

EVALUATION OF A HAND HYGIENE CAMPAIGN IN OUTPATIENT HEALTHCARE
CLINICS

by

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Abstract

Hand hygiene by healthcare workers is an effective means of preventing healthcare-acquired infections. However, hand hygiene compliance can be low among healthcare workers. This study used introduction of a gel sanitizer and informational poster as interventional tools in attempt to improve hand hygiene in two outpatient healthcare clinics. Healthcare workers at two outpatient clinics were observed for frequency of hand hygiene (attempts vs. opportunities). Gel sanitizer and informational posters were introduced together as an intervention. Direct observation of hand hygiene frequency was performed during baseline, intervention, and follow-up. A post-study survey of healthcare workers was collected. In both clinics, baseline hand hygiene was poor (11% and 21%) but significantly improved ($p \leq 0.0001$) after interventions (36 and 54%), and was maintained ($p > 0.05$) through the follow-up period (32 and 51%). Throughout the study, post-contact hygiene was statistically observed more than pre-contact hygiene. In both clinics, healthcare workers self-reported a preference for soap and water, yet observations showed that sanitizer use predominated over soap and water use when sanitizer was available after the intervention. Fifty per cent of the surveyed healthcare workers considered the introduction of gel sanitizer to be an effective motivating tool for improving hand hygiene. Hand hygiene performance by healthcare workers in outpatient clinics may benefit from promoting gel sanitizer and using informational posters. Direct observation by trained observers may provide more accurate information of hand hygiene tool preference compared with survey results.

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List of Abbreviations

CDC	Centers for Disease Control
HCW	healthcare worker
HAI	Healthcare-associated infection
ICU	intensive care unit
LPN	Licensed Practical Nurse
MD	Doctor of Medicine
MRSA	methicillin-resistant <i>Staphylococcus aureus</i>
RN	Registered Nurse
USA	United States of America
UTI	urinary tract infection
VRE	vancomycin-resistant enterococci
WHO	World Health Organization

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Dedication

This work is dedicated to my parents. I thank you Mom and Dad for encouraging me at every step of my work. It is because of your blessing that I have been able to achieve this much.

Thanks to my sister, Milanjyot, for making me smile and motivating me to accomplish my goal.

Chapter 1 - Background

Healthcare-associated Infections

Hospital-acquired infections (HAIs), also known as nosocomial infections, are a major cause of concern in healthcare settings (CDC, 1994). The onset of clinical disease from HAIs typically occurs more than 48 hours after hospital admission (Garner, Jarvis, Emori, Horan, & Hughes, 1988). Bacteria, fungi, viruses, and protozoans are potential causes of HAIs (Ananthanarayan & Paniker, 2004). They include methicillin-resistant *Staphylococcus aureus* (MRSA), *Acinetobacter baumannii*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Haemophilus influenza*, *Clostridium difficile*, vancomycin-resistant enterococci (VRE), influenza virus, human enteric virus, rotavirus, Severe Acute Respiratory Syndrome associated coronavirus, and various fungal organisms. One route of transmission of HAI is via the hands of healthcare workers (HCWs), which can be contaminated by touching inanimate objects in the clinical setting as well as by touching other patients (Pessoa-Silva, et al., 2004; Riggs, Sethi, Zabarsky, Eckstein, Jump, & Donskey, 2007; Bhalla, Aron, & Donskey, 2007; Duckro, Blom, Lyle, Weinstein, & Hayden, 2005; Lucet, et al., 2002; Hayden, Blom, Lyle, Moore, & Weinstein, 2008; McBryde, Bradley, Whitby, & McElwain, 2004; Ray, Hoyen, Taub, Eckstein, & Donskey, 2002; Bhalla, et al., 2004). Hand hygiene is perhaps the most important way to minimize transmission of HAI, and up to 31% of HAIs may be preventable with appropriate hand hygiene (Casewell & Phillips, 1977).

Hand Hygiene

Hand hygiene may be defined as “any method that removes or destroys microorganisms on hands” (Widmer, 2000). In addition to soap and water, various chemicals that can be used as handwashing agents include alcohols, chlorhexidine, iodophors, and quaternary ammonium compounds (Boyce & Pittet, 2002). The CDC recommends that when hands are visibly soiled with blood or other body fluids, they should be washed with either a non-antimicrobial soap and water or an antimicrobial soap and water (Boyce & Pittet, 2002). If they are not visibly soiled, an alcohol-based handrub can be used to decontaminate the hands (Boyce & Pittet, 2002).

Use of soap and water helps in dissolving and removing fatty materials (WHO, 2009). Handwashing with soap and water may take extra time that is not always available to busy HCWs, and soap may become contaminated with bacteria which could lead to further colonization of hands with bacteria such as *Acinetobacter baumannii* (Winnefeld, Richard, Drancourt, & Grobb, 2000; Boyce, Kelliher, & Vallande, 2000).

Alcohol-based handrub is “an alcohol containing preparation (liquid, gel or foam) designed for application to the hands to inactivate microorganisms and/or temporarily suppress their growth” (WHO, 2009). Solutions containing 60-95% alcohol are most effective against microorganisms (Price, 1939; Larson & Morton, 1991; Harrington & Walker, 1903). Alcohols are effective germicides and kill multidrug-resistant pathogens such as MRSA and VRE, along with *Mycobacterium tuberculosis* and some fungi (Coulthard & Sykes, 1936; Gardner, 1948; Kampf, Jarosch, & Rüden, 1998; Kampf, Höfer, & Wendt, 1999). Some viruses such as herpes-simplex virus, human immunodeficiency virus, influenza virus, respiratory syncytial virus, as well as Hepatitis B and C viruses can

also be killed by alcohol-based antiseptics (Larson & Morton, 1991; Platt & Bucknall, 1985; Krilov & Harkness, 1993; Sattar, Tetro, Springthorpe, & Giulivi, 2001). Alcohol-based rubs containing emollients cause less skin irritation and dryness than soap and other antimicrobial preparations, and their use can be performed much quicker, thus reducing the time taken for maintenance of hand hygiene (Winnefeld, Richard, Drancourt, & Grobb, 2000; Boyce, Kelliher, & Vallande, 2000; Larson, et al., 2001; Larson, et al., 2001).

However, it is not appropriate to use alcohols when the hands are visibly dirty or contaminated by proteinaceous materials, for example, blood (Larson & Bobo, 1992). Alcohols have a poor activity against bacterial spores such as *Clostridium difficile*, protozoan oocysts, and some viruses, for example, norovirus (Jimenez & Chiang, 2006; Liu, Yuen, Hsiao, Jaykus, & Moe, 2010; Wullt, Odenholt, & Walder, 2003). Handwashing with soap and water, therefore, should be considered after contact with these infectious agents (Boyce & Pittet, 2002; Liu, Yuen, Hsiao, Jaykus, & Moe, 2010). Both the U. S. (CDC) and the World Health Organization (WHO) recommend use of alcohol-based handrubs or sanitizers for all clinical healthcare settings except when hands are visibly soiled, at which time an antimicrobial soap and water should be used (Boyce & Pittet, 2002; WHO, 2009).

Individual HCWs may have different hygiene tool preferences and may be affected by different motivators and barriers to hand hygiene. Acknowledging and providing preferred hygiene tools, while promoting change and minimizing barriers, is a challenge for all hygiene campaigns. To improve and sustain hand hygiene performance in a healthcare clinic, barriers to proper hygiene should be recognized and addressed. Various perceived barriers to adherence with hand hygiene practice recommendations include - skin irritation

caused by hand hygiene products, lack of hand hygiene supplies, interference with HCW-patient relationships, priority of patient care over hand hygiene, use of gloves, forgetfulness, lack of knowledge of guidelines, insufficient time for hand hygiene, high workload, understaffing, poor acknowledgement of hand hygiene opportunities during patient care, and insufficient education about the risk of cross-transmission of pathogens, (Larson & Killien, 1982; Conly, Hill, Ross, Lertzman, & Loule, 1989; Dubbert, Dolce, Richter, Miller, & Chapman, 1990; Larson & Kretzer, 1995; Sproat & Inglis, 1994; Kretzer & Larson, 1998; WHO, 2009). Previous intervention studies have determined that a multifaceted campaign, incorporating more than one interventional approaches, is required to achieve improved and sustained hand hygiene habits among HCWs (Naikoba & Hayward, 2001; Lankford, Zembower, Trick, Hacek, Noskin, & Peterson, 2003; Noritomi, et al., 2007; Vietri, Dooley, Davis, Longfield, Meier, & Whelen, 2004; Whitby, McLaws, Slater, Tong, & Johnson, 2008). A rapid access to hand hygiene material helps in improving adherence (Pittet, Mourouga, & Perneger, 1999). Availability and increased use of alcohol-based handrub was the main reason for improved hand hygiene compliance rate in one multifaceted hospital-wide study (Pittet, et al., 2000). Hand hygiene promotion strategies, such as in-service education, information leaflets, workshops and lectures, automated dispensers, and performance feedback on hand hygiene adherence rates, have led to transient improvement in various healthcare settings (Donowitz, 1987; Graham, 1990; Dubbert, Dolce, Richter, Miller, & Chapman, 1990; Simmons, Bryant, Neiman, Spencer, & Arheart, 1990; Jarwis, 1994). While there is no evidence that posters or educational materials alone are effective at changing behavior, posters using persuasive, positive, and motivating messaging to invoke a sense of responsibility in HCWs for their

patient's health may be beneficial in combination with other campaign strategies (Gould, Hewitt-Taylor, Drey, Gammon, Chudeleigh, & Weinberg, 2007; Jenner, Jones, Fletcher, Miller, & Scott, 2005; Noritomi, et al., 2007).

Hand Hygiene in Outpatient Clinics

Several multifaceted studies have been successful in improving hygiene in teaching hospitals; however, few studies have been performed in outpatient healthcare clinics (Bischoff, Reynolds, Sessler, Edmond, & Wenzel, 2000; Cohen, Kitai, Levy, & Ben-Amitai, 2002; Mensah, Murdoch, Binstead, Rotheram, & Franks, 2005). An observational study was performed in outpatient glaucoma clinics in the U.K. Hand hygiene behavior of HCWs was covertly observed for 1 week and the results (18% compliance) were presented and circulated by memo. After two weeks of declaration of results, hand hygiene was monitored for another week and it improved to 28%. Although nurses had highest frequency of hand hygiene, the intervention increased the attempts in females ($p < 0.001$) and doctors ($p = 0.01$), while males ($p = 0.57$) and nurses ($p = 0.36$) did not show significant change. The improvement observed was transient and the presentation sessions were not attended by all staff members, especially nurses, which could be the reason for smaller increase in their hand hygiene attempts during the post-intervention period. The authors of that study concluded that hospital policy for hand hygiene was not being followed and recommended the involvement of patients in motivating HCWs to wash their hands (Mensah, Murdoch, Binstead, Rotheram, & Franks, 2005).

Another study was conducted in two hospital outpatient dermatology clinics of Israel to determine hand contamination among physicians working in these clinics and to observe their hand hygiene practices. Culture samples were obtained from fingers of

dominant hands of 13 dermatologists, and 11 of them were contaminated by *Staphylococcus* species, with *Staphylococcus aureus* being isolated from 9 hands; one sample contained a methicillin-resistant strain of *Staphylococcus*. None of the dermatologists was trained in hand hygiene practices, and all were willing to be reeducated. The hand hygiene behavior of these physicians was recorded by unobtrusive observers without letting them know the purpose of observations. The average compliance was 31.4%, with 38.5% post-contact and 7.7% pre-contact hand hygiene. A questionnaire regarding hand hygiene was distributed among 70 dermatologists during a professional conference, one year before the conduction of the mentioned study, to which only 51 responded. According to the self-reported behavior, pre-contact attempt was 35.3% while post-contact was 37.3%. Soap and water were preferred by 78.4% physicians, while 17.7% chose chlorhexidine gluconate, and 19.6% reported preferring 70% alcohol. Several barriers to hand hygiene were reported, including excessive workload, lack of awareness, sensitivity to hand hygiene products, lack of facilities, insufficient training, and lack of adherence. The researchers could not correlate hand hygiene attempts with the workload of the HCWs. The number of culture samples and the quantity of medium used was inadequate to give the accurate contamination rate. According to the researchers, there was a possibility that the physicians were aware that they were being observed which might have influenced their hand hygiene behavior. The authors of this study recommended incorporation of an educational program, readily accessible hand hygiene facilities and materials, along with involvement of senior staff as role models to improve hand hygiene for the dermatology clinics. They also suggested that barriers such as understaffing and

improper location of handwashing facilities should be addressed (Cohen, Kitai, Levy, & Ben-Amitai, 2002).

Overview of the Current Study

The goal of this study was to implement and test the efficacy of a hand hygiene campaign in two outpatient healthcare clinics in the U.S., using increased availability of hand sanitizer and a novel motivating poster as interventions. Both direct observation and a survey were used to assess efficacy during post-interventional and follow-up periods. It was hypothesized that this intervention would lead to an overall improvement in hand hygiene within these clinics.

Chapter 2 - Research questions &

Objectives

Research questions

The research questions investigated for this study were:

- Could an interventional hand hygiene campaign in two outpatient healthcare clinics lead to improved hand hygiene?
- Are there differences in observed hygiene at baseline compared with one week and one month after introduction of the intervention tools?
- Are there observed differences in hygiene attempts between gender, profession, pre- and post-contact?
- Which hygiene tools do HCWs in these settings prefer?
- Would observed HCWs retrospectively believe that either or both interventional tools were motivating and actually influenced their hand hygiene habits?

Objectives

The study aimed to accomplish the following objectives:

- To directly observe the baseline, post-interventional and follow-up hand hygiene behaviors of HCWs.
- To assess the impact of interventions on the hand hygiene behavior of HCWs.
- To evaluate the perceptions of HCWs regarding the effectiveness of the hand hygiene campaign using a post-study survey.

Chapter 3 - Methods

Design and Sample

The study had an interventional design and was conducted in two medical outpatient clinics of a multi-facility healthcare system in the Midwestern U.S. Direct observation was used to record hand hygiene attempts by HCWs at baseline, after intervention, and during the follow-up period. Recruitment of clinics occurred by initial contact with the administration of the healthcare system to determine mutual interest; specific outpatient clinics were then chosen from within this healthcare system based on willingness to participate, clinic layout being conducive to direct observation, and sufficient anticipated caseload during the study period. All data were collected anonymously, and the study involved observation of public behavior; therefore, it was given an exempt status by the Institutional Review Boards of both Kansas State University and the participating healthcare system.

The first clinic was an outpatient oncology clinic. Patients visited mainly for diagnostic tests and intravenous chemotherapy sessions. The setting had an open layout so that patients and HCWs could be viewed at all times. There were 8 open cubicles facing the nursing counter. They did not have doors or curtains. There were six private rooms and two family rooms. The nursing counter was extended along the length of the area covered by the open cubicles. There were two handwashing stations present at two ends of the nursing station. Sinks, soap, paper towels, and foam sanitizers were provided at both stations. Foam sanitizers were already affixed on the wall at the door to each private room. No handwashing or sanitizing supplies were provided in the open cubicles. Observers

collecting data for this study sat at a point that was close to the center of the setting and from where all patients in cubicles, HCWs, and handwashing stations could be easily viewed.

The second clinic was an outpatient gastrointestinal clinic. Patients visited for various endoscopic diagnostic procedures. The study setting included 15 recovery rooms that were separated by solid walls. The rooms had curtains at their entrances, which could be completely open, completely closed, or partially open. The nursing counter faced towards these rooms. It had a handwashing station at each end, each with a sink, soap, and paper towels. Each recovery room had foam sanitizer at its entrance. Observers sat at the nursing counter from where all rooms, HCWs, and handwashing stations could be easily seen.

HCWs of the two clinics were directly observed during this study. They included all nurses, doctors, and other HCWs who came in direct contact with patients and their equipment during observation periods. Participants were aware of the presence of the observers, but the objective of observation was not revealed to them in order to minimize the Hawthorne effect, that is, the tendency of people to behave differently when they are aware of being observed during a research as compared to when they are not aware of being observed (Buchanan & Huczynski, 1997).

Handwashing attempts were recorded anonymously, without correlating them with respective HCWs. The reason for this was to maintain confidentiality of the participants. Due to the small number of HCWs during each observation period, random sampling could not be employed in order to select participants. Instead, all HCWs observed were included as a convenience sample. This implied that all hand hygiene opportunities of all HCWs,

which were observed by the researcher, were included as a sample. No random numbering was applied to the HCWs or opportunities.

Doctors, nurses, and other HCWs were distinguished from visitors and patients by their uniforms and their identification cards. All nurses and doctors had their designations (MD, RN, LPN, etc.) in bold letters on their identification cards, which were visible from the observers' position. HCWs who were not doctors or nurses, or whose designation/profession could not be established, were recorded as "Other HCWs."

Two interventions were introduced during the study – gel sanitizer and informational poster. They were brought into both clinics after baseline observations were recorded. An 8.5x11-inch colored poster (Appendix A) was designed to motivate HCWs to increase their hand hygiene attempts/opportunities. The poster described MRSA infections as one cause of HAIs. One objective of the poster was to appeal to HCWs to improve their own hand hygiene in order to improve the safety and health of their patients and minimize nosocomial spread of diseases such as MRSA. The picture depicting the microscopic view of hands with a dense population of microbes was included in an attempt to add shock or disgust to the poster as an additional motivation for hand hygiene. Pictures of soap and water and sanitizer were used as visual reminders for performing hand hygiene, and as measures to eliminate disease causing microorganisms. The poster described situations when handwashing was considered most important in these clinical settings. These criteria were based on recommendations from the CDC (Boyce & Pittet, 2002) and discussions with the healthcare system's administration. These situations included: before and after direct patient contact; before and after touching equipments (including intravenous fluid lines and pumps); and, before putting on and after taking off gloves. Prior to inclusion in

the study, initial posters were piloted among media-messaging design experts and healthcare staff. Amendments to the posters were made according to recommendations during piloting. After finalization, twenty identical posters were strategically posted in each clinic. In the oncology clinic, the posters were displayed at the nurses' stations, handwashing stations, and near each patient cubicle. In the gastrointestinal clinic, they were displayed at the entrances to patients' rooms. The purpose of selecting these areas was to make the posters as conspicuous as possible. One influential physician in the gastrointestinal clinic was displeased when posters were put on display, due to concern that the tape would damage the clinic's walls; while the study design was not altered, painter's tape was used to ease his concern and to prevent damage.

Gel sanitizer was not available in either clinic prior to the intervention.

Approximately 10 pump bottles of gel sanitizer with 65% ethyl alcohol were provided on the nursing stations in both clinics, distributed to be adjacent to each patient room or area. The purpose of introducing gel sanitizers was to provide hygiene options other than foam or soap and water and a new visual motivation to perform hand hygiene. Including gel sanitizer as an intervention was based on the literature review that suggested that its introduction increases the percentage of hand hygiene attempts (Rupp, et al., 2008).

Measures

For the purpose of this study, acceptable hand hygiene could be performed with soap and water or hand sanitizer (foam or gel). Hand hygiene attempts were compared with hand hygiene opportunities, which were defined as before and after a HCW made contact with a patient (Boyce, 2008). Hand hygiene technique was not critiqued during this study; therefore, it was not to be designated as a complete assessment of hand hygiene

compliance. Hand hygiene attempts were monitored by direct observation. Only observations which were clearly visible to the observers were recorded. In the gastrointestinal clinic, only observations of hand hygiene opportunities with fully open or partially open curtains allowing complete visibility of contact and hygiene were included. Any comments made by the participants regarding hand hygiene were recorded anonymously during the data collection period. In order to minimize inter-rater bias, two observers were similarly trained. Once trained, they observed and recorded the same hand hygiene opportunities to compare the uniformity in data recording and to improve it further. The overall agreement between the observers was 96%.

Data were collected in each clinic during three periods: Baseline, Post-Intervention, and Follow-up. During the baseline period, the hand hygiene behavior of HCWs was observed and recorded for four hours a day, for three random days during one week. After the collection of baseline data, the poster and gel-sanitizer interventions were introduced. One week after interventions were introduced, hand hygiene behavior of HCWs was observed for five days, for four hours each day. All posters were removed after completion of post-intervention observations, due to administration request. Remaining gel sanitizer was left at each clinic but was removed by the administration due to their healthcare clinics' policy. This design allowed evaluation of the impact of a short intervention period. One month after post- interventional observations were made, follow-up direct observation of hand hygiene was performed for three days, for four hours each day. Neither posters nor gel sanitizers were provided during the follow-up period.

A survey was distributed to HCWs in both clinics three months after the study, in order to evaluate their perception of the hand hygiene campaign, motivation, and impact on

their hygiene practice, barriers to hygiene, and their preference of hygiene product. A five-point Likert scale (ranging from strongly agree to strongly disagree) was used for questions regarding efficacy of intervention.

Analytic Strategy

Pearson's χ^2 analyses were used to compare the frequency of hand hygiene attempts during the three observation periods and for analyzing hygiene attempts pre-contact and post-contact with patients. A p-value ≤ 0.05 was considered significant. Descriptive statistics were used to assess hygiene frequency by gender and profession, due to limited observations of male healthcare workers and physicians. Descriptive statistics were used for comparing type of hygiene product used, as product availability varied throughout the study.

Chapter 4 - Results

In both oncology and gastrointestinal clinics, overall rate of hand hygiene attempts to opportunities were low (11% and 21%, respectively) during baseline observations and improved significantly (36 and 54%, respectively) after interventions were instituted, $p \leq 0.0001$ in each clinic (Table 1). This increased hygiene rate was maintained through the follow-up observation period ($p=0.139$ in the oncology clinic, $p=0.283$ in the gastrointestinal clinic) (Table 1). From returned surveys ($n=56$ total, 41 from the oncology clinic and 15 from the gastrointestinal clinic), 50% of all surveyed HCWs agreed or strongly agreed that the campaign increased their awareness about hand hygiene, by a greater percent at the gastrointestinal clinic (12/15, 80%) than the oncology clinic (16/41, 39%). Overall 34% agreed the hand hygiene campaign improved their hand hygiene practices.

The percent of each hygiene product used (soap and water, foam sanitizer, or gel sanitizer) shifted during the three observation periods in each clinic. When gel sanitizer was made available during the intervention, it was used as frequently as foam sanitizer, and more often than soap and water. At the oncology clinic, soap and water (53%) and foam sanitizer (47%) were used almost equally at baseline, but soap and water (21%) and foam (40%) usage dropped as HCWs began to use gel sanitizer (40%) after its introduction for the intervention (Figure 1). During the follow-up period, gel sanitizer was not provided, and soap and water usage remained low (24%) while HCWs continued to use foam (63%) or self-provided gel (13%) sanitizer (Figure 1). At the gastrointestinal clinic, foam sanitizer use (59%) was higher than soap and water use (40%) during baseline observations (Figure 2). Post-intervention (soap and water 19%, foam 40%, gel 41%), and follow-up (soap and

water 34%, foam 62%, self-provided gel 4%) product usage in the gastrointestinal clinic mimicked that of the oncology clinic (Figure 2).

Fifty percent (28/56) of total HCWs surveyed agreed or strongly agreed that the introduction of gel sanitizer was a motivation for performing hand hygiene more frequently. Surveyed HCWs from the oncology clinic reported a mixed preference for hygiene products (58% soap and water, 24% foam, 22% gel), whereas 80% of surveyed HCWs from the gastrointestinal clinic reported a preference for soap and water, with the remaining preferring foam (3/15, 20%), and gel (3/15, 20%) (Figure 3). In both clinics, some survey responders chose more than one hygiene product. For optimal location, 66% (37/56) of all surveyed HCWs preferred that sanitizers be placed in the immediate vicinity of the patients.

According to survey results, 93% (14/15) of HCWs in the gastrointestinal clinic were aware of the poster that was included in the intervention for the hand hygiene campaign, and 36% (5/14) agreed or strongly agreed that they were effective as a motivational tool for encouraging hand hygiene. In the oncology clinic, 49% (20/41) of surveyed HCWs were aware of the posters, and of these HCWs, 45% (9/20) agreed or strongly agreed that they were effective.

Many factors encountered as hindrances to handwashing were reported by HCWs. Perceived barriers to hand hygiene among all survey responders (n=56) included: skin irritation (34%), forgetfulness (32%), insufficient time (24%), interference with patient care (11%), insufficient facilities or lack of materials (5%), and insufficient training (5%); some HCWs selected multiple barriers (Figure 4). Twenty-three percent (13/56) of surveyed HCWs reported that none of the above was a barrier in their clinic.

Frequency of observed hand hygiene was statistically greater after patient contact than before patient contact at baseline ($p=0.001$ in oncology clinic, $p=0.002$ in gastrointestinal clinic), as well as after intervention and during follow-up observations ($p<0.0001$ during both periods in both clinics) (Table 1). Hand hygiene improved from baseline to the intervention period for pre-contact and post-contact observations ($p\leq 0.0001$ for both clinics), and this improvement was sustained with no significant decreases in hygiene in both clinics during the follow-up period (Table 1). A similar trend was seen in the survey responses ($n=53$), where HCWs self-reported “always” performing hand hygiene after contact with patients (79%, 42/53) consistently more than “always” performing hand hygiene before contact with patients (57%, 30/53).

Throughout the study, female HCWs demonstrated more consistent hand hygiene than male HCWs (Table 2). No male HCW was observed performing hand hygiene at the oncology clinic during the baseline and follow-up periods. Similarly, no doctor was seen washing or sanitizing their hands at the oncology clinic during the baseline or follow-up periods. Nurses demonstrated more consistent hand hygiene than doctors in both clinics (Table 2).

During the course of the study, numerous events and comments were observed and recorded in addition to hand hygiene behavior. When the posters were being hung in the gastrointestinal clinic, a senior physician expressed great disapproval for the posters and project in general, stating that the tape would damage the walls and the posters would negatively influence the patients. After discussing this issue with the healthcare system administration, the study continued and painter’s tape was used to minimize risk of damage to the walls.

The healthcare system policy was to offer foam sanitizer rather than gel sanitizer; yet, several HCWs were observed carrying personal bottles of gel sanitizer in their pockets. These nurses believed that foam sanitizer was “too sticky and took a lot of time to dry.” They stated that “it was inconvenient to use, especially when gloves were to be worn and caused excessive drying and damage to the skin.” One nurse commented that gel sanitizer was “more gentle, less sticky, and smelled better than foam sanitizer.”

The survey asked HCWs about the reasons for higher post-contact hand hygiene as compared to prior to contact with the patient. Priority of self-protection over the health of patient was one of the reasons. Some cited that contact with patients is a reminder of hands getting contaminated and the need for hand hygiene. A couple of HCWs perceived that before contacting a patient, the hands are clean. It was reported that washing the hands after contact with a patient also served as pre-contact hand hygiene before approaching a new patient. Established patterns, physical condition/appearance of the patients, and removal of gloves were other reasons. One HCW mentioned that keeping sanitizer on one’s desk is important so that it is used before touching a patient.

At the oncology clinic, in their response to the campaign, some HCWs reported that they were not aware of the posters or sanitizers and wanted the campaign to be carried out in all areas of the clinic. One HCW reported that it did not add anything to their practice as they were already washing their hands regularly, while another stated it as intimidating. More posters and gel sanitizer bottles were requested by some HCWs.

In the gastrointestinal clinic, it was mentioned by a HCW that their hand hygiene actions beyond the curtains could not be counted, which might have led to poor appraisal of use of foam sanitizers by them. One HCW believed that washing hands after touching

inanimate objects such as curtains would kill the germs. Another appreciated the effort made by the campaign and stated that handwashing is a habit reinstated in mind right from the childhood and ones who have been regularly reminded will practice it more.

Chapter 5 - Discussion

This study confirmed that hand hygiene performance by HCWs in busy outpatient healthcare settings is low, and that short-term exposure to interventional tools can lead to modest improvement during a one-month follow-up period. Survey results imply that individual motivation for this improvement (through posters or gel sanitizer) varied, suggesting that pretesting interventions at each clinic may help achieve the greatest hand hygiene compliance. Including an educational seminar to remind HCWs when and how hand hygiene should be performed and to reinforce a clinic-wide expectation for adhering to hand hygiene recommendations are additional interventions that may promote further hygiene compliance (WHO, 2009; Mensah, Murdoch, Binstead, Rotheram, & Franks, 2005; Pittet, et al., 2000). Modeling and support of proper hand hygiene behavior from clinic leaders (such as physicians and head nurses) has also been suggested to be an important factor for improving hand hygiene (WHO, 2009; Pittet, Simon, Hugonnet, Pessoa-Silva, Sauvan, & Perneger, 2004; Pittet, et al., 2000). Low hygiene performance among physicians and a negative attitude by an influential physician toward posters may have contributed to only modest improvement in overall HCW hygiene and supports the theory that involvement and investment of clinic leaders should be encouraged for future outpatient clinic hand hygiene campaigns.

In order to minimize spread of infection, it is recommended that hands should be washed or sanitized immediately before and after every direct contact with a patient (Boyce, 2008). In observations from both clinics, hand hygiene performance was consistently better after patient contact than before patient contact (Table 1); similar findings were reported in the survey of HCWs and in other handwashing studies (Bahal,

Karamchandani, Fraise, & McLaws, 2007; Whitby & McLaws, 2004; Whitby, McLaws, & Ross, 2006). When asked why post-patient handwashing was higher, surveyed HCW responses included: belief that self-protection is a priority, contact with a patient is a reminder to perform hygiene, and belief that post-contact hygiene from one patient serves as adequate pre-contact hygiene for the next patient. The self-protection theory for higher post-contact hygiene suggests that future campaigns should focus on motivating HCWs to take personal responsibility in a more clinic-specific, patient-oriented approach (Bahal, Karamchandani, Fraise, & McLaws, 2007; Whitby & McLaws, 2004; Whitby, McLaws, & Ross, 2006).

Most surveyed HCWs reported preferring soap and water to either type of sanitizer. This reported preference for soap and water may stem from previous training and belief that soap and water is the best method of hand hygiene and therefore the “correct answer” on a survey. Currently, handwashing with soap and water is recommended by the CDC and WHO for HCWs when hands are visibly soiled with blood or other body fluids; however, alcohol-based sanitizer is recommended for HCWs during all other clinical situations (Boyce & Pittet, 2002; WHO, 2009) except when the hands are contaminated by norovirus and *Clostridium difficile*. Future campaigns should emphasize these recommendations during educational interventions and provide data to HCWs to support that sanitizer may be more effective than soap and water in many situations (Lilly & Lowbury, 1978; Boyce & Pittet, 2002). Despite this reported preference for soap and water, HCWs were observed to use sanitizer more than soap and water after gel sanitizer was made available during the study. This may have been due to factors including increased accessibility of gel sanitizer after the intervention, convenience, faster administration time, and perceived decrease in

skin irritation. After administrators removed gel sanitizer from the clinics, some HCWs began carrying gel sanitizer in their pockets for personal use, suggesting ongoing preference. This discrepancy between self-reported preferences and actual observed practice suggests there are many factors and potential barriers that influence hygiene performance. Providing a variety of hygiene materials and performing routine direct observation of hygiene performance and monitoring product usage are recommended by the CDC to help optimize hygiene compliance (Boyce & Pittet, 2002).

The primary barriers to hand hygiene reported in this study were irritation to hands, forgetfulness, and insufficient time (Figure 4), similar to what has been reported in other healthcare settings (Cohen, Kitai, Levy, & Ben-Amitai, 2002; Graham, 1990; Sickbert-Bennett, Weber, Gergen-Teague, Sobsey, Samsa, & Rutala, 2005). The consistency, content (some contain aloe), and smell of soap and sanitizers can also influence compliance. As some HCWs believed gel sanitizer was less irritating to their skin than other products, these HCWs may practice improved compliance if gel sanitizer is available. Outpatient clinic administrators may consider factoring their HCWs' preferences in addition to cost of these products prior to purchase. Furthermore, administrators should consider convenience of hand hygiene when determining staff assignments and scheduling, to minimize the barriers of inadequate time or accessibility. Placement of hand sanitizer upon entry to each patient's immediate vicinity may also act as a visual reminder, save time, and be optimal for minimizing nosocomial transmission of disease (Pittet, Mourouga, & Perneger, 1999; Voss & Widmer, 1997).

The poster was designed to improve hand hygiene by increasing awareness, being informative, and encouraging HCWs to take personal responsibility for reducing the spread

of infection (Jenner, Jones, Fletcher, Miller, & Scott, 2005). Reasons for the limited effect of the posters may include lack of support from influential HCWs, gender differences, or ineffective poster design. Rather than supporting the campaign, the influential physician who was very displeased with the poster placement in his clinic may have negatively swayed other HCWs and hindered the campaign's overall impact. Involving clinic staff in the design and messaging of posters, designing posters to be more clinic-specific, providing posters with new messages routinely, and choosing locations both near hygiene materials and patients may also help HCWs feel involved and dedicated to the hand hygiene campaign (Pittet, et al., 2000).

Limitations and Recommendations for Future Research

Limitations of this study included a possible Hawthorne effect altering hand hygiene performance in the presence of an unfamiliar direct observer, while use of video cameras or training staff to be observers could have minimized this possible source of bias, the clinic layouts, patient privacy, and busy staff made these less desirable. In order to minimize this bias, only clinic administrators, head nurses, and medical directors were consulted regarding study design; in the future, after collection of baseline data, recruitment of influential HCW support and ideas is recommended so they can become more involved and act as positive role models for proper hand hygiene adherence. A second limitation was that observations were not recorded by HCW identity, as this presents the possibility that a HCW with excellent hand hygiene habits could have been observed with greater frequency than a HCW with poor habits, thus skewing the data and statistical interpretation. Although HCWs prefer anonymity during hygiene observations, recording and associating identity with hygiene performance is recommended for future

research so that statistical analyses can be as accurate as possible. Unfortunately, due to fluctuating patient caseload during the selected observation periods, a discrepancy in the total opportunities for hand hygiene existed during the various observational time periods; future studies could schedule additional observation periods to strive for more equal sample sizes throughout the study. Finally, leaving interventions in place for a longer time period and extending follow-up observations beyond one month (to 3, 6, and 12 months) would be beneficial to evaluate these interventions for sustained effect on hygiene performance in outpatient clinics.

Conclusions and Implications for Practice

This hand hygiene campaign documented that introduction of gel sanitizer and an informational poster can be modestly successful at improving overall hand hygiene performance in outpatient healthcare clinics in the U.S. To maximize clinical impact of such a campaign, it is suggested that administrators and influential HCWs work together to create an environment where strict adherence to hand hygiene is expected, provide a variety of hygiene tool options (including either pocket gel sanitizer or pump bottles in the immediate vicinity of the patient), and encourage HCWs to create their own motivational posters that can be rotated through the clinic on a regular basis. This study is also a stimulus for an increased focus in outpatient clinics on pre-contact hygiene, to minimize spread of disease to patients. Intermittent evaluation of hand hygiene performance, using direct observation, is an important way to recognize areas for improvement and to keep hand hygiene compliance a priority in outpatient clinics. This might also help in monitoring the thoroughness or technique of hand hygiene. Observing and critiquing quality becomes very challenging for research purposes, because of its subjective nature. While it may be

possible to include measurement of duration of handwashing or handrubbing with sanitizer in future studies, this may only be practical with video cameras so that timing could be performed accurately and Hawthorne effect is minimized. Evaluating complete hand coverage with soap or sanitizer would remain very subjective in a real-life clinic or hospital setting.

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Figures and Tables

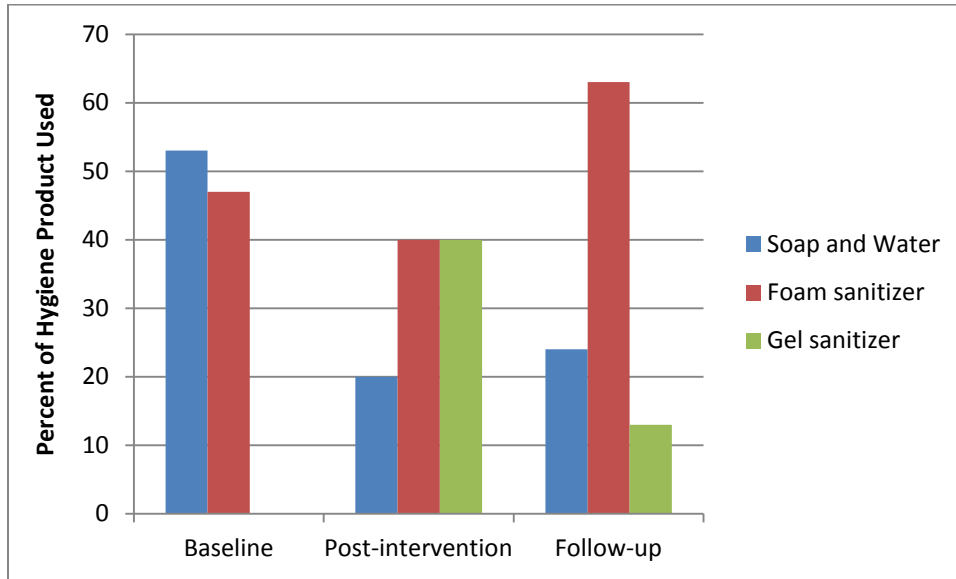


Figure 1. Percent of each hygiene product used at the oncology clinic based on observations over the study period. (*N*: Baseline = 74, Post-intervention = 423, Follow-up = 88).

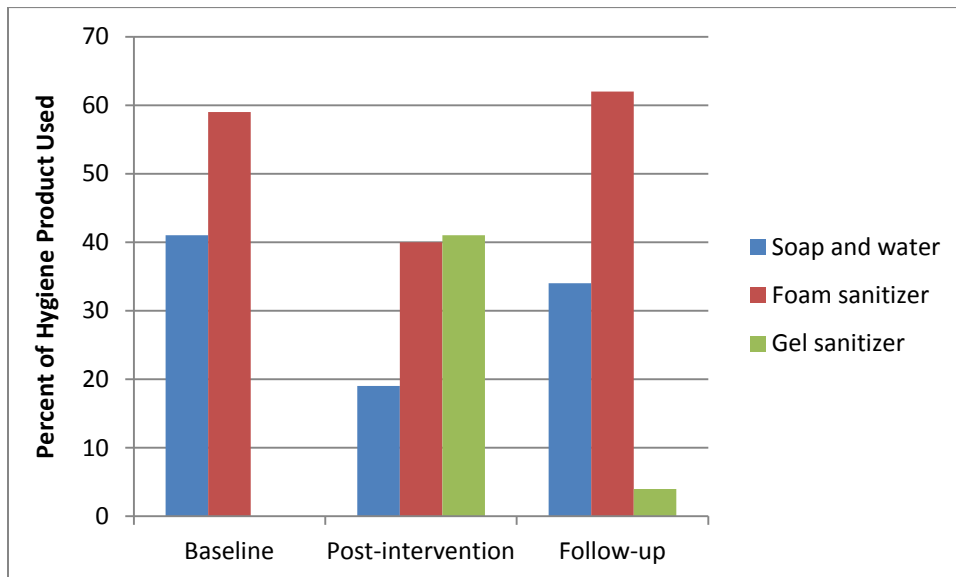


Figure 2. Percent of each hygiene product used at the gastrointestinal clinic based on observations over the study period. (*N*: Baseline = 164, Post-Intervention = 456, Follow-up = 176)

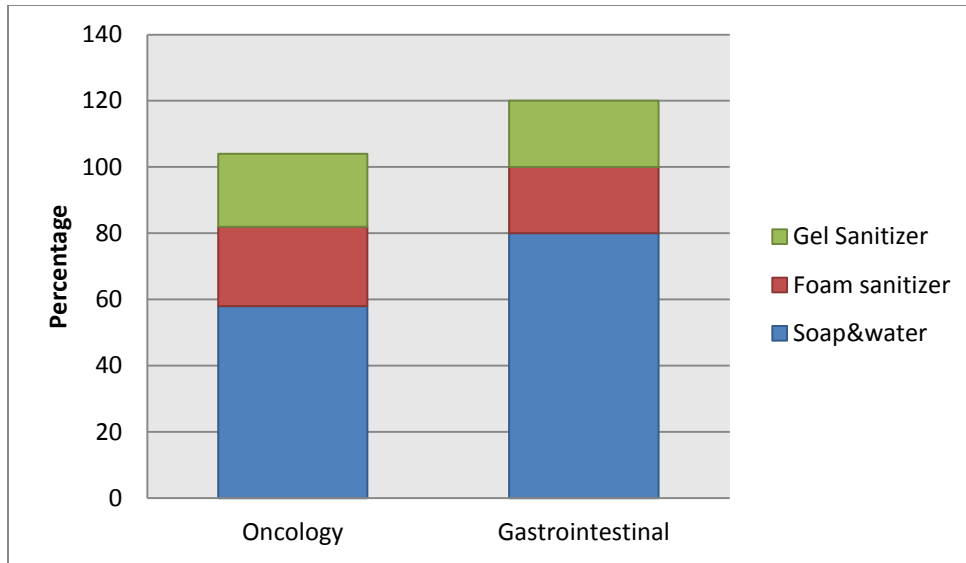


Figure 3. Percentage for hand hygiene product preference (based on surveys) in both clinics. (N: oncology = 41; gastrointestinal = 15).

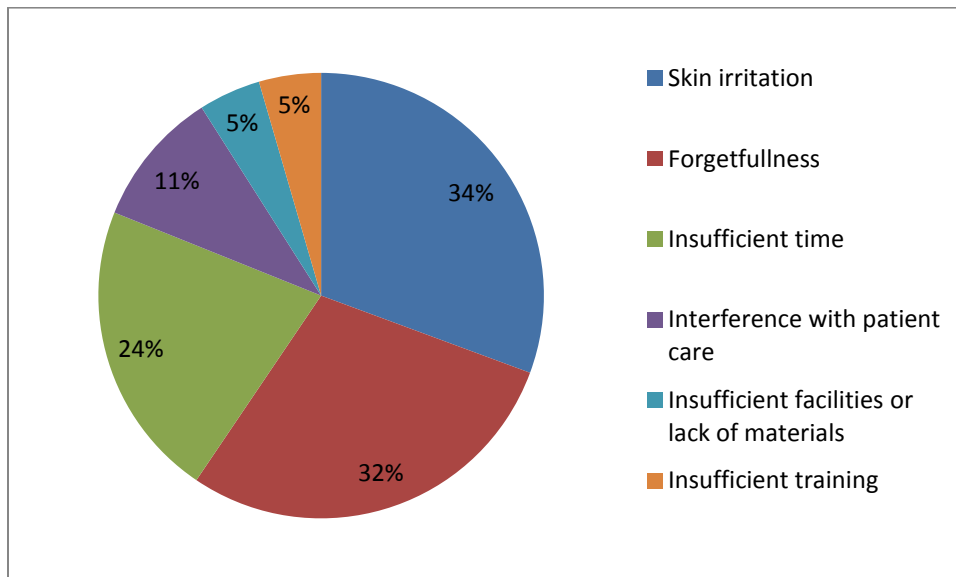


Figure 4. Barriers to hand hygiene reported via surveys by HCWs in both clinics. (N = 56).

Table 1. Summary of hand hygiene attempts/opportunities (percentage) with corresponding χ^2 and p-values for observations at the oncology and gastrointestinal clinics. Each calculation had 1 degree of freedom.

	Oncology	Oncology χ^2 and p-values	Gastrointestinal	Gastrointestinal χ^2 and p-values
Total Hygiene				
• Baseline	74/684 (11%)	} $\chi^2=141.97$ p \leq 0.0001	164/798 (21%)	} $\chi^2 = 197.97$ p \leq 0.0001
• Intervention	423/1167(36%)		456/840 (54%)	
• Follow-up	88/279 (32%)	} $\chi^2 = 2.18$ p=0.139	176/346 (51%)	} $\chi^2 = 1.15$ p=0.283
Hygiene Pre-Contact				
• Baseline	22/323 (6%)	} $\chi^2 =37.28$ p \leq 0.0001	56/359 (16%)	} $\chi^2 = 62.42$ p \leq 0.0001
• Intervention	138/609 (23%)		174/419 (42%)	
• Follow-up	29/152 (19%)	} $\chi^2 = 0.91$ p=0.340	68/178 (38%)	} $\chi^2 = 0.57$ p=0.450
Hygiene Post-Contact				
• Baseline	52/361 (14%)	} $\chi^2 = 126.92$ p \leq 0.0001	108/439 (25%)	} $\chi^2 = 155.76$ p \leq 0.0001
• Intervention	285/558 (51%)		282/421 (67%)	
• Follow-up	59/127 (46%)	} $\chi^2 = 0.88$ p=0.348	108/168 (64%)	} $\chi^2 = 0.39$ p=0.532

Table 2. Summary of hand hygiene attempts versus hand hygiene opportunities, according to gender and profession, expressed as percentages.

		Attempts / Opportunities (%)		
		Baseline	Intervention	Follow-up
<i>Oncology</i>				
Gender	Male	0/19(0)	1/9(11)	(N/A) ^a
	Female	74/665(11)	422/1158(36)	88/279(32)
Profession	Physician	0/15(0)	1/15 (6)	(N/A) ^a
	Nurse	74/651 (11)	421/1140(37)	88/277(32)
<i>Gastrointestinal</i>				
Gender	Male	3/61(5)	43/138(31)	20/60(33)
	Female	161/737(22)	413/702(59)	156/286(55)
Profession	Physician	1/53(2)	11/84(13)	2/28(7)
	Nurse	155/726(21)	438/747(59)	174/318(55)

Appendix A

Motivational Handwashing Poster



Hospital acquired infections, like MRSA, can cause up to 30% of hospital illnesses each year.

Washing your hands with soap and water or using alcohol-based hand sanitizer can reduce the spread of infection.



Hands should be cleaned and sanitized with **soap and water** or by using **alcohol-based hand sanitizer**:

- before and after patient contact
- before and after touching equipment (IV lines & fluid pumps)
- before putting on gloves and after taking off gloves

It's our responsibility to stop the spread of infection. Please wash or sanitize your hands.

Appendix C

Follow-up Survey to Evaluate the Effectiveness of Hand Hygiene Campaign

Recently a *Hand Hygiene Campaign* was conducted atHospital including posters and increased availability of gel sanitizer. This is a follow-up survey for healthcare staff to evaluate the effectiveness of the *Hand Hygiene Campaign*.

1. Profession

- a) Doctor b) Nurse c) Other Healthcare worker

2. Gender

- a) Male b) Female

3. Did the recent *Hand Hygiene Campaign* increase your awareness about hand hygiene practices?

- a) Yes b) No

4. The *Hand Hygiene Campaign* was effective in improving my hand hygiene practices.

- a) Strongly disagree c) Neither agree nor disagree e) Strongly Agree
b) Disagree d) Agree

5. What do you prefer most as a means of hand hygiene?

- a) Soap and water b) Foam Sanitizer c) Gel Sanitizer

6. Increased visibility and availability of gel sanitizer was a source of motivation for sanitizing hands.

- a) Strongly disagree c) Neither agree nor disagree e) Strongly agree
b) Disagree d) Agree

7. Which is the most suitable place to keep sanitizer, to make its use most effective?

- a) At the nursing station c) With you as a pocket article
b) In the immediate vicinity of the patient d) Other _____

8. Were you aware of the posters hung up during the campaign?

- a) Yes b) No



9. The posters were effective in motivating hand hygiene.

- a) Strongly disagree c) Neither agree nor disagree e) Strongly Agree
 b) Disagree d) Agree

10. Which of these do you consider to be barriers to hand hygiene in your clinic?

- a) Insufficient time d) Skin irritation g) Other__
 b) Interference with patient care e) Lack of facilities or inaccessible materials
 c) Forgetfulness f) Insufficient training

11. Please indicate how frequently you wash or sanitize your hands (check one per row):

	Always	Usually	Sometimes	Never
When starting your shift	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Before contact with equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
After contact with equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Before putting on gloves	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
After removing gloves	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Before patient contact	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
After patient contact	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
When leaving at the end of your shift	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. Many studies find that healthcare workers practice better hygiene after patient contact than before patient contact. Why do you think this may be true?

13. Please add any further comments or suggestions about the poster or hygiene campaign here.

Note: If you have any questions regarding the survey or study please contact Dr. Kate Stenske at kstenske@vet.ksu.edu or Ramandeep Kaur at raman22@k-state.edu.