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How Can We Improve Hand Hygiene Compliance and its Clinical Implications in Healthcare Professionals?

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HOW CAN WE IMPROVE HAND HYGIENE COMPLIANCE AND ITS CLINICAL IMPLICATIONS IN HEALTHCARE PROFESSIONALS?

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Thesis Abstract

Hand washing is one of the most important things that an individual can do to help prevent and control, the spread of bacteria, infections, and many illnesses from occurring. This study aimed to investigate the importance of hand hygiene compliance in nurses who practice at Rhode Island Hospital (RIH) in Rhode Island. The research in this study focuses on the compliance of hand hygiene created by the nursing staff. The branches of RIH target the Neurosurgery, Pulmonary, Dermatology, and the Dialysis Unit, to examine whether the implementation of visual reminders (i.e., "healthy hands" posters) create awareness amongst the nurses in each department. In this mixed-method, prospective, and quasi-experimental study, self-reporting was used to study the frequency of handwashing before and after the implementation of visual reminders. An additional method was created to measure the amount of Germ X Hand Sanitizer used in collaboration with visual reminders in a pre and post-intervention. A Focus Group Discussion was also conducted with the participants to obtain feedback that would increase hand hygiene awareness and its compliance. The results indicated that visual reminders create awareness and increase handwashing frequency among Rhode Island Hospital nurses. The implementation of visual reminders provided nurses with the knowledge and understanding of the importance of the issue.

Keywords:
Thesis, Nurses, Healthcare, Hand Hygiene, Compliance, Visual Reminders, Germ X, Focus Group, Rhode Island Hospital, Rhode Island

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List of Abbreviations

CDC	Centers for Disease Control and Prevention
HAIs	Healthcare-Associated Infections
HCWs	Healthcare Workers
IDN	Infectious Disease News
WHO	World Health of Organization
IHI	Institute of Healthcare Improvement
APC	Ambulatory Patient Center
RI	Rhode Island
RIH	Rhode Island Hospital
IRB	Institutional Review Board
PICU	Pediatric Intensive Care Unit
CHG	Chlorhexidine Gluconate
FGD	Focus Group Discussion
The Four Departments	Neurosurgery, Pulmonary, Dermatology, Dialysis

CHAPTER 1: INTRODUCTION

Background Problem

During healthcare delivery, healthcare providers continually touch surfaces, objects, waste, food, and body fluids, increasing the risk of transmission. Consequently, microorganisms can spread within the healthcare setting within a short period (Reynolds, Sexton, Norman & McClelland, 2020). Empirical evidence collected over the past decades compels healthcare providers to be among the most common vehicle of transmitting microorganisms. The transmissions can occur in various settings, including equipment to the patient, patient to patient, and environment to the patient. For instance, Yawson and Hesse (2013) found that healthcare compliance to hand hygiene by healthcare workers can reduce the spread of infectious diseases by at least 50%. In the wake of infectious diseases, healthcare providers' role in the spread of microorganisms is becoming an essential source of concern in the academic and regulatory frameworks (Reynolds et al., 2020).

One of the concepts receiving increasing attention is hand hygiene. Reynolds et al. (2020) define hand hygiene as a way of cleaning one's hands in a manner that substantially reduces the potential pathogens on hands. According to Demirel (2019), hand hygiene is one of the most important methods of reducing the risk of transmission amongst healthcare providers and patients. It is also among the five key initiatives set out by the World Alliance for Patient Safety's Strategies. In the same line of thought, the World Health Organization (WHO) explains that hand hygiene is an essential initiative for the achievement of "clean care" (Peter et al., 2019). The main goal of clean care is to

ensure the acknowledgement of the importance of hand hygiene in enhancing patients' safety. The World Health Organization (WHO) initiatives and other healthcare bodies aimed at promoting hand hygiene compliance are reflections of the evolving nature of hand hygiene as a subject.

It started in the mid-1800s when hand hygiene compliance originated from a Hungarian physician named Ignaz P. Semmelweis. In 1844, Semmelweis, known as the "savior of mothers," discovered that the occurrence of childbed fever could eliminate by the use of handwashing in obstetrical clinics (Vermeil et al., 2019). Semmelweis also found that when physicians washed their hands before delivering babies, it prevented deaths in postpartum women. Semmelweis' observation, appeared that healthcare workers' (HCWs) hands play a part in transmitting pathogens in the health care setting. Various organizations, including the CDC and WHO continue to publish guidelines on appropriate hand hygiene for HCWs (Anderson, Derrick, MD, & MPH, 2014).

Florence Nightingale, a nurse who served during the Crimean War, known as "The Lady with the Lamp," created a cultural change in the healthcare framework by emphasizing hand hygiene. In 1850, Florence Nightingale improved the unsanitary conditions for the infected against the fatal bacterial disease identified as cholera (Waterall, 2020). Through this initiative, Florence Nightingale diminished cholera's spread, thus significantly reducing the fatalities (Anderson et al., 2014). Nightingale also changed the way nurses cared for patients by promoting "clean care." At that time, Nightingale only focused on educating nurses about the importance of hand hygiene. Nightingale also began implementing handwashing and other hygiene practices within

the war hospital (Waterall, 2020). While the target of these practices was to fight miasma, Nightingale's handwashing practices reduced infections.

When a string of foodborne illnesses and healthcare-associated infections broke out in 1980 due to poor hygiene compliance, a deep public concern emerged. Healthcare-associated infections (HAIs) refer to healthcare delivery diseases in hospitals, ambulatory settings, home care, and other settings. These unanticipated infections tend to develop during medical or surgical treatment and may result in significant patient illnesses and deaths when hand hygiene is not addressed during patient contact (Boyce, 2019). The Centers for Disease Control and Prevention (CDC) identified hand hygiene as an essential way to prevent the spread of infections. It was the first to nationally endorse hand hygiene guidelines influencing WHO and many more to follow in the 1980s (*Healthcare-associated infections,* 2015).

The above arguments show that hand hygiene in clinical settings has been an ongoing concern over many years. This tried-and-true component of infection prevention poses a challenge to even the best health care organizations. According to the Institute of Healthcare Improvement's (IHI) data, hand hygiene compliance rates are only 50% (*Using a Multidisciplinary Approach to Improve Hand Hygiene*, 2018). Due to low compliance, IHI believes that there is a gross violation of healthcare standards (Grayson et al., 2018).

According to Grayson et al. (2018), HAIs impose severe emotional, financial, and medical consequences. For instance, 1 in 25 inpatients develops an infection related to hospital care. The costs of these infections to both the patients and the United States are

unbearable. Currently, the healthcare system is both fragile and sensitive. The effects of non-compliance spread through the domino effect. In the end, the rates of morbidity and mortality increase (Waterall, 2020). For instance, Juthamanee (2020) provides that between 1 and 3 million people die due to healthcare-associated infections (HAIs). High costs in hospitals due to HAIs are preventable through strict compliance to hand hygiene guidelines.

The Institute of Healthcare Improvement (IHI), which aims to improve healthcare worldwide, outlined multidisciplinary approaches to increase handwashing and reduce infections throughout six virtual sessions. In the sessions, expert faculty shared best practices focusing on accelerating behavior and cultural changes. IHI highlighted that teams tested and implemented change using evidence-based guidelines and engaged in multiple disciplines and departments. IHI also built a critical system to support and execute meaningful hand hygiene changes (Wong & Lee, 2019). In comparison, the WHO recommended different ways to improve hand hygiene and prevent infections by publishing the 'Five Moments of Hand Hygiene' guide. This framework directed healthcare professionals to wash hands before patient contact, before an aseptic task, after bodily fluid exposure, after patient contact, and after contact with patient surroundings (Stahmeyer et al., 2017).

At the same time, Kurgat et al. (2019) created a simple approach to improve hand hygiene compliance in the Pediatric Intensive Care Unit (PICU). The authors developed a bulletin board that reemphasized hand hygiene's effect on the transmission of microorganisms. The bulletin board remained visible for two weeks in the PICU. Kurgat

et al. (2019) reported that the method improved compliance to hand hygiene guidelines by 71.8% (Öncü et al., 2018).

Despite the overwhelming evidence regarding hand hygiene's importance in reducing the spread of infectious diseases amongst healthcare providers and users, compliance rates remain low. Some of the low compliance reasons include insufficient utilities such as sinks, lack of incentives, and low nurse-patient ratio. Regardless of the reason, the risk of spreading infectious diseases remains a significant concern in the United States. As a result, this research will investigate the role of handwashing knowledge in increasing compliance with handwashing guidelines set for healthcare providers such as doctors and nurses.

Research Question

- Does the implementation of visual reminders such as posters help create awareness and increase hand hygiene compliance amongst the nursing staff?

Specific Research Aims

This research study was to determine hand hygiene compliance within the nursing staff at Rhode Island Hospital (RIH). The three specific aims include:

1. To provide visual reminders for enhancing compliance to hand hygiene guidelines for nurses.
2. To measure the usage of an alcohol-based hand rub (Germ X Hand Sanitizer).
3. To assess the reason for compliance or non-compliance in hand hygiene practice by conducting a Focus Group Discussion.

AIM 1: To provide visual reminders for enhancing compliance to hand hygiene guidelines for nurses

The visual reminders will be made available in the four departments, namely Neurosurgery, Pulmonary, Dermatology, and Dialysis Unit. The research will provide ten to fifteen 8x10 sized posters in each department. The colored posters will be in all clinic rooms, hallways, and notice boards. The goal of the initial aim would determine that setting daily reminders in the hospital would improve hand hygiene compliance between the nursing staff that practice at RIH.

AIM 2: To measure the usage of an alcohol-based hand rub (Germ X Hand Sanitizer)

The second aim was to measure the usage of the Germ X Hand Sanitizer product in a 30-fluid ounce (887 ml) bottle. The research will measure the volume of the sanitizer weekly to record volume reductions. The assumption is that the decrease in the hand sanitizer volume will be due to handwashing by nurses. To ensure the validity of this assumption, the hand sanitizer bottles will have an anti-wastage disclaimer reading as "please avoid wastage of hand sanitizers."

AIM 3: To assess the reason for compliance or non-compliance in hand hygiene practice by conducting a Focus Group Discussion

The third aim is to collect feedback from nurses regarding compliance or non-compliance with the hand hygiene requirements. At the same time, the 3rd aim will enable nurses to explain the appropriateness of visual reminders. The focus group will also allow the participants to give positive or negative feedback and suggest new alternatives to reduce HAIs through increased compliance to hand hygiene.

Research Hypotheses

- **Null hypothesis:** The provision of visual reminders will not increase compliance to hand hygiene requirements at RIH by a statistically significant margin.
- **Alternative hypothesis:** The provision of visual reminders will increase compliance to hand hygiene requirements at RIH by a statistically significant margin.

CHAPTER 2: LITERATURE SEARCH AND RATIONALE

Critical Literature Review

Theme 1: The Role of Visual Reminders as a Source of General Education

Since the mid-1800s, hand hygiene has been one of the simplest, most effective ways to prevent the spread of healthcare-associated infections, making it a critical patient safety priority (Pittet & Allegranzi, 2018). Most healthcare professionals tend not to take hand hygiene compliance seriously. Due to poor adherence, supporting factors include sinks or hand sanitizer dispensers located in inconvenient places within the hospital facilities. Other factors that reduce the compliance rates include soap/hand sanitizer dispensers being empty and employee concern over side effects such as dry skin. Additional factors that reduce compliance rates include a lack of sufficient knowledge and understanding of the severity of poor hand hygiene compliance. For instance, Pittet and Allegranzi (2018) indicate that some nurses fail to understand the link between increased re-admission rates and poor hand hygiene. Therefore, Pittet and Allegranzi (2018) believe that visual reminders would enable nurses to access general information about hand sanitizers and non-compliance severity.

Furthermore, Rickard (2013) is also among the studies that adequately cover hand hygiene's importance. The authors particularly studied the relationship between nurses' compliance to hand hygiene and infections in a hospital. Also, the author investigated the reasons why healthcare professionals fail to comply with hand-hygiene policies. The result revealed that around 10% of hospital patients acquire a healthcare-associated infection. The main reasons for non-compliance discovered by Rickard (2013) include

low education and patient empowerment. The author also found that about one-third of the conditions are preventable through increased awareness amongst healthcare providers.

Additionally, Rickard (2013) found that non-compliance can reduce through a change in nurses' work culture. The cultural shift should entail the provision and proper utilization of hand-cleansing utilities. Also, the cultural shift should encourage the provision of feedback about local infection rates. In particular, hospital managers should list the overall objectives of infection rates.

Similarly, Malihe et al. (2015) studied the importance of nurses' knowledge regarding hand hygiene in neonatal wards and neonatal intensive care units. The study occurred in neonatal units in the hospitals affiliated to Tabriz University of Medical Sciences. The authors surveyed 150 nurses invited by the census sampling method. The researchers administered a questionnaire investigating the participants' knowledge regarding hand hygiene. 95.5% of participants had a baccalaureate in nursing, while 4.5% of them had a Master of Science degree in neonatal intensive care. 61.1% of the participants worked in NICU, 89.3% worked in rotation shits, while another 10.7% worked in fixed shifts. Simultaneously, 15.9% of the participants did not participate in previous educational courses regarding hand hygiene. Among the educated nurses, 55.5% participated in 1 to 3 last educational courses, 20% participated in 3 to 5 last academic courses, and 68% reported a need for continuing education regarding hand hygiene. The mean score of the nurses' knowledge was 10.39 (SD=2.44). 1.9%, 29.9%, and 68.1% of the nurses obtained low, moderate, and high expertise (Malihe et al., 2015). During data

analysis, it appeared that only 90% of the questions were answered by the nursing staff. The available responses showed that the guidelines on hand hygiene in the hospital were unrealistic. The participants also suggested that the infection control committees revise the underlying educational methods and frameworks of enforcing hand hygiene among healthcare workers. The authors also found that the hospital should promote nurses' experience and information through visual materials such as posters.

Theme 2: The Role of Visual Reminders as General Reminders

Abdella et al. (2014) also investigated the relationship between hand hygiene compliance and hospital transmitted infections at Gondar University Hospital. The study used a stratified sampling technique with 405 participants. Data collection was through a standardized questionnaire and the WHO's observational checklist. The response rate was 96.4%. Overall, hand hygiene compliance among health care providers at Gondar University was poor. Healthcare workers' hands are the most usual vehicle for transmitting healthcare-associated infections (Abdella et al., 2014). The results also showed that the proper hand hygiene compliance of healthcare providers was only 16.5%. Also, three hundred twelve (73%) of the respondents were knowledgeable of hand hygiene compliance, while another 244 (60.2%) had prior training on the submission of hand hygiene. Approximately 131 (57%) were aware of Alcohol-Based Hand Rub, and 148 (36.5%) were mindful of tissue paper's existence for drying. Therefore, Abdella et al. (2014) recommended the provision of training courses aimed at enhancing the understanding of hand hygiene and compliance by healthcare professionals. The authors

also suggested providing each healthcare provider with an alcohol-based hand rub at Gondar University.

Demirel (2019) also investigated the compliance rates of healthcare providers about handwashing guidelines. The study occurred in a private hospital in Istanbul, Turkey. The respondents totaled 270 medical staff. The informed observation was performed by the infection control committee in the entire hospital using "Five Moments for Hand Hygiene" for one year. The results showed that the compliance rate was 35%, 54%, and 64% for the physicians, nurses, and other healthcare staff. After the first six months of the observation, an improvement study occurred with the hospital's quality department using the plan-do-check-act cycle. The reasons for poor compliance discovered by Demirel (2019) included the lack of awareness from healthcare personnel on hand hygiene, few cautious reminders of hand hygiene, the dissatisfaction of the healthcare personnel with soap and hand disinfectants, and the inadequate number of hand disinfectants in outpatient clinics.

Theme 3: The Role of Visual Reminders in Encouraging Feedback and Supervision

Zottele et al. (2017) analyzed hand hygiene compliance by healthcare professionals within an emergency unit at a university hospital located in the state of Rio Grande do Sul. Each healthcare professional was monitored three times by direct non-participant observation using WHO's five recommended hand hygiene moments. The study revealed fifty-nine healthcare professionals participated in the research applying descriptive and analytical statistics. The observation sessions lasted for an average of 11 minutes (SD=50s) and occurred in all three work shifts. It included 77 (46%) in the

morning, 32 (20%) in the afternoon, and 57 (34%) in the night shifts. After comparing the professional categories, nurses showed greater compliance than resident physicians (OR=2.83, CI=95%: 1.09=7.34). Also, it emerged that hand hygiene compliance in an adult emergency room was low (54.2%). In an environment with a safety culture, healthcare professionals and managers must incorporate safe hand hygiene practices. Placing alcohol preparations at the bedside of emergency rooms would favor hand hygiene in the WHO five moments during patient care. Multidisciplinary approaches could also be essential strategies for forming partnerships to develop learning and implementation of hand hygiene practices. Some of the barriers to compliance identified by Zottele et al. (2017) include the inadequate flow of patient care due to overcrowding, heavy workloads, stress, lack of knowledge regarding hand hygiene protocols, bad habits, skin irritation, and lack of positive examples from superiors.

In the second half of the year, 183 actions were available for observation. The observations included 33 physicians (25%), 65 nurses (50%), and 33 healthcare staff (25%). For all categories, the mean compliance rate was 60%. Therefore, Demirel (2019) concluded that there needs to be constant cooperation between hospital administrators, infection control committees, and quality control departments to improve hand hygiene compliance. Demirel (2019) also observed that healthcare providers need to ensure long-term and consistent efforts for increased hand hygiene. In particular, the steps should focus on expanding the knowledge and pro-activeness of healthcare providers. According to the authors, the most robust approach to improving hand hygiene is surveillance, primarily through direct observation, most often carried out by direct observation.

Marques et al. (2017) aimed to develop a gamification solution that collects data and provides real-time feedback to improve hand hygiene compliance. The study occurred in an intensive care unit of a Portuguese tertiary hospital. Marques et al. (2017) performed two work iterations, both of which applied gamification components. In each session, the authors used different indoor location technology. Marques et al. (2017) also developed a dashboard screen where the nurses provided real-time feedback via a monitor placed in the nurses' room. Nurses that worked in the ICU were a part of a focus group during the research. Each of these nurses participated in several sessions across the implementation process. The results showed that nurses enjoyed the study's concept and considered the focus group a unique opportunity to receive feedback on performance. The tests performed on the indoor location technology in the first iteration were unacceptable. The reason for the unacceptability is the lack of accuracy and unstable behavior of participants. In the second work iteration, indoor location technology failed to work efficiently. As a result of this failure, the authors were unable to test the gamification solutions to predict or test the positive effects of hand hygiene compliance. Therefore, Marques et al. (2017) concluded that indoor location technologies are still not ready to be applied in the healthcare field with nursing wards. The authors also concluded that finding an accurate IPS system to track healthcare workers inside the hospital was mandatory for hand hygiene compliance.

Theme 4: The Role of Visual Reminders by Informing about the Availability of Hand Hygiene Utilities

Akyol (2007) also studied nurses' practices and opinions of handwashing during routine patient care to prevent cross-infection in hospitals. The author collected data through questionnaires, where the response rate turned out to be 100%. The study occurred in Turkey at the University of Ege Faculty of Medicine Application and Investigation Hospital at Internal Medicine Clinics. The research integrated a total of 129 respondents comprising of clinical nurses. The survey consisted of two categories, 'clean' and 'dirty,' in which nurses' actions were evaluated using a Fulkerson scale. The scale, also known as The Ford-Fulkerson method, is a procedure used to detect the maximum flow from the start vertex to the sink vertex in a given graph. 75% of the participants reported handwashing after contact with contaminated and non-contaminated patients, equipment, and the environment. The results showed that nurses could not comply with handwashing guidelines due to dense working conditions and insufficiency of utilities such as soap. The results also revealed that nurses have a low level of knowledge concerning the requirements of proper handwashing and "clean healthcare." In some instances, the utilities are available, but the nurses are not aware of such availability.

Yawson and Hesse (2013) studied handwashing compliance among health workers in a large West African Teaching Hospital. The cross-sectional observational study assessed personal and care-related compliance among doctors and nurses in 15 service provisions. Data collection was with an infection prevention checklist and a health worker compliance form based on the World Health Organization guidelines. Overall, the study revealed that the care-related compliance of doctors and nurses was

low. For instance, care-related handwashing compliance among doctors and nurses ranged from 9.2% to 57% and 9.6% to 54%, respectively. At the same time, essential and washing utilities were deficient in all 15 service areas of observation. Most health workers observed in the 15 centers of observation washed their hands after using the washroom, before attending to a patient, or before undertaking the medical procedure. This compliance was highest in areas where the hand washing utilities were available. Necessary equipment such as liquid soap bottle was unavailable in five service centers, including high-risk areas such as the Central Laboratory's phlebotomy room. Although ten centers had a liquid soap bottle, liquid soap was only available in four centers. As a result, the healthcare workers needed to walk through congested work stations to use the bottle.

Theme 5: The Role of Visual Reminders in Creating a Proper Compliance Atmosphere

Al-Wazzan et al. (2011) also studied the relationship between compliance with hand hygiene guidelines among nursing staff in secondary care hospitals in Kuwait and the rates of infections occurring in the course of treatment. The cross-sectional study occurred through direct observation using the Lewisham observation tool and self-administered questionnaire in six major public secondary hospitals. A self-administered questionnaire was prepared and distributed to the nursing staff at each ward immediately after the inspection. Of the 550 questionnaires, 454 were completed and returned. The research entailed 204 observation sessions and 312 recorded hand hygiene practices. The results showed that there lacked significant variations in self-reported compliance

between hospitals. However, there were significant differences in self-reported adherence between different wards. In particular, nurses in intensive care units and pediatric departments consistently reported higher compliance. Al-Wazzan et al. (2011) concluded that high self-reported adherence might reflect a high level of hand hygiene awareness. The authors also pointed out that approximately 30% of nurses fear sore or dry hands, thus opting to skip hand washing. As a result, Al-Wazzan et al. (2011) recommended that frequent auditing on the current subject and properly applied feedback on performance should be explored to promote hand hygiene practices in Kuwait hospitals.

In the same line of thought, Fox et al. (2015) investigated a new patient hand hygiene protocol that could reduce hospital-acquired infection rates and improve nurses' handwashing compliance in an intensive care unit. The researchers developed a pre-experimental design to compare two common hospital-acquired infections- associated bloodstream infection and urinary tract infection. The new patient protocol consisted of soap and water baths. It also consisted of 2% Chlorhexidine Gluconate (CHG) wipes applied to patients' hands three times a day during their hospital stay to reduce HAIs. The study happened at Mission Hospital in the intensive care unit.

Throughout a 12-month investigation, the results showed that the reduction of infection rates occurred for the soap and water baths on the common hospital-acquired infections. Also, nurse compliance improved, but insignificant. Fox et al. (2015) concluded that hand hygiene protocol for patients in the intensive care unit is associated with reductions in hospital-acquired infections and improvements in nurses' handwashing compliance. Therefore, Fox et al. (2015) concluded that preventing such diseases requires

continuous quality improvement efforts to monitor lasting effectiveness and investigate strategies to eliminate infections.

The study's critical point highlighted that the nurses' compliance improved in hand hygiene but was not as significant. The authors emphasized that nurses protected themselves and washed their hands when they left the patient's room, instead of doing so before and after patient contact to protect the patients due to the insufficient increase. The literature review failed to discuss if the nurses' attitudes/behaviors changed regarding future treatments. This initiative would be a significant factor for Mission Hospital in improving their hand hygiene compliance.

Literature Gap

The literature covered in this chapter agrees that the role of hand hygiene in reducing infections is elaborate. For instance, Rickard (2013) found that one-third of the diseases are preventable through increased awareness amongst healthcare providers. At the same time, Malihe et al. (2015) discovered that nurses are willing to observe the hospital regulations, but unrealistic expectations and unavailability of materials negatively affect compliance. Akyol (2007) also found that nurses have a low level of knowledge concerning the requirements of proper handwashing and "clean healthcare." In the same way, the materials identified barriers to hand hygiene. Some of them include overcrowding, heavy workloads, stress, lack of knowledge regarding hand hygiene protocols, bad habits, skin irritation, and lack of positive examples from superiors (Zottele et al., 2017).

Despite these findings' usefulness, the materials fail to identify behavioral changes for nurses that would reduce infections positively. As a result, this research will investigate the different nurses' behavioral changes that nurses can adopt to achieve clean healthcare. In particular, the behavioral change orientation will adopt the Hawthorne argument, which provides that "when you directly observe a person, they are likely to change and vice versa." An example of the initiatives for behavioral change is the time spent on hand washing.

Rationale

This research's rationale is the proper illustration of the importance of adhering to healthcare providers' hand hygiene requirements. As stated by the Centers for Disease Control and Prevention, healthcare providers clean their hands less than half of the required times on average. One of the most common transmission routes for microorganisms is healthcare workers' (HCWs) hands, indicating that hand hygiene is the primary measure to prevent HAIs, and other infections contracted in a hospital. Healthcare professionals receive training about safety, a clean working environment, and to educate patients on hand hygiene and its importance. The overall objective is to increase care quality while indirectly educating the patients through trained healthcare providers.

However, professionals who fail to comply with the hand hygiene requirements vastly increase healthcare costs to the general healthcare system. Previous studies show that hospital-acquired infections can raise the cost of healthcare by at least 25%. In the worst scenarios, the cost may rise to 80% or cause death. Although non-compliance may

arise from a blatant violation of the hand hygiene requirements, it may also emerge from the lack of awareness. Without the proper training, education, and knowledge from these professionals, it is impossible to raise awareness within the entire healthcare system.

Another important rationale is the discovery of methods of resolving the increasing rates of hand hygiene non-compliance. After collecting primary and secondary data, the research will conduct in-depth data analysis to determine the recommended corrective actions to bridge the compliance gap. Compliance with proper hand hygiene can reduce diarrhea-related deaths by 165,000 cases per year. At the same time, it can reduce the cost of healthcare by US$0.90 and US$2.50 per capita per year. The reduction can be higher in developing than in developed nations. The funds saved in the process can facilitate future research, especially with a focus on emerging diseases.

CHAPTER 3: METHODOLOGY

Type of Research

According to Taherdoost (2016), the main research types are qualitative, quantitative, and mixed. Usually, qualitative research is numerical and relies on calculations to make scientifically informed judgments. On the other hand, qualitative research is non-numerical. The study relies on theories, observations, and correctly reasoned arguments to make judgments. The last type, mixed research, is a combination of both qualitative and quantitative analysis. Among the three types, this research will use mixed methods. The benefit of the hybrid method is that it balances the help of statistical and non-statistical analysis. On the one side, statistical analysis will quantify observations such as the implementation of visual reminders and the changes in the Germ X Sanitizer volume. On the other hand, the non-statistical analysis in the qualitative research will allow the investigation to conduct an in-depth analysis of the observations and the theories underlying them.

Hospital Setting

This study occurred in Rhode Island Hospital (RIH), located in Rhode Island (RI). The hospital is the largest in RI, with a total bed capacity of 719. It is a private and not-for-profit acute care hospital that provides comprehensive services. At the same time, it is the only Level 1 trauma center for Southern New England. As described in the hospital's charter, it provides expert staff and equipment in emergencies 24 hours a day. On top of that, it is the principal teaching and research hospital for The Warren Alpert Medical

School of Brown University and the largest and most comprehensive of the Brown-affiliated hospitals.

Sampling Method

According to Taherdoost (2016), the sampling method is a large determiner of the research's success. Usually, the study should select a method that is both workable and reliable. The condition of workability indicates that the preferred method must be applied in the real world. For upholding the conditions of workability and reliability, this research will use the purposive sampling method. The benefit of this method is that the study can directly target available nurses working at RI Hospital. The alternative method of sampling would be random sampling. This method is appropriate since it reduces the bias in a study. However, the target hospital indicated that only a few nurses are available for this research due to nurse shortages. Consequently, the analysis must use the purposive sampling method.

Targeted Population

According to Abutabenjeh and Jaradat (2018), a population stands for the total number of elements or persons sharing a common characteristic that the research intends to study. In this study, the target population, therefore, entails all nurses working at RI hospital. The research defined the ideal participants to be between the ages of 25 and 65 years. Also, the target nurses must have practiced for at least two years. The reason for ensuring that the nurses are between 25 and 65 years is to provide sufficient exposure to the frameworks of positive hygiene behaviors. Also, the selection of nurses with at least

two years of experience ensures an adequate understanding of proper and hygienic healthcare requirements. The sample size of the study is 133 nurses. Each of the four departments will provide between 13 and 15 participant nurses. Van Dun, Hicks, and Wilderom (2017) advise that research should include the maximum number of participants to increase reliability and validity. However, this research could only access 133 nurses because the hospital management believed the nurses were preoccupied with managing the existing patients. The hospital management, therefore, only allowed the participation of 133 nurses.

Ethical Requirements

The data collection started after each nurse signed a consent form. The consent document provided participants with a description of the study, the participants' underlying risks, benefits, and rights. The consent form's preparation followed guidance by Umanailo et al. (2019), where such documents should provide sufficient information to enable participants to make informed decisions. Additionally, the consent forms showed that the participating nurses would participate without compulsion or intimidation. The consent form strictly prohibited the participants from providing personal details such as names, addresses, and telephone numbers for anonymity. Instead, the research offered notable and non-identifiable names to the participants. Examples include Nurse A, Nurse B, and Nurse C.

Data Collection

The data was from four different departments, namely the Neurosurgery, Pulmonary, Dermatology, and the Dialysis Unit located in an outpatient building called the Ambulatory Patient Center (APC) of RIH. The study lasted for four weeks. It started on the 25th of June 2018 and ended on the 20th of July 2018. Self-reporting was used for collecting the frequency of handwashing for each participating nurse. The research observed the frequency and length of handwashing for each respondent over an eight-hour shift, especially before and after patient contact. Visual reminders were posted along the walls, clinic rooms of each department, and notice boards to determine hand hygiene compliance effectiveness. In particular, new data sheets were available to each of the four departments daily. The participating nurses tallied each time they sanitized their hands using the posters as a reminder to comply. The sheet was then returned to a designated area (the nurses' station) at the end of each shift. The research collected the data sheets daily and locked them in the cabinet of the nurses' station.

During this study, the volume of product Germ X Hand Sanitizer was also used to enable the research to measure the nurses' compliance with hand hygiene. The volume of Germ X used was measured weekly for the four weeks of observation. Over the first week, the research measured Germ X's usage without the provision of visual reminders. For the other three weeks, the researchers measured the use of Germ X with the provision of visual reminders.

The research supplied an alcohol-based hand rub bottle and placed it at the nurses' station in each of the four departments. Nurses who were not a part of the study

were asked not to use the product as it was used for testing purposes only. Before starting the project, the participating nurses were asked only to use the supplied product to disinfect their hands before and after patient contact. One full bottle contained 11.27 ml of the product. At the end of each day, the research temporarily removed the nurses' hand sanitizer and locked it in a cabinet located at nurses' station. This removal was to ensure that the nurses only used the hand sanitizers provided in the research. The department managers were directly refrained from providing the hand sanitizers to nurses. This requirement was to ensure that the other nurses or healthcare providers were not using the supplied product. The research measured the volume of the hand sanitizers at the start and end of every week. The difference between the starting and ending sanitizers was assumed to be the volume used for the present study.

A Focus Group Discussion was also necessary to understand the perception of healthcare workers' compliance, based on a series of questions. The Focus Group Discussion occurred in the break rooms of each department during the participants' lunchtime. During the Focus Group Discussion, the participants suggested alternatives and recommendations to increase the awareness and compliance of hand hygiene measures. The nurses who participated in the focus groups were the same nurses who engaged in the fundamental research. The four focus groups lasted for fifteen minutes, with a total duration of 60 minutes for each department. The discussions also allowed nurses to effectively communicate with other colleagues to assist and influence others to comply with this public concern.

The Focus Group Discussion varied between 6-9 participants in each department. During the group discussion, communication, knowledge, and action were highlighted as effective measures to capture the real-life data of the participants' perception of visual reminders in a social setting. In this qualitative analysis, effective communication with colleagues and other healthcare professionals is the first step to influence nurses in complying with the public issue. The second step in complying with the public concern would be knowledge. During the Focus Group Discussion, the nurses highlighted their lack of knowledge and strongly believed that visual reminders created a better learning experience due to creativity. The nurses found the visual reminders that were posted triggered the importance of hand hygiene and complied with them. The final measure that was discovered to get nurses to adhere to the subject would be action. When nurses were aware of the accessibility of the alcohol-based hand rub and understood that they were a part of a study, this improved hand hygiene compliance.

The analyzed theme highlighted for this section focused on participant perception of importance. The participants understood the Focus Group Discussion's significant concept and realized the importance of public concern. The nurses were able to gain valuable knowledge from the group questions to spread awareness and comply with the subject. The participant perception of importance theme provides a useful measure of ethical compliance in hand hygiene and leaves room for continuous performance improvement.

Intervention Procedure

i. Pre-Testing

A week before posting the posters, data was to determine how often nurses sanitize their hands before and after patient contact without the presence of visual reminders. One bottle of Germ X Hand Sanitizer was available in each of the four departments near the nurses' station. Germ X was measured at the end of the first week to determine usage before posting visual reminders. Blank data sheets were also available for nurses to tally the frequency of handwashing or sanitization before and after patient contact.

ii. Testing

During the next three weeks, visual reminders were present in each of the four departments. The data was collected to determine how often nurses sanitized their hands before and after patient contact. Nurses tallied the frequency of handwashing using the sheets provided by the research. Data was to determine if visual reminders increased compliance in the four departments based on the nurses' sheets and results.

iii. Post-Testing

After four weeks of testing, data was for checking hand hygiene compliance before and after visual reminders. This procedure would show whether the provision of visual reminders has positive effects on the adherence to hand hygiene requirements.

Data Analysis

I. Quantitative Data

The data in this study measured how often nurses sanitized their hands before and after implementing visual reminders in their departments. Ten to fifteen visual reminders of 'healthy hands' posters were posted along the hallways and in each departments' clinic rooms, measuring the importance of hand hygiene to prevent infections and bacteria.

Test of Independence Using the Chi-Square

The Chi-Square Test of this study was used for independence to determine whether there is a significant relationship between hand hygiene compliance and visual reminders. The test was to test how likely it is that an observed distribution is due to chance. The Chi-Square Test is meant to measure how well the empirical distribution of data fits the independent variables' distribution. The test was determined by three significant primary levels: 0.01, 0.05, and 0.10. In this study, the significant level of 0.05 was for determining the visual reminders' level significance in the pre-post intervention. The data of this study were entered and coded on an Excel spreadsheet.

A second observational study measured the volume of the Germ X hand sanitizer product. In this study, the usage of the product *Germ X* was measured daily within the four weeks of the experiment as another alternative to determine the visual reminders' effectiveness. This portion of the study involved measuring the amount of product used by nurses in a standardized 30 fluid ounce (887 ml) bottle from the start to the end of the study. The nurses self-reported the frequency of handwashing, while the researcher measured the volume of Germ-X used daily.

According to Tao, Chen, Henao, Feng, and Duke (2018), the Chi-Square works by comparing the expected variables' distribution against the variables observed after an observation. In this research, nurses' compliance levels in the absence of visual reminders are the predicted distribution. On the other hand, the compliance levels after the provision of visual reminders will represent the observations. If the "expectations" equals the "observations," the null hypothesis will be correct. If there are differences between the "expectations" and "observations," the alternative hypothesis will apply. After the test, if the calculated p-value will be less than or equal to the selected significance level, the null hypothesis will qualify for rejection. In other words, there will be a statistically significant relationship between the placement of visual reminders and the compliance to hand hygiene by nurses. If the calculated p-value exceeds the p-value set at the selected significance level, the null hypothesis will be acceptable. According to Tao et al. (2018), the Chi-Square is appropriate for this research because it is about the same population (nurses) who may show different categorical variables. In one category, the research will observe the compliance rates before the provision of visual reminders. In the other category, the research will observe the compliance rates after the provision of visual reminders. The Chi-Square technique will correctly indicate a statistically significant relationship between the dependent and independent variables.

II. Qualitative Data

The primary method during the analysis of qualitative data for the Focus Group Discussion was theming. According to Correa and Lietman (2017), theming requires the separation of responses based on the theme, topics, ideas, and patterns for easy analysis. After collecting raw data through a face-to-face interview with each department, the research applied the following steps.

- **Step 1 (Familiarization):** This step entails the understanding of data. Examples of the actions taken in this stage include reading through the notes, transcribing raw data, and accepting the general overview of the information.
- **Step 2 (Coding):** This step entails important specific codes that define the data. Since this research investigates the frequency of handwashing, examples of codes frequently include, rarely and occasionally.
- **Step 3 (Generating Themes):** After coding the messages, the research will then create themes such as misinformation, lack of knowledge, and lack of incentives.
- **Step 4 (Reviewing, Defining, and Naming Themes):** The purpose of this step is to certify that the themes are accurate and relevant. Also, this step will help to reduce redundancy and repetition. The action will also entail the arrangement of themes from the simplest to the most complex. The concluding step will require the research to list and define the themes.
- **Step 6 (Writing up):** The last step will be writing the information in an academically and professionally acceptable manner. The objective should be to write the report in a relevant, reliable, and workable way.

The researcher recorded each session's minutes and wrote down the responses as the participating nurses spoke. The same three questions were asked and facilitated by the research. The questions were as followed: Was the implementation of the posters useful? After participating in the study, how important is hand hygiene to you? Do you have any other suggestions and recommendations that could help motivate nurses to improve the hand hygiene compliance?

CHAPTER 4: RESULTS

The purpose of this chapter is to report the outcomes of the study. Initially, the research was set out to investigate handwashing awareness through visual reminders to increase hand hygiene compliance among the nursing staff at RIH. The research's background problem was an increase in the number of nurses who fail to comply with hand hygiene requirements in the general healthcare system. In Chapter 3, the research prepared primary research with a sample size of 133 nurses. This chapter will now report the critical outcomes of the study. The chapter's main sections include the demographic information, quantitative data results, and qualitative data results.

Demographic Information

i. **Quantitative Data Results**

Over the observation period lasting for a month, there was a total of 2,025 hand hygiene opportunities. Of this number, there were only 1,539 hand hygiene compliance observations by the participating nurses obtained across the four departments. Table 1 (Appendix 1) demonstrates the results of the four departments:

Visual Reminder Results

Table 1: Rate of Compliance with Hand Hygiene Before and After Intervention

Table 1a shows the compliance rates before and after intervention in the Neurosurgery Department. Before the introduction of visual reminders, the compliance rate was only 33.49%. In this case, there was a total of 203 hand hygiene compliance opportunities. The nurses complied with 68 of these opportunities. After the introduction of visual reminders, the rates increased to 78.61%. There was a total of 668 compliance

opportunities. The participating nurses complied in 553 of the 668 opportunities. Figure 1 shows this information.

Table 1b shows the compliance rate before and after the introduction of visual reminders in the Pulmonary Department. Before the introduction of visual reminders, the compliance rate of hand hygiene was 57.53%. At this level, there were 73 compliance opportunities, and nurses complied just 42 times. After the introduction of visual reminders, the rates of compliance increased to 79.98%. At this stage, there was a total of 374 compliance opportunities. The nurses complied with 315 of these opportunities. Figure 2 provides a summary of this information.

Table 1c shows the compliance rates before and after the introduction of visual reminders in the Dermatology Department. Initially, the compliance rate was 40.22%. There were 87 compliance opportunities, 35 of which were utilized by the participating nurses. After the introduction of visual reminders, the compliance rates increased to 83.25%. Specifically, there were 288 hand hygiene compliance opportunities, the participating nurses utilized 249 of which. Figure 3 contrasts this information.

Table 1d shows the compliance rates before and after the introduction of visual reminders in the Dialysis Unit. The compliance rate before the introduction of visual reminders was 56.81%. As shown, there were 88 hand hygiene compliance opportunities, the nurses utilized 50 of which. In comparison, the introduction of visual reminders increased the compliance rates to 82.28%. There were 271 compliance opportunities. The participating nurses only used 227 of these opportunities. Figure 4 provides a summary of this information.

Chi-Square Determination: Reject or accept the null hypothesis:

- This research selected the p-value of 0.05 because, according to Tao et al. (2018), this is the usual value for p. Since the calculated critical value exceeds each department's critical region shown in Table 1, the null hypothesis qualifies for rejection. Therefore, visual reminders will increase compliance to hand hygiene requirements at RIH by a statistically significant margin.

Germ-X Sanitizer Results

The research supplied an alcohol-based hand rub bottle and placed it at the nurses' station in each of the four departments. One full Germ X bottle contained 11.27 ml of the product. The difference between the significance of the starting and ending volume was assumed to be used for hand hygiene compliance by the participating nurses. Table 2 demonstrates the results of the Germ X Hand Sanitizer product measurements:

Table 2a The results in this table are for the Neurosurgery Department. The previous section shows that this department had a compliance rate of 33.50% before the introduction of visual reminders. At the start of the first week, the alcohol-based hand rub had 11.27 ml (100%) of Germ X. At the end of the first week, the remaining content was 10.26 ml. In other words, the nurses only used 9% of the content. In the second week, the research introduced visual reminders. As a result, there was a compliance of 84 out of 169 opportunities.

Simultaneously, the bottle started at 10.26 ml (91%) and ended week 2 at 7.33 ml (65%). In this case, the nurses used 35% of the Germ X hand sanitizers. In the 3rd week (with visual reminders), the compliance rate was 182 out of 208 opportunities. The bottle

started the week at 7.33 ml (65%) and ended the week at 3.27 ml (29%). During the final week (Week 4 with visual reminders), the bottle started at 3.27 ml (29%) and ended at 0.56 ml (5%). The graph in *Figure 5* depicts this information.

Table 2b This table shows the results collected from the Pulmonary Department. Before the introduction of visual reminders, there were a total number of 73 hand hygiene opportunities and compliance of 42 times (57.53%). Without visual reminders, the Germ X bottle started at 11.27 ml (100%) and ended the first week at 10.60 ml (94%). This observation designated that only 6% of the bottle was used, representing the nurses' lack of hand hygiene compliance in the Pulmonary Department. In Week 2, with visual reminders being present, there was a compliance of 46 out of 85 opportunities. The same week, the bottle started at 10.60 ml (94%) and ended at 8.79 ml (78%). In the 3rd week (with visual reminders), there was a compliance of 122 out of 144 opportunities. The bottle started the week at 8.79 ml (78%) and ended at 6.73 ml (42%). In the last week (Week 4 with visual reminders), the bottle started at 6.73 ml (42%), and ended at 1.58 ml (14%). The graph in *Figure 6* depicts this information.

Table 2c This table shows the results collected from the Dermatology Department. Before the intervention, there was a compliance rate of 35 out of the available 87 opportunities. In the 1st week (without visual reminders), the bottle started at 11.27 ml (100%) and ended at 10.82 ml (96%). This observation designated that only 96% of the content remaining, representing the lack of hand hygiene compliance in nurses in the Dermatology Department. In Week 2 (with visual reminders), there was a compliance of 39 out of 59 opportunities. The same week, the bottle started at 10.82 ml

(96%) and ended at 9.58 ml (85%). In the 3rd week (with visual reminders), there was a compliance rate of 101 out of 117 opportunities. The bottle started the week at 9.58 ml (85%) and ended at 6.09 ml (54%). During the 4th week (with visual reminders), the bottle started at 6.09 ml (54%) and ended at 2.25 ml (20%). *Figure 7* provides a summary of this information.

Table 2d This table is for the Dialysis Unit. Before the introduction of visual reminders, there were a total of 88 hand hygiene compliance opportunities and compliance of 50 (62.5%). Before introducing visual reminders, the Germ X sanitizer started at 11.27 ml (100%) and ended the first week at 10.37 ml (92%). This change specified that only 92% of the content remained, representing the lack of hand hygiene compliance in nurses in the Dialysis Unit.

In Week 2, the visual reminders were now available. As a result, the compliance rates increased to 47 out of 69 opportunities. In the same week, Germ X sanitizer started at 10.37 ml (92%) and ended the week at 8.12 ml (72%). In week 3 (with visual reminders), there were compliance rates of 87 out of 105 opportunities. The bottle started the week at 8.12 ml (72%) and ended at 4.85 ml (43%). During the final week (Week 4 with visual reminders), the bottle started at 4.85 ml (43%) and ended at 1.48 ml (14%). *Figure 8* provides a summary of this information.

ii. **Qualitative Results**

Focus Group Discussion

The purpose of the focus groups was to synthesize the qualitative aspects of the study. Therefore, the qualitative results are divided into five key themes regarding the role of visual reminders in enhancing the rates of compliance to hand hygiene requirements. The research consequently selected five themes, namely (1) general education, (2) reminders, (3) encouraging feedback and supervision, (4) information about the availability of utilities, and (5) the creation of a compliance atmosphere.

Theme 1: The Role of Visual Reminders as a Source of General Education

The first theme relates to the perception of visual reminders as a source of general education regarding hand hygiene, rewards for compliance, and punishments for non-compliance. In other words, this theme focused on the role of visual reminders in providing information that bridges the knowledge gap attached to compliance or non-compliance. Although this theme emerged from the respondents during the focus groups, it was also dominant during the literature review. For instance, Stahmeyer et al. (2017) argued that the lack of proper and sufficient knowledge is one reason why nurses fail to comply with the requirements for hand hygiene. As a result, the authors recommended providing educational materials to increase nurses' hand hygiene information. This theme also emerged during the focus groups, where the participating nurses indicated that "*an increase in information regarding hand hygiene can increase the rates of compliance*." At the same time, another respondent believed that compliance with hand hygiene would

"*increase by at least 25% in other healthcare facilities if the general information about hand hygiene compliance was fun and creative*".

Theme 2: The Role of Visual Reminders as General Reminders

This theme focused on the role of visual reminders in reminding nurses to undertake hand hygiene compliance requirements. This theme assumes that a significant number of nurses fail to comply with hand hygiene requirements due to forgetfulness. As a result, the provision of reminders would mostly resolve non-compliance. Initially, Vermeil et al. (2019) found that forgetfulness is one of the largest non-compliance drivers. Therefore, the authors concluded that reminding nurses of the importance of complying with hand hygiene would increase compliance. This theme also dominated the focus groups, where one respondent indicated that "*nurses have a lot of responsibilities. The work is overwhelming hence the tendency to forget about hand hygiene compliance*." In the same line of thought, another respondent indicated that "*nurses often forget about hand hygiene due to the overwhelming nature of their work. If management can provide friendly verbal reminders, the compliance rates would rise by a big margin*."

Theme 3: The Role of Visual Reminders in Encouraging Feedback and Supervision

The 3rd theme focused on the role of visual reminders in enhancing both feedback and supervision. The underlying assumption is that management and feedback are critical to the enhancement of hand hygiene compliance. During the literature review, this theme was dominant. For instance, Won and Lee (2019) discovered that nurses might fail to comply due to the lack of supervision. In such a case, the hospital management authority should monitor activities and offer rewards and punishments based on compliance rates.

In the same way, the 3rd respondent cited that "*feedback and supervision are important in ensuring compliance to the hand-hygiene requirements*." The overall implication is that nurses should require supervision to observe hand hygiene. This argument points to humans' nature, where the first reaction is to oppose an initiative rather than support it. This opposition is vital when the change disturbs the normal operations of humans.

Theme 4: The Role of Visual Reminders by Informing the Availability of Hand Hygiene Utilities

The 4th theme emerging from the focus groups is visual reminders in providing information about handwashing utilities. Examples of proclaimers providing this remembrance include "wash your hands here, soap available, hand sanitizer available, and sink available." These disclaimers' importance is that they inform nurses of the nearest places to find the utilities required for handwashing. During the literature review, this theme was also dominant. For instance, Reynolds et al. (2020) found that unawareness about handwashing utilities' availability and location reduces the compliance rates. The authors, therefore, suggested the provision of indicators showing the location of hand washing utilities. This finding aligns with a statement by one of the respondents in the focus groups who concluded that the awareness of nurses regarding the location, availability, and use of hand hygiene utilities increases compliance to hand hygiene requirements in a hospital.

Theme 5: The Role of Visual Reminders in Creating a Proper Compliance Atmosphere

The respondents' last key theme is visual reminders' role in creating a proper compliance atmosphere. Initially, Boyce (2019) indicated that nurses are likely to comply, depending on the facility's existence or non-existence of a compliance atmosphere. Usually, nurses may perceive the management as strict, non-strict, or moderately strict. The nurses can also perceive the consequences of failing to comply with hand hygiene frameworks provided at the hospital. Based on these factors, nurses can then comply, depending on the perceived rewards and punishments (Boyce, 2019). Boyce (2019) argues the arguments compare to the theory of conscious choice where people make decisions based on the perceived punishments and rewards. An extension of this argument indicates that hand hygiene posters create the impression that the hospital takes hand hygiene seriously. As one of the respondents quoted, "*the perception of hand hygiene as a serious requirement in the hospital would increase the willingness of nurses to comply*." This response closely compares to the statement by another respondent where the rates of compliance directly relate to the *"perceived rewards and punishments of compliance to hand hygiene requirements within a healthcare ecosystem*."

CHAPTER 5: DISCUSSION

Restatement of the Research

The section aims to compare the outcomes of the study against the findings by other researchers. The research set out to answer the research question- *Does the implementation of visual reminders such as posters create awareness and help increase hand hygiene compliance amongst the nursing staff?* At the same time, the research developed the following research hypotheses:

- **Null hypothesis:** The provision of visual reminders will not increase compliance to hand hygiene requirements at RIH by a statistically significant margin.
- **Alternative hypothesis:** The provision of visual reminders will increase compliance to hand hygiene requirements at RIH by a statistically significant margin.

In chapter two, researchers conducted a literature review where they found gaps in their research that needed further investigation. In particular, the materials failed to identify behavioral changes for nurses that would reduce infections positively. As a result, the research investigated the participating nurses' behavioral changes that nurses adopted to achieve clean healthcare. The research collected primary data from RIH, with 133 respondent nurses. The nurses were from four departments, namely the Neurosurgery, Pulmonary, Dermatology, and the Dialysis Unit.

Discussion of the Findings Against the Literature Review

The general quantitative results are that the compliance rates increased after the introduction of visual reminders. For instance, the Neurosurgery Department's compliance rate was only 33.49% before introducing visual reminders. After the introduction of visual reminders, the rates increased to 78.61%. In the Pulmonary Department, the compliance rate before the introduction of visual reminders were only 57.53%. After the introduction of the visual reminders, the rate of compliance increased to 79.98%. In the Dermatology Department, the compliance rate was 40.22%. The rate then increased to 83.25% after the introduction of visual reminders. The compliance was 56.81% in the final department but later expanded to 82.28% after introducing visual reminders in the Dialysis Unit.

The results that were discovered were similar to other scholars' findings covered in the literature review. In particular, most authors found that the use of visual reminders are vital in five components such as (1) general education, (2) reminders, (3) encouraging feedback and supervision, (4) information about the availability of utilities, and (5) the creation of a compliance atmosphere. For instance, Rickard (2013) discovered that about one-third of hospital-acquired infections are preventable through increased awareness amongst healthcare providers. The author also discovered that non-compliance could reduce through a change in nurses' work culture and the provision of information regarding the proper use of hand hygiene utilities.

Malihe et al. (2015) discovered a gap between nurses' and hospital management's expectations in the same line of thought. As a result, the appropriate action for bridging

the gap was using visual posters to communicate information. Equally, Akyol (2007) found that only 75% of nurses comply with hand hygiene requirements. The author also found that visual posters or other methods to convey information can primarily increase compliance rates. Equally, Zottele et al. (2017) found that nurses cannot manage healthcare provision's overwhelming nature. Some common compliance reasons include overcrowding, heavy workloads, stress, lack of knowledge regarding hand hygiene protocols, bad habits, skin irritation, and lack of positive examples from superiors. One of the strategies suggested by Zottele et al. (2017) is the provision of visual posters.

In the qualitative sections, the respondents argued that the provision of visual posters is important to the growth of compliance with hand hygiene requirements. Through theming, this research divided the responses into five main categories, namely (1) general education, (2) reminders, (3) encouraging feedback and supervision, (4) information about the availability of utilities, and (5) the creation of a compliance atmosphere. A close analysis of these themes indicates consistency with the outcomes of the literature review. For instance, Zottele et al. (2017) discovered that placing alcohol preparations at the bedside of emergency rooms would favor hand hygiene in the WHO's *Five Moments* during patient care. Multidisciplinary approaches could also be essential strategies for forming partnerships to develop learning and implementation of hand hygiene practices. This author concluded that the creation of a general atmosphere promoting compliance reduces the noncompliance by large margins. At the same time, Abdella et al. (2014) investigated the largest contributors to noncompliance. In the end, the authors recommended the provision of training courses aimed at enhancing the

understanding of hand hygiene and compliance by healthcare professionals. Also, Demirel (2019) discovered that the lack of awareness from healthcare workers increases compliance rates.

Similarly, Demirel (2019) discovered that there needs to be constant cooperation between hospital administrators, infection control committees, and quality control departments to improve hand hygiene compliance. This argument reinforces the theme of the "creation of a compliance-based atmosphere. However, the results of this research are different from some of the literature. For instance, Fox et al. (2015) found that hand hygiene had positive but insignificant effects on the levels of infections. Therefore, the authors suggested improving quality care across the platforms rather than in hand hygiene alone.

Chapter Summary

This chapter's results show that the literature review conforms with the results gathered from the research and respondents. In particular, the visual reminders, which stand for prompts that periodically remind an individual to do a specific task, positively correlate with hand hygiene compliance. Before the installation of visual reminders, the compliance rates in all departments at RIH were low. The low compliance rates were evident in the first week. In the second week, the rates improved but remained low. The rates became highest in the third and fourth weeks due to the reminders' persistence for a long time. This observation is valid since, at the start, the research anticipated that nurses would have poor compliance with hand hygiene due to a lack of visual reminders in the departments. Based on the data from the first week in all departments, the expectations

were accurate. The compliance was low due to nurses forgetting to sanitize their hands and record the key data. In the second week of the study, there was a slow but moderate shift change with the visual reminders posted. Nurses started to participate and comply actively. Participants still forgot to record their data, but it was evident that hand hygiene was improving in each of the four departments due to the increasing compliance.

With the visual reminders posted along the walls, clinic rooms of each department, and notice boards, nurses were able to get into a routine by week three of hand washing. Even though about 5% of nurses still forgot to record their data, the implementation of visual reminders typically increased the compliance rates.

By the fourth week of the study, nurses prioritized sanitizing their hands before and after patient contact and recorded their data. The visual reminders correlated a 90%-95% compliance with handwashing before and after patient contact, creating awareness in each of the four departments. The chapter's overall observation is that non-compliance with hand hygiene among healthcare workers is a complex problem. Rickard's study that links with the present study is that nurses lacked an understanding of hand hygiene as a public concern. Rickard stated for compliance to improve, the cultural change would need to take place and healthcare personnel feedback. In both studies, when healthcare professionals failed to comply, it represented a poor work ethic and reflected on the quality of care that the patients were receiving. A healthcare professionals' level of care is crucial to the community, so it is critical to comply with this public concern. This observation is similar to what the respondents indicated. For instance, one of the participants argued that "*a lot of feedback was based on the 'creativity, friendliness, and*

colorfulness' that the posters portrayed. They portrayed 'character' and positivity throughout the department. Nurse B from Neurosurgery stated*, "The posters that were put around the hospital are boring, and we tend to ignore them. With yours, they stand out. They have color and character to them. You provided us with a friendly reminder daily to wash our hands, and we believe your posters helped our department and made our patients feel safe. The reminders provided a lot of information and highlighted that compliance with hand hygiene is an issue of public concern*." These results also link to Asadollahi et al.'s where nurses' perception and their judgment on hand hygiene largely depend on visual materials' availability.

Furthermore, Reynolds et al. study also link with the present study where visual reminders improved nurses' compliance with hand hygiene requirements. Therefore, the results of this study indicate that visual reminders could be applied to other healthcare facilities. These visual reminders are useful in urgent care clinics, rehabilitation centers, doctor offices, nursing homes, and ambulatory surgical centers. In recent studies, researchers proved that many individuals have suffered and died of transmitted bacteria and infections due to contaminated hands from a healthcare professional. As a result, visual reminders can remind healthcare professionals to comply with this issue to prevent mortality and morbidity.

CHAPTER 6: CONCLUSION, STUDY LIMITATIONS, RECOMMENDATIONS, AND FUTURE RESEARCH

Conclusion

This research set out to answer the research question- *Does the implementation of visual reminders such as posters increase hand hygiene compliance amongst the nursing staff?* The specific aims of the research included (1) to provide visual reminders for enhancing compliance to hand hygiene guidelines for nurses, (2) to measure the usage of an alcohol-based hand rub, and (3) to assess the reason for compliance or noncompliance in hand hygiene practice by conducting a Focus Group Discussion. Also, the null hypothesis read as- *The provision of visual reminders will not increase compliance to hand hygiene requirements at RIH by a statistically significant margin.* On the other hand, the alternative hypothesis read as- *The provision of visual reminders will increase compliance to hand hygiene requirements at RIH by a statistically significant margin.* The prevailing research question emerged from the increasing rates of infections arising from noncompliance to hand hygiene. For instance, between 1 and 3 million people die due to healthcare-associated infections (HAIs). High costs in hospitals due to HAIs are preventable through strict compliance to hand hygiene guidelines. After the literature review, a deep gap emerged since the materials fail to identify behavioral changes for nurses that would reduce infections positively. As a result, this research investigated the different nurses' behavioral changes that nurses can adopt to achieve clean healthcare. The study, therefore, recruited 133 responding nurses working at RIH. The nurses were from four departments, namely the Neurosurgery, Pulmonary, Dermatology, and the

Dialysis Unit, located in an outpatient building called the Ambulatory Patient Center (APC) of RIH. The research collected data over four weeks. In the first week, it observed compliance rates without the provision of visual reminders. In the second, third, and fourth weeks, the research collected compliance data after visual reminders. The rates increased after introducing reminders in the four departments, thereby confirming that visual reminders positively correlate with compliance rates. For instance, the Neurosurgery Department's compliance rate was only 33.49% before introducing visual reminders. After the introduction of visual reminders, the rates increased to 78.61%. In the Pulmonary Unit, the compliance rates before the introduction of visual reminders were only 57.53%. After the introduction of the visual reminders, the rates of compliance increased to 79.98%. In the Dermatology Department, the compliance rate was 40.22%. The rate then increased to 83.25% after the introduction of visual reminders. The compliance was 56.81% in the final department but later expanded to 83.76% after introducing visual reminders in the Dialysis Unit. For understanding the association between compliance rates and visual reminders, the researchers divided the qualitative data into four main themes: (1) general education, (2) reminders, (3) encouraging feedback and supervision, (4) information about the availability of utilities, and (5) the creation of a compliance atmosphere. The overall implication is that visual reminders serve as a general source of information regarding hand hygiene, rewards for compliance, and punishments for noncompliance. The second theme assumed that a significant number of nurses fail to comply with handing hygiene requirements due to forgetfulness. Equally, the third theme, focused on visual reminders' role and found that feedback and

supervision are important in ensuring hand hygiene compliance. The fourth theme indicated that the visual reminders provided information regarding hand hygiene utilities such as water, soap, towels, and hand sanitizers. The last theme implied that visual reminders create an atmosphere of compliance, changing the nurses' culture in the medium and long term. Usually, nurses may perceive the management as strict, non-strict, or moderately strict. The nurses can also perceive the consequences of failing to comply with the hospital's hand hygiene frameworks. Based on these factors, nurses can then comply, depending on the perceived rewards and punishments. After calculating the Chi-Square statistic and discovering that the critical value exceeds the critical region, the null hypothesis qualifies for rejection. Therefore, the provision of visual reminders will increase compliance to hand hygiene requirements at RIH by a statistically significant margin. The results gathered in this research closely link to the findings gathered by other scholars. During the literature review, most studies found that visual reminders serve multiple purposes that eventually improve compliance rates. The materials agreed that visual reminders influence the nurses' culture, encourages collaboration, and reduces the nurses' resistance to changes. Also, visual reminders create an atmosphere of compliance, thus encouraging the habit of complying to hand hygiene requirements. Therefore, the research found that the answer to the research question is positive. Visual reminders' implementation created awareness and helped increase hand hygiene compliance among RIH nursing staff. The results collected in this research are also applicable to other hospitals.

Study Limitations

- **Effects of Demographic Characteristics:** Within the four weeks of the study, the four departments showed a significant increase in hand hygiene compliance based on the results. However, the research did not capture the demographic characteristics of the nurses, especially gender. Previous researchers found that the gender of participants may determine the level of compliance with instructions. Also, there is a perception that women are more attentive than men. The demographic characteristics of the nurses may have altered the results.
- **Change of Behavior:** This research required nurses to self-report their behavior regarding hand hygiene. As a result, the nurses and hospital management were aware that the research was directly observing their behavior concerning hand hygiene. The participants may alter their behavior during the study period to show the behavior they perceive the researcher is pursuing. Simultaneously, hospital management may ask the nurses to increase hand hygiene during observation to uphold the hospital's public image. Therefore, the research would increase reliability by observing the nurses without disclosing that hand hygiene practices are the variable under observation.
- **The Assumption that the Volume of Sanitizer Used is Equivalent to Compliance:** The Germ X Hand Sanitizer presents another limitation due to the amount of usage each nurse squeezed into their hands. There was no control over how much, how little, or how many times the nurses used the product. The product was measured weekly from the baseline intervention to the after

intervention of each week. The final quantitative limitation of the study is the small sample size of the Focus Group Discussion.

Recommendation

- **Proper Communication:** One of the key recommendations that will strongly motivate nurses and improve hand hygiene compliance is adequate communication with colleagues. Adequate communication informs nurses that hand hygiene is a collective rather than individual responsibility. This approach will convince nurses that they serve a purpose that is bigger than themselves. Multiple materials show that employees' portrayal as parts of a bigger destiny motivates compliance while also reducing the resistance to change.
- **Proper Education:** Another critical requirement is to increase the knowledge of nurses regarding hand hygiene. For many years, research focused on educating nurses on the methods of hand hygiene. However, this research found that nurses now need training based on the quality of their attitude. In particular, nurses need to understand that hand hygiene protects both patients and healthcare providers.
- **Visualization and Illustrations:** This research found that in of the reasons why nurses fail to comply is that the target pathogens are invisible. For reducing the invisibility of bacteria, hospitals should use visual presentations to depict the pictures of bacteria. For instance, the provision of pictures showing bacteria with spikes creates a visualization of the bacteria's image, thus encouraging compliance.

- **Rewards and Punishments:** Although hand hygiene depends on healthcare providers' willingness to cooperate, hospital management should be willing to provide incentives and penalties to increase compliance. The reason is that the evidence collected in the study suggests that some nurses may make conscious decisions to comply or fail to comply based on the rewards and punishments.
- **Acceptability of Products:** The research also discovered that hand hygiene products' acceptability also determines the extent of compliance. Some of the determiners of acceptability include the smell, feel, and skin irritation abilities of products. Also, hospital management should prefer the use of and sanitizers rather than soap and water. The reason is that soap requires proper rinsing, which may take more time than the common alcohol-based sanitizers.
- **Proper Use of Visual Materials:** This research emphasized the importance of visual materials in determining hand-hygiene frameworks' compliance. For a long time, stakeholders assumed that visual reminders should direct healthcare providers to sanitize their hands. This research discovered that graphic posters have multiple purposes, which emerged as the qualitative section's themes. They include (1) general education, (2) reminders, (3) encouraging feedback and supervision, (4) information about the availability of utilities, and (5) the creation of a compliance atmosphere. Therefore, hospital management should ensure that the posters serve multiple purposes rather than just direct nurses to observe hand hygiene compliance.

Future Research

- **Effects of Withdrawing Visual Reminders:** A suggestion for future research studies using visual reminders would be to retest the departments without visual reminders. Retesting the departments without visual reminders would show whether visual reminders' withdrawal can reduce the compliance rates. This initiative will either indicate that visual reminders impacted Rhode Island Hospital nurses, or that RIH still has additional complications that require managerial attention.
- **Antimicrobial Resistance:** Recently, there emerged evidence that microbes are developing strong resistance against penicillin and the subsequent antibiotics. In 2014, the government of the United Kingdom reported that there was a 40% increase in this resistance. The increment caused the deaths of about 700,000 persons across the globe. This research occurred without the consideration of the emerging microbial resistance. In the future, scholars should investigate whether the behavior of nurses is contributing to the opposition. Future research should also investigate whether the results of modern studies apply to the consideration of the emerging microbial resistance.
- **The Benefits of a Multidisciplinary Approach:** Most studies portray hand hygiene compliance as nurses' sole responsibility. Also, this research investigated behavioral changes that can increase adherence to hand hygiene requirements. However, a properly constituted framework of hand hygiene compliance also entails third party stakeholders such as the government. In particular, high-level

political leadership has a positive effect on general adherence to hand hygiene. For example, excellent political fundraising can allocate resources to provide free water, soap, and sanitizers. Such an increment would directly raise the level of compliance showed by nurses. Therefore, future research should investigate the role of 3rd parties in determining nurses' compliance rates.

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Appendices

I. **Table 1:** Rate of Compliance With HH Before and After Intervention

1a: Neurosurgery

	Compliance No. / (No. HH Opportunities)	Compliance Rate	P-Value
Baseline Intervention (Wk. 1)	68 / (203)	33.49%	**0.00001** *[1]
After Intervention (Wks. 2-4)	553 / (668)	78.61%	
Total No. Compliance (No. HH Opportunities.)	621 (871)		

1b: Pulmonary

	Compliance No. / (No. HH Opportunities)	Compliance Rate	P-Value
Baseline Intervention (Wk. 1)	42 / (73)	57.53%	**0.000416** *
After Intervention (Wks. 2-4)	315 / (374)	79.98%	
Total No. Compliance (No. HH Opportunities.)	357 (420)		

1c: Dermatology

	Compliance No. / (No. HH Opportunities)	Compliance Rate	P-Value
Baseline Intervention (Wk. 1)	35 / (87)	40.22%	**0.000371** *
After Intervention (Wks. 2-4)	249 / (288)	83.25%	
Total No. Compliance (No. HH Opportunities.)	375 (284)		

1d: Dialysis

	Compliance No. / (No. HH Opportunities)	Compliance Rate	P-Value
Baseline Intervention (Wk. 1)	50 / (88)	56.81%	**0.049958** *
After Intervention (Wks. 2-4)	227 / (271)	82.28%	
Total No. Compliance (No. HH Opportunities.)	277 (359)		

Grand Total of HH Opportunities:	2,025
Grand Total Number of Compliance:	1,539

[1] * P-Value is significant at the level 0.05 ($p<0.05$)

II. **Table 2:** Germ-X Sanitizer Results

2a: Neurosurgery

Time	No. of HH Compliance/ No. of Opportunities	Compliance Baseline Inter. Start Per Week (%)	Compliance After Inter. End Per Week (%)
Pre (Before, Wk.1)	68/203	11.27 ml (100%)	10.26 ml (91%)
Post (After, Wk. 2)	84/169	10.26 ml (91%)	7.33 ml (65%)
Post (After, Wk. 3)	182/208	7.33 ml (65%)	3.27 ml (29%)
Post (After, Wk. 4)	287/291	3.27 ml (29%)	0.56 ml (5%)
Total of HH Opp.	871	**Total of Compliance**	621

2b: Pulmonary

Time	No. of HH Compliance/ No. of Opportunities	Compliance Baseline Inter. Start Per Week (%)	Compliance After Inter. End Per Week (%)
Pre (Before, Wk.1)	42/73	11.27 ml (100%)	10.60 ml (94%)
Post (After, Wk. 2)	46/85	10.60 ml (94%)	8.79 ml (78%)
Post (After, Wk. 3)	122/144	8.79 ml (78%)	6.73 ml (42%)
Post (After, Wk. 4)	147/148	6.73 ml (42%)	3.58 ml (14%)
Total of HH Opp.	450	**Total of Compliance**	357

2c: Dermatology

Time	No. of HH Compliance/ No. of Opportunities	Compliance Baseline Inter. Start Per Week (%)	Compliance After Inter. End Per Week (%)
Pre (Before, Wk.1)	35/87	11.27 ml (100%)	10.82 ml (96%)
Post (After, Wk. 2)	39/59	10.82 ml (96%)	9.58 ml (85%)
Post (After, Wk. 3)	101/117	9.58 ml (85%)	6.09 ml (54%)
Post (After, Wk. 4)	109/112	6.09 ml (54%)	2.25 ml (20%)
Total of HH Opp.	375	**Total of Compliance**	284

2d: Dialysis

Time	No. of HH Compliance/ No. of Opportunities	Compliance Baseline Inter. Start Per Week (%)	Compliance After Inter. End Per Week (%)
Pre (Before, Wk.1)	50/88	11.27 ml (100%)	10.37 ml (92%)
Post (After, Wk. 2)	47/69	10.37 ml (92%)	8.12 ml (72%)
Post (After, Wk. 3)	87/105	8.12 ml (72%)	4.85 ml (43%)
Post (After, Wk. 4)	93/97	4.85 ml (43%)	1.48 ml (14%)
Total of HH Opp.	359	**Total of Compliance**	277

**** 887ml = 100% = 11.27ml**

Grand Total of Opp. **2,055**

Grand Total No. of Comp. **1,539**

III. Graphs (Figure 1-8)

Visual Reminders Results:

Figure 1

Compliance in the Neurosurgery Department

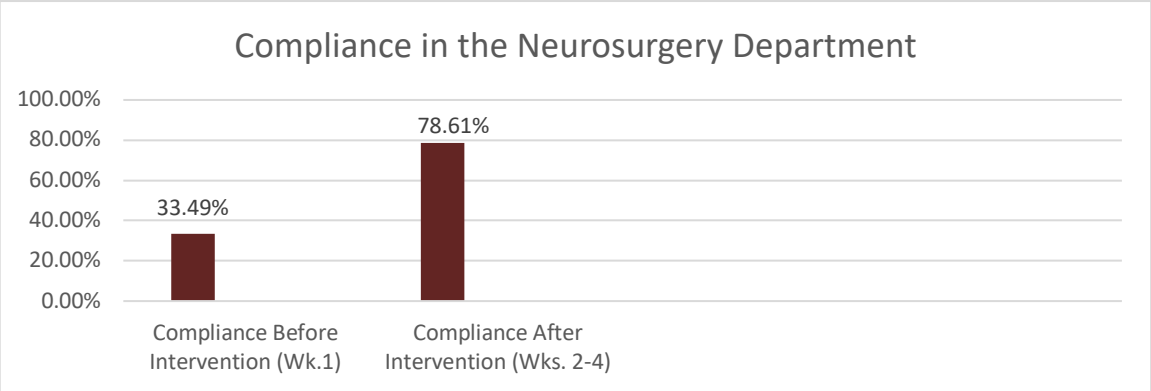


Figure 2

Compliance in the Pulmonary Department

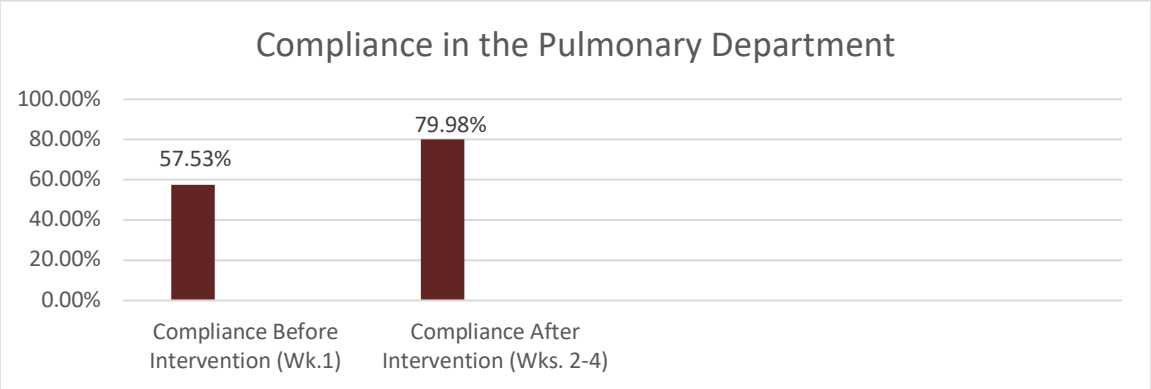


Figure 3

Compliance in the Dermatology Department

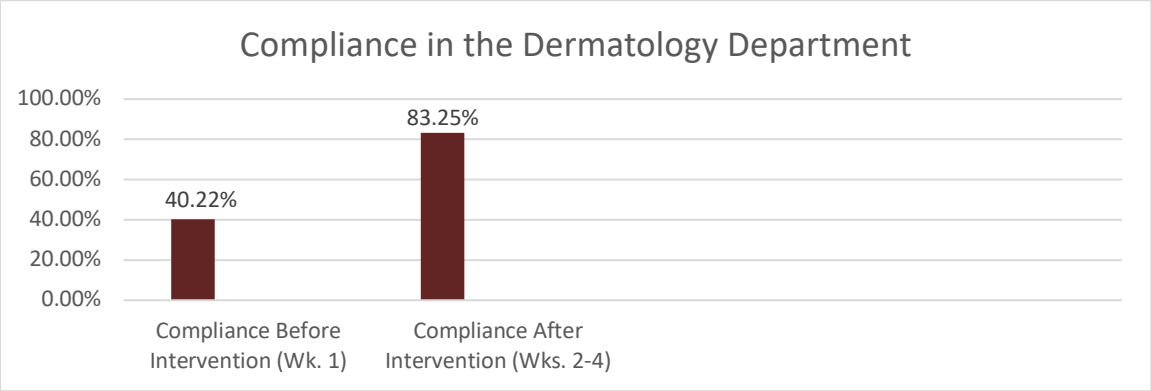
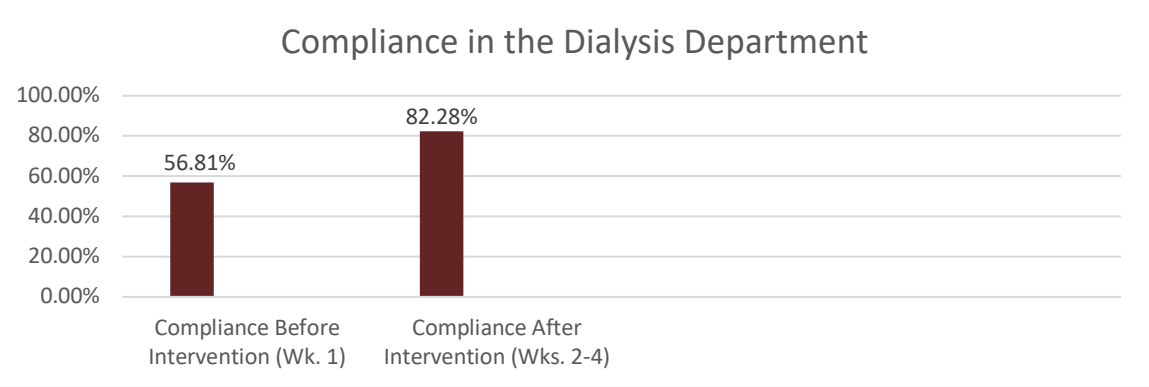


Figure 4

Compliance in the Dialysis Department



Germ X Results:

Figure 5

The volume in ml used in the Neurosurgery Department

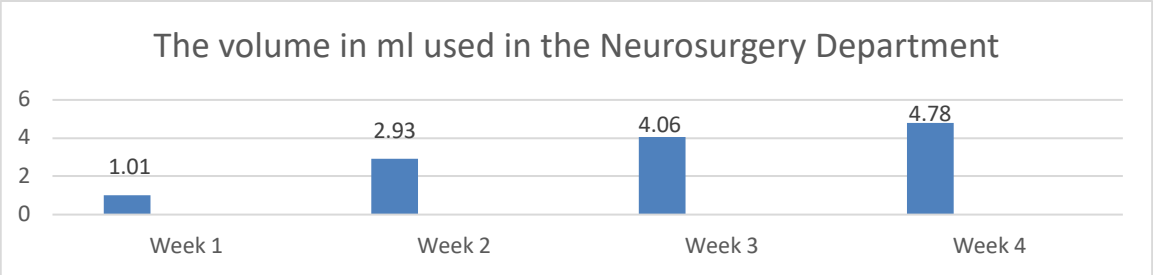


Figure 6

The volume in ml used in the Pulmonary Department

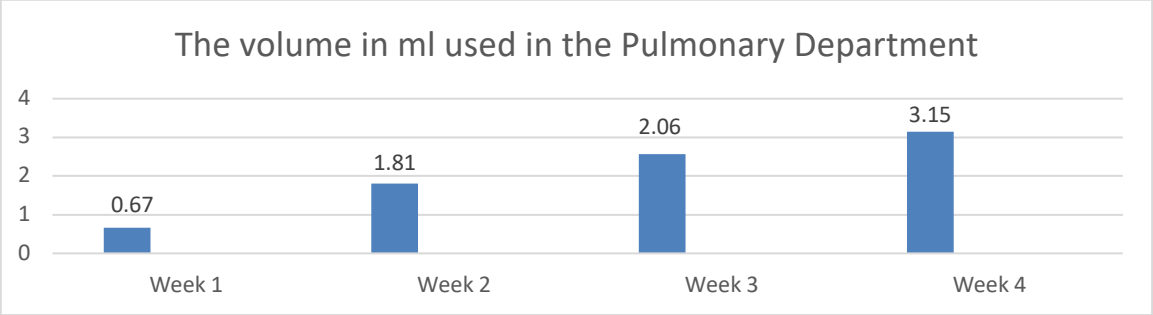


Figure 7

The volume in ml used in the Dermatology Department

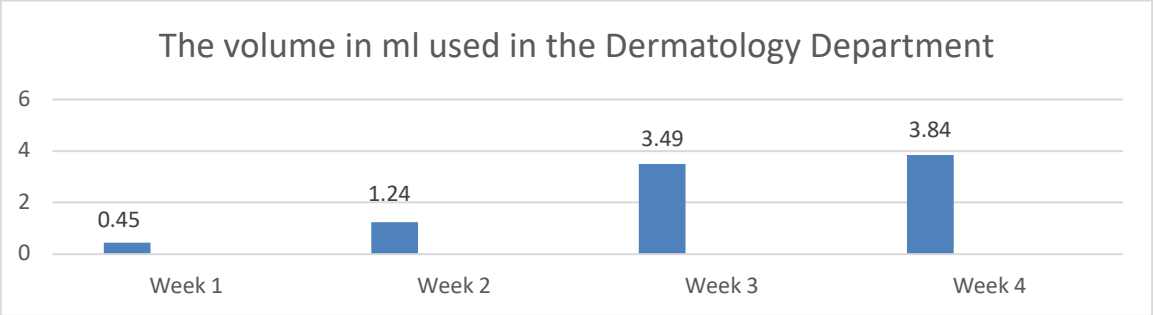
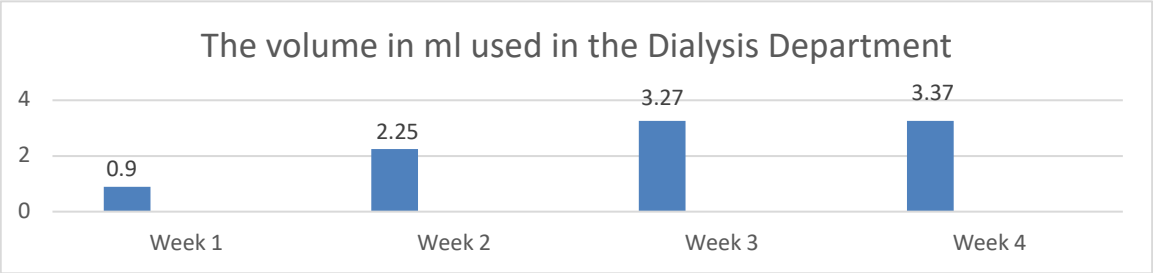


Figure 8

The volume in ml used in the Dialysis Department



IV. Focus Group Discussion Questions:

Was the implementation of the posters useful?

The participants had positive feedback when discussing the implementation of the posters. According to the nurses, a lot of feedback was based on the 'creativity, friendliness, and colorfulness' that the posters portrayed. They portrayed 'character' and positivity throughout each of the four departments. Nurse B from Neurosurgery stated, "The posters that are put around the hospital are boring, and we tend to ignore them. With yours, they stand out. They have color and character to them. You provided us with a friendly reminder daily to wash our hands and we believe your posters helped our department as well as made our patients feel safe."

The implementation of the posters also created a better learning experience for the nurses and helped understand how severe this ongoing issue is. Nurse A from Neurosurgery stated, "The posters were handy. Even though we have posters here, we can say collectively as a group that we had a better learning experience with yours." In addition, Nurse A from Pulmonary stated, "We are required to wash our hands frequently because we come in the most contact with patients, but sometimes we tend to forget more so when it is a busy clinic day. When your posters were surrounded in our department, especially in the clinic rooms, it reminded us that this is something that we need to take more seriously."

After participating in the study, how important is hand hygiene to you?

Equally important to the creativity and friendly reminder that the posters brought to the four departments, they also created a better understanding of knowledge and

changed behavior that will help create awareness in the compliance of hand hygiene. Nurse B from Dermatology stated, "Keeping our hands clean is one of the most important steps that we can take to avoid the spread of germs, bacteria, infections and any lingering diseases that may take place in our department, as well as the facility. Being a nurse, I don't think hand hygiene is taken seriously, and as us nurses dealing with a patient and their faces, I believe it extremely important to wash, wash, and wash!" Nurse A from Dialysis also stated, "Contaminated hands can cause serious complications, especially for our pediatric and elderly patients, as well as those who have a weakened immune system. All it truly takes is about 15 seconds of your day, squeeze/press the tube of sanitizer, rub your hands together until dry, and that's it!"

Furthermore, the presence of the visual reminders created nurses to become much sensitive and caring about the issue with the understanding of future consequences. Nurse A from Dermatology stated, "Hand hygiene is always important. It opens your eyes in perspective to where if we as nurses forget to wash our hands that one time it could affect millions of other people, it is a domino effect."

Do you have any other suggestions and or recommendations that could help motivate nurses to help improve the compliance of hand hygiene?

Along with getting feedback from the nurses regarding the implementation of the visual reminders and how vital hand hygiene was to them, they were also allowed to suggest recommendations that they felt would help improve the compliance of hand hygiene. Nurse C from Neurosurgery stated, "A simple but important recommendation that could help motivate nurses to help improve the compliance of hand hygiene would

be to carry around a personal UV bacteria light. The UV bacteria light would help show the nurses the amount of bacteria that are located on doorknobs, nurse's stations, desktops, counters, clipboards, etc. Once nurses notice the amount of bacteria, there is with the UV light; this will motivate our colleagues to wash much frequently. We never really realize how much bacteria and germs are surrounding us, so if the bacteria were clear as day, a lot of things would change in the healthcare industry." Nurse C from Dermatology also stated, "A suggestion/recommendation that I would completely agree on would be to carry personal hand sanitizers. Sometimes the sanitizer dispensers here are empty, and it usually takes maintenance a couple of days to refill them. I think carrying personal sanitizers would help motivate and increase the compliance of hand hygiene because the bottle is convenient and trustworthy. I believe it should almost be a requirement to carry around, promoting to live a healthy lifestyle starts with us."

IRB Approval:	**6/7/2018**
IRB Accepted:	**6/7/2018**

V. Informational Letter/ Consent Form

How Can We Improve Hand Hygiene Compliance Among Healthcare Professionals?
PI: Karina Bertsch, Rhode Island Hospital (401) [redacted]
Lead Researcher: Marissa Moniz (401) [redacted]

You are being asked to take part in a research study here at Rhode Island Hospital, looking at the effectiveness of visual reminders for better hand hygiene. We are specifically recruiting nurses in the Departments of Neurosurgery, Pulmonary, Dermatology, and the Dialysis Unit.

Participation in this study is voluntary and does not affect your standing within your employment. You can choose not to participate and will not be forced to do so. If you do choose to participate, you can change your mind at any time and let the lead researcher know that you chose to withdraw from the study. There will be no consequence as a result of doing so.

If you want to take part in this study, let the researcher know that you want to take part and you will be asked to tally on a data sheet the number of times you wash your hands before and after patient contact. The data will determine how often nurses wash their hands before and after the implementation of visual reminders (i.e. healthy hand posters) in the departments. Self-reporting data will be used to collect the data during 8 hour shifts for 4-5 weeks. The study will take place in the Departments of Neurosurgery, Pulmonary, Dermatology and the Dialysis Unit, located in the Ambulatory Patient Center (APC) of Rhode Island Hospital.

There is no foreseen risk to taking part in this study, and the potential benefit could potentially be improved hand hygiene. All participants in the study will be anonymous.

If you have any questions or concerns about participating in the study, you can contact the PI or Lead Researcher (see above), or Janice Muratori in the Lifespan Office of Research Administration at (401) [redacted].

If you decide to quit the study after initiating participation, we may continue to use information that was collected before you quit the study to complete analysis and reports of this research.

_____

Participants Name

_____

Researchers Name

VI. RIC IRB Informed Consent

SECTION 8: INFORMED CONSENT

8.01 Types of Informed Consent

A fundamental ethical principle of research with human participants is that each person has the right to choose whether to be in a study. No person can be coerced to participate in research, and there can be no negative consequences of declining participation or withdrawing from a study. The consent document provides participants with a description of the study, its risks and benefits to the participants, and explains their rights as a research participant. The consent document should provide sufficient information for the person to make an informed decision about whether to participate. Depending on the targeted population, different documents may be needed:

Consent Document: **For adults who are legally capable of providing consent on their own behalf. Adults who are incapable of providing legal consent in any way due to medical, psychological, developmental, or cognitive limitations or conditions require the permission of a legal guardian in order to be a research participant.**

Permission Document: **For legal guardians of adults incapable of giving legal consent or for minors (under the age of consent). The age of consent may vary depending on the local customs of where the data is collected. Both parents must give their permission unless one parent is deceased, unknown, incompetent, or not reasonably available, or when only one parent has legal responsibility for the care and custody of the child. A waiver of permission may be granted if the research involves a population for which parental or guardian permission is not a reasonable requirement in order to protect the participants (for example, neglected or abused children), provided an appropriate mechanism for protecting the children who participate in the research is substituted, and provided that the waiver is not inconsistent with federal, state, or local law.**

Assent Document: **For minor participants (7-17 years of age). Children below the age of 7 are given a verbal description of the activities and asked whether they would like to participate in the activity. Parents or legal guardians must give permission before asking the child for assent. A waiver of assent may be granted if the capability of some or all of the children is so limited that they cannot reasonably be consulted or if the intervention or procedure involved in the research holds out a prospect of direct benefit that is important to the health or well-being of the children and is available only in the context of the research. See Section 9.03 for more information regarding research with minors.**

VII. Healthy Hands Posters

IRB Approval:	6/7/2018
IRB Accepted:	6/7/2018

Did You Remember to Wash Your Hands?

Healthy hands start with us!

Clean hands save lives!