Hand Hygiene: An analysis of one hospital’s intervention and a discussion of the limitations of observational hand hygiene studies

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Hand Hygiene: An analysis of one hospital’s intervention and a discussion of the limitations of observational hand hygiene studies

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Abstract

Healthcare-associated infections affect over one million people in the US each year, costing patients and hospitals large amounts of resources and time. Hand hygiene is one of the most effective ways to prevent the spread of these costly infections. However, hand hygiene compliance rates among healthcare workers remain startlingly low. Many institutions have been searching for interventions that will increase the compliance rates of their healthcare staff. Successful interventions found in the literature include increased access to hand hygiene resources, the installation of visual reminders, the implementation of campaigns modeled from the World Health Organization (WHO), and other similar measures.

A rural 99-bed hospital (Hospital A) designed a hand hygiene intervention that included the installation of additional alcohol-based hand rub dispensers with visual reminders to one 18-bed unit (Unit 1). The hand hygiene compliance rates were covertly observed pre- and post-intervention. The pre-intervention hand hygiene compliance rate was 46.7% for nurses entering patient rooms and 68.8% compliance upon exiting patient rooms. The post-intervention rates were lower than expected, at only 28.1% upon entering patient room and 42.6% upon exiting.

The Unit 1 nurses were surveyed following the intervention to assess their attitudes toward the changes. The survey results indicated that the nurses had responded positively to the intervention and believed that their hand hygiene compliance had increased. This thesis aims to analyze the data obtained from Hospital A’s study, as well as discuss the numerous limitations of observational hand hygiene studies. Future research recommendations will be discussed as well.


**Introduction**

Each year, over 35.1 million people are hospitalized in the United States. Of these, approximately 1.75 million will contract healthcare-associated infections (HAIs), which are infections acquired “during the course of receiving healthcare treatment for other conditions” (CDC, 2010). There are many types of HAIs, including catheter-associated urinary tract infections, surgical site infections, ventilator-associated pneumonia, *Clostridium difficile* infections, and central line-associated bloodstream infections (CDC, 2010). These HAIs cost patients and hospitals large amounts of time and resources. It is estimated that HAIs cost US hospitals $35.7 - 45 billion annually (Scott, 2009). In addition to this large financial burden, it is estimated that in 2002 alone, 98,987 patient deaths were caused by or associated with an HAI (Kleven et al., 2007).

The most important step to preventing HAIs is proper hand hygiene (CDC, 2002). Several studies have illustrated the correlation between increased hand hygiene compliance among healthcare workers and decreased HAI rates. A study, conducted in Saudi Arabia implemented multi-faceted intervention to increase hand hygiene in a 350-bed community hospital. The hand hygiene compliance rates increased from 38% to 85% over five years. In the same time span, ventilator-associated infection rates decreased from 6.12/1,000 patient days to 0.78/1,000 patient days. Likewise, central line-associated bloodstream infections decreased from 8.23/1,000 patient days to 4.8/1,000 patient days. Catheter-associated urinary tract infections decreased similarly as well, from 7.08/1,000 patient days to 3.5/1,000 patient days (Al-Tawfig et al., 2013). This study illustrates a very significant correlation between proper hand hygiene and the decrease of HAIs.

The importance of hand hygiene in the reduction of HAIs is further highlighted in Didier Pittet’s *Evidence-based model for hand transmission during patient care and role
of the improved practices, published on behalf of the World Health Organization (WHO) Global Patient Safety Challenge, World Alliance for Patient Safety (Pittet, 2006). In five steps, Pittet explains how the hands of healthcare workers are responsible for the transmission of healthcare-associated pathogens between patients. First, pathogens present on the patient’s skin are shed onto objects surrounding the patient. Then, the organisms are transferred to a healthcare worker’s hands. The pathogens must be capable of living on the healthcare worker’s hands for at least a few minutes. Then, the healthcare worker either forgets to complete hand hygiene or does it inadequately. Finally, the healthcare worker’s contaminated hands directly contact another patient or an object with which that patient will come into direct contact (Pittet, 2006).

The cross-contamination that occurs in Pittet’s five steps could easily be prevented by correct hand hygiene. The healthcare worker will undoubtedly come into contact with HAI related pathogens during the course of care for each patient; however, these pathogens will not be carried over to another patient if the healthcare worker properly disinfects his or her hands. Thus, hand hygiene is the single most important and effective way to prevent the occurrence of costly HAIs (Pittet, 2006).

Despite these findings, many healthcare workers continue to miss this crucial step in the prevention of HAIs. The WHO Guidelines on Hand Hygiene in Health Care states that the average hand hygiene compliance rate of healthcare workers is only 38.7% (WHO, 2009). Hand hygiene compliance rates are defined as the number of times hand hygiene is completed out of the number of times that hand hygiene should have been completed by the healthcare workers. With the majority of hand hygiene compliance
rates remaining unacceptably low, many healthcare institutions have been searching for effective ways to increase the hand hygiene rates of their workers (Huskins et al., n.d.).

**Literature Review: Hand Hygiene Interventions**

Worldwide, many different hand hygiene interventions have been studied. Several interventions based on the WHO “Clean Care is Safer Care” campaign have been implemented and evaluated (Reichardt et al., 2013; Mestre, et al., 2012; Oh et al., 2012). One such intervention is the German campaign, “Action: Clean Hands,” which began in January 2008. More than 700 hospitals have participated in the campaign. The intervention measures include: increased support from administration, increased education of healthcare staff, measurement of alcohol-based hand-rub consumption, implementation of WHO’s “My Five Moments for Hand Hygiene,” and increased availability of hand-rub products (Reichardt, et al. 2013). When Germany’s “Action: Clean Hands,” campaign was evaluated, it was found that an 11.4% increase in hand hygiene compliance was observed by the 62 hospitals who chose to report their results. Additionally, alcohol-based hand-rub consumption results were reported by 129 hospitals; the data illustrated an overall consumption increase of 30.7%. It was concluded that this campaign has led to an overall increase in hand hygiene compliance throughout the nation (Reichardt et al., 2013).

Another study, conducted in a medical center in Barcelona, also involved interventions based on the WHO approach. Specifically, the healthcare center increased the number of alcohol-based hand-rub dispensers, increased the frequency of hand hygiene compliance audits and provided more consistent feedback to healthcare staff.
This intervention was studied over a two year time period and a significant hand hygiene compliance increase of 25% was observed (Mestre, et al., 2012).

In Singapore, a slightly different hand hygiene intervention was studied. This intervention involved the implementation of the WHO’s five moments for hand hygiene campaign. However, it also involved “providing guidance to nurses in a non-intimidating manner” and communicating openly with the nurses about “the appropriate placement of alcohol-based hand rub at the point of the care” (Oh et al., 2012). The results of this intervention were measured in many different ways including a 50% increase in hand hygiene after contacting a patient or object and a 73% increase in hand hygiene before contacting a patient or object (Oh et al., 2012).

The University of Miami-Jackson Memorial Hospital Center for Patient Safety focused on the theory that healthcare workers frequently forget to complete hand hygiene. A study was conducted involving four different approaches to reminding the healthcare staff to utilize hand hygiene products. The first intervention was the relocation of the alcohol-based hand rub dispensers to a position that would be directly in the line-of-sight when entering the room. The second intervention involved leaving the dispenser in its original location but adding flashing lights to the container. The third intervention was a combination of the previous two, relocating the dispenser to the line-of-sight position and adding the flashing lights. The fourth intervention was a warning sign placed on the door, stating that the room was under surveillance and an alarm would sound if the healthcare worker failed to complete hand hygiene. The baseline hand hygiene rate in this setting was 36.7%. All four interventions resulted in higher hand hygiene rates, with results of 53.5%, 60%, 66%, and 93.3% respectively (Nevo et al., 2010).
Methods

Based on this literature, Hospital A, a 99-bed acute care hospital in Montana, designed a hand hygiene intervention that involved increasing the number and locations of alcohol-based hand rub dispensers and adding reminder signs to the new dispensers. The hospital implemented this intervention in 2013 after an initial round of observations resulted in low compliance rates. Hospital A collected information about the nurses’ hand hygiene compliance using covert observational studies. An observational tool (Figure 1) was designed by the hospital’s Infection Control Specialist and the data recorded included the hand hygiene event that occurred and whether it was successful or not. Successful hand hygiene included the use of alcohol-based hand rub or hand washing with soap and water. Hand hygiene events were recorded both when the healthcare worker entered the patient room and when they exited. Additionally, data was recorded about the use of gloves and whether the patient room being observed was in isolation precautions or not. However, the study was carried out anonymously and personal identifying information was not recorded for any purpose, protecting individual identities.

Following observations concerning hand hygiene habits, a specific intervention took place over the course of three months and involved the nurses of one specific 18-bed unit, Unit 1. Alcohol-based hand rub dispensers were added directly outside the patient rooms, in addition to the dispensers already located inside the doorway of each patient room. A visual reminder was installed in the form of a brightly colored sleeve that fit over the alcohol-based hand rub canister. The sleeve read “Think about it: Foam in, Foam out.” Hand hygiene rates were observed on Unit 1 for five weeks before the intervention was implemented. The post-intervention observations were conducted for four weeks.
The pre-intervention and post-intervention data sets were analyzed by comparing the baseline hand hygiene rate of for the Unit 1 nurses to the overall compliance rate post-intervention. Trends in hand hygiene rates for healthcare workers upon entering patient rooms as compared to exiting patient rooms were also analyzed.

Anonymous pre- and post-observational survey data were also collected about the nurses’ reactions to the hand hygiene intervention. This survey data was analyzed to assess the nurses’ attitudes toward the additional alcohol-based hand rub dispensers and their new locations and the visual reminder. The percentage of nurses who found these additions and changes helpful was calculated, as well as the percentage of nurses who suggested implementing a similar intervention on other hospital units. The nurses’ opinions and comments regarding the effectiveness of the intervention were also collected in the survey.

**Results**

During the pre-intervention observations, a total of 124 observations were made: 60 observations of nurses entering patient rooms and 64 observations upon exiting rooms. The pre-intervention hand hygiene compliance rate for nurses entering patient rooms was 46.7%. The rate for nurses exiting the patient rooms was slightly higher at 68.8% compliance.

The post-intervention observations resulted in 118 total observations. Nurses entering patient rooms accounted for 57 of the observations and 61 observations of nurses exiting the rooms were made. The post-intervention hand hygiene compliance rate for nurses entering patient rooms was only 28.1%. The post-intervention data for nurses
exiting the rooms was also lower than expected at 42.6% compliance. Figure 2 summarizes the results of both the pre- and post-intervention observations.

After observing the results of the intervention, the hospital conducted an anonymous survey of the nurses who have worked on the unit on which the intervention occurred; 17 nurses responded to the survey. Those responding included 5 nurses who have worked as registered nurses (RNs) for less than 2 years, 4 who have been RNs for 2-5 years, 3 who have 5-10 years of experience and 5 who have worked as RNs for over 10 years.

Of those responding, 35.29% indicated that consistent feedback of hand hygiene rates would be the most effective way to improve the hand hygiene of the unit; 29.41% answered that promotion campaign, including posters, rewards, messaging, etc., would be the most effective intervention. When asked if the addition of dispensers outside each patient room had made hand hygiene more convenient, 16 of the 17 nurses answered yes. Additionally, 14 nurses indicated that they were using more alcohol foam product as a result of adding dispensers outside each room, while 11 nurses answered that they were using more alcohol foam product as a result of the brightly colored visual reminder. The survey also included questions about whether the nurses thought it was a good idea to add the interventions to other units. Sixteen nurses agreed that adding the alcohol foam dispensers outside the patient rooms on the other units was a good idea. Fifteen nurses thought it would be a good idea to add the brightly colored reminder signs to the dispensers inside the patient rooms and on the other units.
Discussion

This hospital’s hand hygiene intervention seemed to follow all the criteria of the successful studies found in the literature; however, the intervention did not result in increased hand hygiene compliance. Rather, the compliance rates actually decreased. Interestingly, the survey rates stood in contrast to the observational data, with the nurses responding positively to the intervention. The compliance rates dropped significantly; however, 94.1% of the nurses surveyed said that the additional dispensers made hand hygiene convenient and 82.4% claimed they were using more alcohol-based hand rub due to the additional dispensers outside each patient room. Additionally, 64.7% of the nurses claimed they were using more alcohol-based hand rub as a result of the visual reminder that had been installed. The majority of nurses surveyed also agreed that the intervention should be applied to other units as well.

The results of the survey questions illustrate a strong positive response to the intervention measures. Most nurses surveyed claimed to be using more alcohol-based hand rub as a result of the intervention. However, if that were the case, then the researchers should have observed a significant increase in hand hygiene compliance. The unexpected decrease in hand hygiene compliance rates could be due to confounding factors, such as the unit’s census during the periods of observation. Further data from the hospital would be required in order to analyze this. However, it could be possible that the census was higher during the post-intervention period and the nurses were much busier, affecting their ability to complete proper hand hygiene.

Another possible reason that this intervention did not increase the hand hygiene compliance could be that it was the wrong intervention for that group of nurses. In
designing this intervention, the hospital assumed that the nurses needed to be reminded to complete hand hygiene, thus they placed a new dispenser with a visual reminder directly outside the doors to the patient rooms. Through this intervention, Hospital A not only made the alcohol foam dispensers more noticeable, but they also increased the number of them, making them more accessible and available. However since the hand hygiene rates did not increase from this intervention, it is possible that the nurses on the study unit do not need additional reminders to complete hand hygiene. Perhaps they need a different intervention, like increasing education about why hand hygiene is important in the healthcare setting or an incentive program for complying with proper hand hygiene guidelines.

Because the observations and the survey were conducted anonymously, it is not possible to know if the nurses who were observed not completed hand hygiene responded to the survey. If the nurses had been identified, narrowing down the reasons why hand hygiene compliance decreased would be easier. For example, if the nurses who did not complete successful hand hygiene also responded in the survey that they did not like the new dispenser locations then Hospital A could search for a different intervention more suited to that group of nurses. Or, if the nurses who had low hand hygiene compliance rates answered in the survey that they thought their hand hygiene performance had improved, then Hospital A could deduce that the nurses are over-estimating their own performance and may not be aware of their true hand hygiene habits.

**Limitations of Observational Studies**

The unforeseen results of this hand hygiene intervention could also be due to flaws in the study design itself; there are numerous limitations to observational studies.
One such limitation is the possibility of the Hawthorne effect, which occurs when participants are aware they are being observed and that awareness impacts their behaviors (McCambridge, et al., 2013). It is likely that both before and after the intervention, the nurses realized they were being watched and changed their behavior, especially since the study took place in a small setting where an observer was likely very noticeable. It is logical to assume that a nurse who knows he or she is being watched is going to make sure to do his or her very best in every aspect of the job, hand hygiene included. Perhaps the nurses were more aware of the observer during the pre-intervention observations and that is why those rates are much higher.

Another limitation of observational studies is that, unlike experimental studies, the researcher has no control over the variables being studied. In this case, the observer could not control how many times the nurses entered or exiting patient rooms. This is problematic because the observer cannot control the number of observations made. It seems possible that, depending on when the observations were made, the observer may have missed many of the opportunities for hand hygiene. There are usually set times throughout the day when nurses distribute meds or make rounds on their patients. This would have been an optimal time to observe the hand hygiene of the nurses, as there would have been a higher volume of nurse-patient interaction. However, maybe the observations were made during times when there was less activity on the floor and not as many opportunities for hand hygiene could be observed. This could have been corrected for by conducting the study for a longer period of time. A higher number of observations, made over a longer time period, would have given results that more accurately represented the hand hygiene patterns of the unit.
Additionally, since the study was done on a small unit, there may have only been a few nurses on staff at any given time. It would have been easy to observe one nurse multiple times during the observation period. That particular nurse may have been a nurse who does not practice good hand hygiene. His or her behavior may not be representative of the unit nurses as a whole and may have been over-represented in the data set. This could explain the decrease in compliance rates after the intervention. However, since confidentiality and ethical considerations were important to the study, the nurses that were observed were not identified in any way so it is not possible to analyze whether a particular nurse strongly influenced the data.

Future Research Recommendations

There are many aspects of Hospital A’s study that could be improved in future research efforts. The hospital would most likely want to validate the survey results that had indicated the nurses were using more alcohol-based hand rub and thus completing hand hygiene more frequently. The observational results did not show this, but there are some additional studies that could be done to validate the results.

The two measures of this intervention should each be tested separately. The intervention of installing additional hand rub dispensers outside the patient rooms should be tested by itself to determine the effect of the additional location of hand hygiene resources. The visual reminders should also be tested separately on the existing location of hand rub dispenser. By testing the two interventions independently, it can be determined which has the greater effect on the hand hygiene compliance of the healthcare workers.
Another future research recommendation would be to use volume metrics as a more subjective approach to studying hand hygiene compliance. The volume of the dispensers both inside and outside the rooms could be measured and then compared to the volumes of dispenser inside and outside of control rooms, where the intervention measures have not been installed. This would eliminate the need for a covert observer. It would also allow for a more complete representation of the hand hygiene patterns of the unit because the volume measurements would account for all shifts and all nurses whereas an observer can only capture a few nurses in a certain shift.

Additionally, many new technologies have been introduced to monitor hand hygiene while eliminating many of the limitations discussed above. One such technology is MediHandTrace®, described as a “radiofrequency identification (RFID)-based real-time automated continuous recording system” (Boudjema, et al., 2014). This system tracks hand hygiene opportunities and the compliance of the healthcare workers. When evaluated against video recordings, the system was 99.02% accurate, 95.65% sensitive and 100% specific (Boudjema, et al., 2014). A technological program like this would make hand hygiene monitoring much more accurate and subjective; however, it is a resource that may not be easily available to all hospitals.

**Conclusion**

Each year, over a million US hospital patients experience the costly, negative effects of HAIs. Hand hygiene is the single most effective way to prevent these infections; however, average hand hygiene compliance rates among healthcare workers are unacceptably low. This has led many researchers to pursue interventions to increase compliance rates in order to decrease HAI rates. The intervention designed by Hospital
A, based on many successful interventions in the literature, focused on installing visual reminders and increasing the number of alcohol-based hand rub dispenser available to healthcare workers.

However, after analyzing the pre- and post-intervention data from the hospital’s study, it is clear that the intervention did not lead to increased hand hygiene compliance rates. Rather, it seemed to have the opposite effect. The hospital also conducted a survey of the nurses, regarding their opinions of the intervention. The analysis of the survey data showed an overwhelmingly positive response to the intervention, with the majority of nurses claiming that they had been using more alcohol-based hand rub due to the intervention measures.

The surprising contrast between the observational data and the survey data illustrates the need for improved research methods regarding hand hygiene performance of healthcare workers. Some improvements that could be made include testing the interventions independently, using a volume-based study, or using RFID technology instead of making direct observations. Hand hygiene remains a very important topic of research for the healthcare field and researchers should strive to continue to improve hand hygiene studies. As hand hygiene compliance rates increase, HAI rates will decrease, leading to improved health and financial outcomes for both patients and healthcare providers and facilities.
References


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Figure 1: The Observational Tool designed by Hospital A’s Infection Control Specialist. This tool was used during the pre- and post-intervention observations. The term “waterless” refers to the use of the alcohol-based hand rub.
Figure 2: The observational study results expressed graphically. The hand hygiene compliance rates decreased significantly during the post-intervention observations.