not wash hands upon exiting the bathroom, and “scare” messaging, or written known effects of failing to wash, presenting as threats, so to speak for not washing. Handwashing behavior was directly measured via direct observation pre and post intervention, with signage rotated during implementation of the campaign but no measurement for effect when signs were changed or discarded (2008). Still, results showed modest increases in hand washing behavior of the experimental group exposed to the campaign, and it was determined through post-intervention surveys that individuals preferred signs containing the “gross” phrases over those indicating the threat or risk of not washing, and reported higher likelihood to wash when presented with such prompts.

Loukus & Dixon (in review) conducted a study during the 2009 H1N1 pandemic that utilized public observation of sanitizing behavior of patrons entering and exiting a large, academic facility on a midwestern university campus. Variables manipulated and
assessed for effect on percentage of individuals who sanitized when afforded the opportunity included: location of the free-standing dispenser; posting of public facts and statistics related to swine flu incidence in the United States, the state of residency, and specific city in which the study was conducted; and a verbal prompt plus social praise initiated by a student researcher physically prompting and dispensing sanitizer to those who responded favorably. Results of this research suggest that visual prompting methods result in short-term, yet minimal effect on percentage of individuals who sanitized, but increases of up to 40% of individuals sanitizing during intervention consisting of verbal cues and social praise for sanitizing (Loukus & Dixon, in review). Because of methodological limitations including the limited population provided by the observed convenience sample, replication of effect shown by the verbal cue and social praise intervention in an health care facility was warranted to determine effects on the general public at large, rather than the convenience sample provided by studying behavior of campus facility patrons.

The purpose of the current research then, was to further results obtained from the limited empirical research aimed at increasing hand washing behavior, and express the need for behavior analytic methodologies over the currently implemented psycho educational approach to behavior change in a naturalistic healthcare facility. As described previously, previous observational research has been conducted aimed at identifying trends amongst demographic populations (Monk-Turner et al., 2005; Botta et al., 2005) no current research indicates the targeting of hand washing behavior amongst public facility visitors; therefore, this study also aims to expand research on visitor handwashing behavior instead of the commonly targeted healthcare employees often
subject to facility campaigns and regulations regarding hand hygiene to contain the spread of infectious disease (Stephens & Ludwig, 2005).
Participants, Setting, and Materials

Participants in this study included all individuals entering and exiting the main entrance of a mid-western healthcare facility. Table 1 provides a thorough representation by session for the various demographic factors assessed, including number observed, gender, individual type (employee/visitor), and total persons observed entering or exiting. All individuals were monitored for use of hand sanitizer while passing the sanitizing station located in the foyer of the facility. All participants remained anonymous during data collection and observers were students disguised as hospital visitors waiting near the registration desk positioned away from the door, but in clear view of the sanitizing station. Materials utilized consisted of the facility’s current hand sanitizing station that included facts and educational material discussing the importance of sanitizing to prevent the spread of disease, personal protective equipment (e.g., gloves, respirators, and tissues), and a bottle of sanitizer at no cost for visitor use. Refer to Figure 1 for a visual display of the apparatus. Pens and data recording sheets (Figure 3) were utilized to document use or non-use of hand sanitizer when individuals passed the sanitizing station, and a timing device helped ensure equal, 15-minute session lengths during observation.

Experimental Design and Procedure

An experimental reversal design identified by the acronym ABABA was utilized throughout the study to strengthen claims regarding experimental control over the dependent variable when intervention was sequentially introduced and removed. ‘A’ represents baseline, or no intervention. During this phase, the currently utilized, stand-
alone sanitizing station was located next to the sliding entrance doors. Visitors and employees passed by the station upon entering and exiting the main entrance of the healthcare facility. ‘B’ represented the introduction of the independent variable. This phase consisted of a student researcher standing in front of the sanitizing station with a full bottle of hand sanitizer with a manual pump (see Figure 2). Approaching visitors and employees were verbally prompted to use the sanitizer before entering or exiting, and upon delivery of the sanitizer, were thanked for using the solution. The procedure began with initial baseline data collection of typical hand sanitizer use with the provided sanitizing station followed by the sequential introduction and removal of the physical prompting with verbal cue intervention. A return to baseline followed each implementation of the independent variable to assess effects on the dependent variable in a controlled fashion.

**Baseline (A).** During all baseline phases, the sanitizing station currently used was located next to the automatic sliding doors to the main entrance of the facility. Data from five individual 15-minute sessions served as baseline for current or typical sanitizing behavior. Data points represent the total average for all individuals using hand sanitizer during the session. After five sessions of baseline data that proved stable (met a difference criterion of less than 30 percent), the described intervention (B) was implemented and sanitizing behavior was measured for effect. Return to baseline conditions followed implementation of Phase B for controlled effects on the dependent variable and was measured as described for all phases.

**Physical prompting with verbal cue and social praise (B).** A student researcher used a full bottle of hand sanitizer that included a manual pump for
dispensing an alcohol-based gel hand sanitizer solution during this intervention. The currently implemented sanitizing station was pushed out of sight of entering or exiting employees and visitors and the researcher stood in its place. As an individual entered the facility, the student researcher made eye contact, smiled and provided a verbal prompt while offering hand sanitizer to the approaching individual. Verbal prompts included statements such as, “Hi, would you like to sanitize before entering today?” or “Hello, would you like some free hand sanitizer?” If the individual declined the researcher’s offer, he or she was provided with a neutral statement such as, “Okay, thank you. Enjoy your day.” or “No problem, have a nice afternoon.” Upon acceptance from individuals, the student researcher responded with a statement of approval and social praise such as, “Great! Thanks so much!” or “Thank you for disinfecting. Have a great day.”

**Data Collection and Interobserver Agreement**

The primary dependent variable measured was the percent of individuals who used hand sanitizer when afforded the opportunity, across all conditions. Total percentage was calculated by dividing the total individuals engaging in hand sanitizer use by the total number of individuals observed entering or exiting the facility during observation sessions. Secondary dependent variables included percent of males versus females engaging in hands sanitizing behavior, percent of employees versus visitors who sanitized, and finally, percent of individuals entering compared to percent of individuals exiting the facility who engaged in hand sanitizing behavior.

A second observer was present for 52% of all sessions and served as the primary observer during intervention. Interobserver reliability was calculated by dividing
the total number of agreements divided by the total number of agreements plus disagreements and multiplying by 100%. Total agreement was found to be 95%.
CHAPTER 3
RESULTS

Figures 4-6 provide a graphic representation of all sanitizing behavior observed for overall percent of individuals who used the provided hand sanitizer, male versus female sanitizing, and sanitizing when comparing those entering versus those exiting the facility.

As depicted in Figure 4, during baseline (A), individuals engaged in sanitizing behavior less than 1% of all afforded opportunities to do so. Within this phase specifically, only two individuals sanitized upon entering or exiting out of a total of 154 observed employees and visitors of the facility, and the two individuals were a couple who entered together. The majority of facility patrons observed during baseline passed the provided hand sanitizer station and glanced at the information provided on the poster attached to the apparatus, but ultimately failed to sanitize. Instead, most continued to their final destination without sanitizing either upon entry and/or exiting.

Upon introduction of the first intervention phase (B), sanitizing behavior improved substantially compared to baseline, yielding an average increase of nearly 47% of the overall total observed, and a total increase of 49.4% in those who specifically received the verbal prompt and social praise. Because many individuals entered in groups or 3 or more, or many groups at once, not everyone received the verbal prompt and data was scored to indicate which individuals did not. A return to baseline (A’) yielded results indicating that sanitizing behavior decreased back to 0% of all individuals which was a total of 270 observations.

Upon re-introduction of the intervention (B’), as indicated on the graph, sanitizing behavior increased 46.6% for all observed individuals who passed the sanitizer, and
increased by 52.4% for all individuals who specifically received the verbal prompt and social praise for sanitizing compared to the second baseline sanitizing levels. A third return to baseline occurred for one 15-minute session to determine whether behavior would revert once again to baseline levels, and as indicated on the graph, no individuals were observed sanitizing when entering or exiting immediately following the removal of the second intervention phase, strengthening claims related to intervention causality in terms of increasing hand sanitizing behavior amongst visitors and employees within the health care facility.

Researchers monitored and recorded data on each observation regarding whether those observed were employees or visitors, male or female, as well as whether the observed individual was entering or exiting the facility when passing the sanitizing station or student researcher during intervention phases. Secondary dependent variables indicated that employees were observed entering or exiting the facility less than 3 percent of all total observations, which suggests that perhaps employees had a specific entrance designated for use when beginning or leaving work. For the clear inequality in observation opportunities between the two, comparative analysis of employee versus visitor sanitizer use was discarded as a secondary dependent variable.

Table 2 and Figure 5 depict total sanitizing behavior for males compared to females who were afforded the opportunity to sanitize. Results indicate that females utilized the sanitizer more than males upon entering or exiting based on the total accepted. 58% of those accepting the verbal prompt to sanitize were female, compared to 42% males.
Figure 6 depicts the total sanitizing behavior of those entering versus exiting the facility. Results indicate that people accepted hand sanitizer on average of 12% more upon entrance to the facility then while exiting the facility and returning to their vehicle (56% entering, 44% exiting).
CHAPTER 4

DISCUSSION

Though simple in nature, the results of study, accompanied by an extensive review from published literature provides a thorough analysis of two approaches to preventative behavior in relation to sickness and disease within a public facility. This study extends the findings of various studies within behavior analytic research that targets safe and preventative behavior. Loukus and Dixon (in review) demonstrated a need for in-situ data collection in a healthcare facility to support the claims that sanitizing behavior remains unaffected when taking a passive approach most often found with psycho educational methodologies. Because the mentioned study was conducted on a university campus, relevance to the public sector at large was limited; therefore, applicability of claims related to causal inference required more empirical support upon which to base suggestions for public intervention only possible through replication of effect. Clayton and Myers (2007) demonstrated the previously suggested need for mediated prompting (verbal cue provided by another individual) versus a passive prompting (signs, posters, pamphlets) for effective behavior change in public sectors to increase safe driving behavior, and this research strengthens the assertion that reliance on passive prompting and the inferred human morale for effective behavior change yield less that mediocre results, even when likelihood of detrimental consequences for not engaging in preventative behavior are substantially high (Loukus & Dixon, in review).

Stimuli used in public awareness interventions and campaigns tend to lose saliency when repeatedly encountered in any environment. This claim has been
demonstrated within the behavior analytic research by investigators both in applied behavior analysis and the sub-discipline of OBM (Clayton & Myers, 2007; Malott, 1995). Unfortunately, the current methodology within a psycho educational approach relies on highly stagnant stimuli often subject to a loss of saliency as individuals recurrently encounter them within their natural environment. Once powerful stimuli expected to maintain behavior change for prolonged periods of time fail due to this loss of saliency—the placement and educational materials provided on the sanitizing station fall subject to such effects. Because the stimuli used in this study have been present in this environment and are highly common in other public facilities, this study provides the basis for the simple demonstration of this loss of effect. It is now apparent that divergent methodologies based upon current behavior analytic findings must be implemented and tested for change and maintenance within public settings to maintain desired effects.

Professionals that adhere to the tenets of a psycho educational approach to preventative behavior often assume that when provided with the proper materials, a sufficient amount of education related to some topic of choice and an opportunity to act, human behavior will change in accordance to the information and materials provided (Brown, 1998). For this healthcare facility, communicating the need for prevention of sickness as well as providing a means to stop the spread of disease is of glorified interest due to the prevalence and likelihood that one will contract the germs left by an individual wrought with disease. This approach, however, repeatedly fails to evoke the intended behavior, and when monitored for effectiveness, authorities may be surprised at the ineffectiveness of this approach not only in healthcare facilities, but also other locations known for high rates of public traffic.
According to the WHO’s annual World Health Report of 2007, over 2 billion individuals utilize airline transportation alone. Each of these passengers holds potential to contract and spread infectious diseases induced by common methods indicated by the CDC (coughing or sneezing, person to person contact, or simply making surface contact with an infected object) (WHO, 2007). Changes in the way humans inhabit the world leads to explosive changes in the means by which disease may spread. (WHO, 2007). Increases in travel or mobility, technology, industrialization of food production and processing, globalized marketing of product, and international reliance on consumer economics all increase the potential for international epidemic and pandemics, illustrated best by the final statistics reported for the 2009 H1N1 (Swine flu) pandemic (CDC, 2010d).

The spread of contaminants in the environment is a result that remains controlled with proper preventative behavior by the general public. The lives of all lay at the hands of those within the environment, and every action taken to prevent the spread is taking one step closer to accomplishing the goal of global wellness. Current methodologies most often adopted may be ineffective in promoting such action as demonstrated in this research and in hand washing studies before this that yielded observed rates as minimal, dependent measures insufficient, and current methods ineffective (Larson et al., 2007; Loukus & Dixon, in review; Stephens & Ludwig, 2005; Monk-Turner et al., 2005). Behavior analysis provides a venue for further growth and movement toward the goal of increased sanitation whether individuals are expected to wash their hands with soap and water or simply accept the complimentary hand sanitizer provided upon entering a public facility.
This study required little effort to conduct, minimal time obligation, and an abundant supply of hand sanitizer in which to provide facility employees and visitors as they entered and exited the public healthcare facility. Facilities such as this may utilize volunteers to perform such action during times of high incidence of disease, thereby indicating replication and promotion may be attainable in the public sector. Albeit its parsimonious nature, this study clearly demonstrates the effectiveness that mediated prompting and providing of simple social consequences may have in comparison to the non-use of sanitizer resulting from adoption of methods provided within a psychoeducational framework. Indeed, percentages of visitors and employees who used sanitizer never exceeded more than 60%; however, this is believed to be the result of the various influences affecting individual adoption of safety behaviors.

Ludwig (2010) provides a comprehensive analysis with a valid example of such compliance inhibiting factors or principles present with any preventative measures suggested as best practice in a short article composed for audiences of safety at work. In the case of hand hygiene in the health care facility, all four detailed principles (outlined in bullets a-d below) may hold some relevance to the limited acceptance and sanitization of individuals in that a) sanitizing behavior seemed less convenient for individuals, especially when pushing wheelchairs or utilizing other ambulation methods, sanitizing upon entry and exit required more time and effort; b) influence of others is low—proven by baseline non-use demonstrated during baseline, with over 50% increases when use was prompted by another; c) threats and discipline were non-existent for individuals entering and exiting the facility, resulting in continued non-use; and d) signs and policies at best increased the knowledge surround behavior, but failed
to promote change and motivation to change (Ludwig, 2010). The signs utilized in this facility became less salient for patrons, and were often ignored upon entry and exit when intervention was not implemented, demonstrating the loss of saliency of passive visual prompting methods (Clayton & Myers, 2007). With all four of the principles working against the likelihood of compliance, it is no surprise compliance rates reached 50% at best.

Furthermore, it has been long known that antecedent interventions that do not utilize effective consequences are likely to lose effectiveness due to a lack of differential consequences provided for the desired behavior (Michael, 1993). This strengthens claims indicating that current methods that rely solely on psycho educational methodology will presumably fail without exposing individuals to such consequences associated with the desired sanitizing behavior. At best, the potential punitive consequences associated with disease contraction (though merely probabilistic in nature) may be expected to control and maintain sanitizing behavior as a function of disease avoidance, which may not be assumed effective by any means based on data observed during baseline phases. Given all points of consideration, this study provides the empirical demonstration required to illustrate these points of efficacy obtained between the currently utilized psycho educational approach and that of behavior analysis, which reliably increased sanitizing behavior with a simple mediated prompt and providing of social consequences for desired behavior. Due to the already present adopted approaches, it may be possible to suggest that effects shown here are the end result of a combination of approaches, and outcomes may benefit from such collaboration of methods.
**Limitations.** There are certain limitations in the current methodology that should be noted when interpreting the accompanying data. First and foremost, the study was conducted in a single location, and in the naturalistic setting. Though results strengthen claims made by previous researchers (Clayton & Myers, 2005; Loukus & Dixon, in review), the population was limited to those individuals residing in the Midwestern region of the United States and factors unique to individuals unknown by the researchers remain and cannot be controlled for during experimentation. Because of this limitation, inference should be placed only on populations equal to that of individuals in this region, during low incidence of sickness (unlike the behavior of those individuals during high incidence of sickness seen when infection from the H1N1 spread). Claims should not be made toward populations of other diverse cultures and geographical regions.

A note about personal history of those observed: factors not apparent may be present possibly thwarting the use of hand sanitizer by individuals entering or exiting the facility. Factors were intermittently identified by customers as explanation for their declined use during intervention phases and included the following: a) the individual already washed hands with soap and water in the facility restroom prior to leaving; b) the individual may have a personal bottle of hand sanitizer in his or her car or handbag that is preferred over the type offered here; c) the person has certain allergies or skin surface reactions related to alcohol based solution; and lastly, d) some individuals simply identified disbelief in the notion that sanitizing by means of waterless solutions would provide any form of protection against harmful viruses or germs. Such factors, along with those encompassed by the four primary principles affecting safety behavior...
(Ludwig, 2010) must be considered, and future research may aim to identify or eliminate certain factors during experimentation. Still, this study provides a valid account of behavior change to the best of its ability considering the overarching limitations already present with experimentation in the natural setting.
Table 1

Participant Demographics

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Totals    775    299    477    20    745    419    361
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Male vs. Female Observed and Sanitized

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<tr>
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<td>2</td>
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<td>35</td>
<td>32</td>
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<tr>
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<td>16</td>
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<tr>
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<tr>
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<td>19</td>
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<td>22</td>
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<tr>
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<tr>
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<td>0</td>
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</tbody>
</table>

Note. Total sanitized and percent sanitized during individual sessions for males (M) and females (F). Prompted individuals include only participants who received the verbal prompt upon entering or exiting. Total observed represents all individuals observed entering or exiting (all prompted and unprompted individuals).
Figure 1. The sanitizing station located in the entrance of the healthcare facility which included a bottle of hand sanitizer with manual pump, hygienic face respirators, latex hand gloves, tissues, and a visual sign indicating the importance of sanitizing. The station was located on the left side of the sliding entrance doors located near the registration desk.
Figure 2. Manual hand sanitizer dispenser with pump used during intervention.
Figure 3. Independent observational data sheet used to record use/non use of hand sanitizer by employees and visitors entering and exiting the facility.
Figure 4. Results obtained during observation showing percentage of individuals who used the hand sanitizer during baseline and again during intervention phases. The black trend line indicates total percent of individuals used out of total observed individuals. Red trend line indicates percent of individuals used out of total individuals that received the verbal prompt. Not everyone received the prompt during high-traffic periods, and no prompt was offered during baseline observation sessions.
Figure 5. Average male vs. female percentages of hand sanitizer use during intervention. Overall, females accepted sanitizer more than males when offered.
Figure 6. Percent of individuals entering vs. exiting who accepted sanitizer during intervention. Overall results suggest more individuals sanitized when entering and failed to sanitize more often while exiting.
REFERENCES


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Title:
Variables Affecting Hand Sanitizer Use in Public Facilities

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