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Improving Hand Hygiene in an Intensive Care Unit

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This is to certify that the doctoral study by

Charles Njenje

has been found to be complete and satisfactory in all respects,

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the review committee have been made.

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2018

Abstract

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by

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BS, University of Central Oklahoma, 1984

BSN, Langston University, 1996

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Doctoral Project Submitted in Partial Fulfillment

of the Requirement for the Degree of Doctor of Nursing Practice

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Abstract

Health-care–associated infections (HCAIs) affect hundreds of millions of people worldwide, causing morbidity and mortality among hospitalized patients. About 2 million patients suffer from HCAIs in the United States, and it is estimated that 99,000 of them die each year. Studies have indicated that transmission of health-care-associated microorganisms occurs through contaminated hands of health care workers. Hand hygiene (HH) is the single most effective way to prevent health-care-associated infections, yet health care workers' hand hygiene compliance remains low. One factor responsible for poor compliance with hand hygiene guide-lines are lack of knowledge of good hand hygiene and lack of hand hygiene techniques. This project evaluated the effect of educational program on hand hygiene for intensive care unit (ICU) healthcare workers. The Health Belief Model was applied as the framework in this project. Key components of the model are perceived susceptibility, perceived severity, perceived benefit, and perceived barriers. A convenience sample of 25 ICU healthcare workers participated in the educational program. Pre- and post- education surveys and tests were assessed using descriptive statistics. Results were consistent with existing findings indicating that education is needed to improve HH compliance and that effective HH reduces infections. The findings from this project may contribute to positive social change by promoting increased HH knowledge and infection prevention while decreasing complications of treatments, costs, morbidity, and mortality, thereby promoting a healthy and safe community.

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Dedication

This project is dedicated to my wife, Blessing Njenje, who has always encouraged me not to quit but finish what I have started. Her fervent prayers and encouragement sustained me throughout the writing of this project. Without her deep love and caring support, it would not have been possible. I also dedicate this dissertation to the memory of my senior brother, Titus Njenje who taught me the value of education and hard work.

Acknowledgement

I would like to express my sincere gratitude and appreciation to Dr. Nichols, my committee chair, for her continuous assistance and support throughout this project. Her support, guidance, and advice have been vital component of my success. I would also like to show my deep appreciation to other members of the committee, Dr. Minnick and Dr. Valdez for their encouragement and suggestions. Dr. Minnick critiqued the project relentlessly and provided meaningful corrections. Dr. Valdez reviewed the project thoroughly and provided positive feedback that brought the project towards a completion. Finally, my sincere appreciation to my family for standing with me throughout the writing of this project. They sacrificed much just to see me complete this journey successfully. Thank you.

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Section 1: Overview of the Evidence-Based Project

Introduction

Hospital acquired- infections (HAIs) are among the most serious complications of healthcare worldwide (Jarvis, 1996; Jeon Seo, 2011). HAIs, also known as *health-care-associated infections* (HCAIs) or *nosocomial infections*, cause serious burdens to health care facilities, clients, and families (World Health Organization [WHO], 2010). HAIs increase hospital costs, length of hospital stays, morbidity, and mortality (Attack & Luke, 2008; Jarvis, 1996; Sharir et al., 2001). Jarvis's work on HCAIs has not changed in the contemporary literature. Infections acquired in the hospital by admitted patients, patients' visitors, and health care workers are considered the fifth leading cause of death in acute care facilities (Jarvis, 1996). The first line of defense in preventing the spread of infections, microorganisms, illness, and disease is good hand hygiene (Akyol, 2005; Mc-Guckin et al., 2004; Mishra et al., 2013; Pitted et al., 2004; Squires et al., 2013).

The association between hand hygiene and transmission of diseases was established about 200 years ago (Burton, 2007; Mishra et al., 2013). As recounted by Shafer (2014), the idea of hand hygiene was originally introduced by Ignaz Semmelweis, a Hungarian physician who found that hand washing by physicians and nurses before delivering babies reduced the mortality rate of postpartum women(Biddle, 2009). Semmelweis urged fellow physicians and nurses involved in child delivery to wash hands between patients' contacts.

He was ridiculed and called a lunatic by fellow physicians and eventually was fired from his post as an assistant lecturer in the department of maternity at a hospital, in Vienna, Austria

(Biddle, 2009). As time progressed, his suggestion that hand hygiene was most effective way to prevent HAIs was recognized as valid (Shafer, 2004). Previous studies have indicated that infectious agents leading to HAIs are transmitted on health care workers' hands through contamination with microorganisms in health care environments (Allegranzi et al., 2009; Mishra et al., 2013).

Problem Statement

It is estimated that hundreds of millions of people worldwide, suffer from infections acquired in hospitals (WHO, 2010). HAIs affect developed and undeveloped countries (WHO, 2007, 2010). In developed countries, about 8% of the population acquires one or more infections while admitted to the hospital (WHO, 2007). In undeveloped countries, more than 20% of the population is affected by HAIs. In the United States, for example, it is estimated that 1 in 136 patients becomes sick as a result of infections acquired in the hospital (WHO, 2007). This is equal to 2 million people a year, leading to approximately $6.5 billion in costs and about 99,000 deaths. In European countries, there are about 4,131,000 cases of HAIs each year, with estimated costs of $9.6 billion and more than 37,000 deaths each year (WHO, 2010). In Mexico, one of the undeveloped countries of the world, about 450,000 hospitalized neonates acquire infections, with these costing about $12,155 per case and leading to more than 35 deaths per 100,000 neonatal admissions (WHO, 2007, 2010).

Studies suggest that HAI rates in intensive care units (ICUs) are far higher than in other inpatient hospital populations (Dasgupta, Das, Chawn, & Hara, 2015; Yost & Martin, 2017). A study of 42 hospitals in Thailand in 2001 showed that ICUs had the highest infection rate compared with other hospital units (Picheansathaian, Pearson, & Suchaxaya, 2008). The severity of the illnesses of ICU patients, coupled with invasive devices used in ICUs introduces

opportunities for transmission of pathogens that cause infections (Yost & Martin, 207). An ICU is an arm of a hospital with special equipment and specially trained personnel to care for severely sick patients who require continuous attention (Rodriguez et al., 2015). The nurse- to- patient ratio in an ICU is usually 1 to 2 (Rodriguez et al., 2015). Nosocomial infection is an important public health problem in ICUs around the globe, and is associated with morbidity, mortality, costs, and lengthened hospital stays (Rogers, Alder dice, McCall, Jenkins, & Craig, 2010; Vincent et al., 2009). HAIs in ICUs demand immediate attention (Picheansathian et al., 2008).

Hand hygiene, which is cost effective, is generally accepted as the single best means of controlling infections in ICUs or elsewhere, but adherence to recommended hand hygiene protocols by healthcare workers remains poor (Rogers et al., 2010; Salam et al., 2012). A systematic review by Erasmus et al. (2010) found that ICU healthcare workers' compliance with hand hygiene guidelines in hospital care was below 40%. It is surprising that , irrespective of the general acknowledgement that hand hygiene plays a pivotal role in reducing HAIs, adherence among health care workers continues to remain poor, than expected (Rodriguez et al., 2015; Rosenthal et al., 2005). The concerns of any health care facility should be the safety of patients, visitors, and staff. Therefore, it becomes absolutely imperative to implement a comprehensive educational program on hand hygiene for ICU health care workers to increase their hand hygiene knowledge and practices. Measures to enhance hand hygiene knowledge and practices in all hospital facility units to reduce infections are critical, irrespective of patients' diagnoses, risk factors, and infection status (Madrazo et al., 2009).

Purpose Statement

The aim of the project was to evaluate the effects of a comprehensive educational training program on hand hygiene for ICU health care workers, in terms of participants' knowledge and practices.

Objectives

The objectives of the project included the following:

- To improve ICU health care workers' knowledge, attitude, and behavior about hand hygiene.
- To increase hand hygiene practices for ICU health care workers to reduce the spread of HCAIs.

Significance or Relevance to Practice

Hand hygiene is the single most important strategy for preventing HAIs (Pittet, 2003; Randle, Charke, & Storr, 2006). Several studies have indicated that healthcare workers' hands harbor pathogens that cause infections (Anderson, 2014; Madrazo et al., 2009; Stone, 2001). Many patient-care activities, such as wound care, intravenous catheter care, respiratory tract care, urinary tract care, bathing, medication administration, handling patients' secretions, taking vital signs and touching contaminated surfaces in patients' vicinity leave health care workers' hands contaminated with microorganisms that cause infections (Anderson, 2014). Health care workers should wash their hands on entering and exiting a unit, before and after patient contact, before and after procedures, before and after eating, after handling body fluids, after using the bathroom, and after touching surfaces within a health care facility to prevent the spread of

infections from one person to another (Anderson, 2014; Garrett, 2013; Rogers et al., 2010). Health care workers should consistently practice hand hygiene and teach patients to do the same.

Health care institutions should institute hand hygiene policies and discipline no-compliance. It is critical that healthcare professionals practice effective hand hygiene using soap and water or alcohol-based hand rub to prevent the spread of infections (Anderson, 2014). Hospital should have hand hygiene policies to implement hand hygiene practices. Moreover, health care workers should have sound education on hand hygiene. The relationship between hand hygiene and the spread of infections should be made clear to health care workers. The role of hand hygiene in care processes and techniques for hand hygiene should be fully understood by health care professionals. It is imperative that health care leaders look for ways to promote a sustained adherence to hand hygiene guidelines (Stone et al., 2010). Patients come to health care facilities to be cared for, and to receive adequate, safe, and effective care, not to acquire infections. Managers, policy makers, and organizations should provide health care workers with essential hand hygiene products and motivate health care workers to make behavioral changes (Allegranzi et al., 2009).

Project Question

Among ICU healthcare workers, to what degree does hand hygiene education improve hand hygiene knowledge and practices to eradicate or reduce HCAIs?

Evidence –Based Significance of the Project

Numerous studies have indicated that proper hand hygiene is the number one means of reducing HAIs (Allergens & Pittet, 2009; Ale mango, Guten, Warthman, Young, & Mackay, 2010; Garrett, 2013; Madrazo et al., 2009; Marra et al., 2010). In a study conducted at the

University of Geneva hospital by Pittet et al. (1995), a hand hygiene program was started following the administration of baseline surveys of hand hygiene knowledge, practices, beliefs, attitudes, and compliance. The university of Geneva hospital is a large acute care teaching hospital that provides health care services to the people of Geneva, Switzerland, and surrounding cities. Hand hygiene tools such as sinks, soap, paper towels, and bottles of alcohol-based hand disinfectants were made available in all patients' rooms. Colorful posters with messages such as "your health is in your hands," "clean your hands," "stop germs spreading," and "clean hands saves lives," were placed at strategic locations emphasizing the importance of hand hygiene. The participants in the project were doctors, nurses, and representatives from each ward. After 5 years of annual hospital surveys, hand hygiene compliance improved among health care workers, and the annual HAIs rate decreased significantly, from 16.9% to 9.9% (Pittet et al., 2000). Similarly, Larson (2003) documented that the prevalence of nosocomial infections decreased as health care workers' compliance with recommended hand hygiene measures improved.

A study conducted by Lua et al. (2012) with school children showed that students exposed to hand hygiene facilities, and brief, repeated instructions on hand hygiene use, had fewer school absences due to illness than students who did not receive repeated instruction on hand hygiene use. Hand hygiene is recognized by Infection Prevention and Control Department as the most single important means of decreasing the spread of infection in both health care facilities and communities (Garrett et al., 2013).

Implications for Social Change in Practice

After this project was completed, health care workers' hand hygiene knowledge increased, as did the impact of hand hygiene in reducing HAIs. ICU health care workers' hands were protected from harmful germs, the healthcare environment was protected from pernicious

organisms, and the spread of bacterial infections from health care workers to patients or vice versa was prevented. Ultimately, HCAIs in the ICU at the end of the project were minimized, if not eradicated. The rate of catheter –associated urinary tract infections decreased from 1.4 % to 0% and central –line- associated blood- stream infections were at 0%. Lower HAI rates due to improved hand hygiene have many potential benefits. For instance, patients may not stay longer for treatment than expected due to HAIs. There may be fewer complications and lower treatment costs owing to elimination of HAIs. There may be less absenteeism from work by health care workers, which would benefit patients through adequate staffing. Further, preventing HAIs would reduce morbidity and mortality (Doronet al., 2011; Garrett, 2013).

The aim of hand hygiene is to reduce microorganisms on the hands as much as possible (Garrett et al., 2013). Intensified educational programs aimed at teaching hand hygiene practices increase health care workers' understanding of the importance of hand hygiene and enhance their motivation to perform the recommended practices. Health care institutions should ensure that HAIs are prevented to provide a safe environment for patients, staff, and visitors. HAIs represent a safety concern and should be taken seriously by hospital personnel.

Definition of Terms

Important terms used in this study include *hand washing, hand hygiene, hand sanitizers, alcohol-based hand rub, sinks, posters, plain soap, waterless* and *nosocomial infection. Hand hygiene* is the act of cleaning one's hands, with or without the use of water or other liquids (McGeer, 2005; Pittet et al., 2000; Rosenthal et al., 2005; Squires et al., 2013). *Hand sanitizer*, otherwise known as *waterless hand-rub,* is an antiseptic agent used as an alternative to hand washing with soap and water, which is applied to hands to reduce the number of microorganisms (WHO, 2009). Alcohol –based hand –rub is extensively used in hospitals as an alternative to

hand sanitizer to reduce the growth of microorganisms (Rosenthal et al., 2005; WHO, 2009). *Posters* are printed paper signs, notices, or advertisements with pictures and messages, which may be attached to walls or other vertical surfaces in public places (Webster, 1998). *Plain soap* is a detergent that contains no antimicrobial agents (WHO, 2009). A hospital acquired infection (HAI) or health-care-associated infection (HCAI) is an infection that was not present when a patient was admitted to the hospital or other health care facility, but was acquired through the delivery of health care (Department of Health and Human Services, 2015; Dasgupta et al., 2015). Such infections are often called nosocomial infections.

Assumptions

Health care workers should know about hand hygiene and its importance in preventing the spread of infections. Health care professionals should know about HAIs and how to control them. They should know about hand hygiene products available on the unit. Healthcare workers should know the techniques of good hand washing. They should know hand hygiene recommendations from the Center for Disease Control and Prevention (CDC), WHO, and Joint Commission that are found in the infection control policies of healthcare facilities and are published in all infection control and public health guide lines (Squires et al., 2013). Health care workers should know that hands harbor microorganisms that cause infections and should be washed routinely and effectively.

Summary

Section 1 addressed hand hygiene and its relationship with infections. I discussed infections acquired in the hospital while receiving treatment and their consequences for patients and the health care industry. Further, I discussed infections in ICUs and hospitals around the

world. I then explained the aims and objectives of this project. I discussed the project's relevance to nursing practice and described the evidence-based significance of the project. Finally, I defined some of the terms used in the study as well as the project's importance for social change in practice.

Section 2: Review of the Scholarly Evidence

Introduction

Nosocomial infections are serious complications of health care (Javis, 1996; Jean Seo, 2011). Millions of people worldwide suffer from HAIs (WHO, 2007, 2010) which occur in developed and undeveloped countries (WHO, 2007, 2010). The cost of treating HAIs is alarming. Further, many infected patients die each year (WHO, 2007, 2010).

Studies have indicated that ICUs have the highest of nosocomial infections among hospital units (Dasgupta et al., 2015; Yost & Martin, 2017). The association between hand hygiene and the transmission of infection was proven many years ago (Burton; Mishra et al., 2013). Hand hygiene has been generally accepted as the single most effective means of reducing infections.

The project focused question was the following: Among ICU health care workers, to what degree does hand hygiene education improve hand hygiene knowledge and practices to reduce HAIs? The aim of the project was to evaluate the effects of a comprehensive educational program on hand hygiene for ICU health care workers in terms of their knowledge, their practices, and ICU infection rates.

In this section, I presented a review of the existing literature about the project, hand hygiene. I also discussed the conceptual model or theory that formed the basis for the project, as well as my role as a DNP student and the project's manager.

Published Outcomes and Research

According to Evagelene (2010), a literature review is a systematic examination of publications related to a research topic; it is a key step in the research process. Research studies and related information on hand hygiene were obtained electronically. The CINAHI, Medline,

Pub-Med, Ovid Nursing Journal, and Cochrane data bases were used. Search terms included *hand hygiene, hand washing, hospital-acquired infections, health-care-associated infections, nosocomial infections,* hand *hygiene practices, hand hygiene compliance, and hand hygiene education.*

Research articles and information published prior to 2000 were excluded from the review unless source was original research and relevant to the topic. When I incorporated an older source into the review, I ensured that the data were verified by current articles (Demayo, 2012). The search for the literature yielded numerous articles and information on hand hygiene. Most of the articles located however, were rejected because they were too old or did not report original research.

Specific Literature

A randomized control study was conducted in the homes of 292 families with children who were enrolled in out-of-home child care in 26 child care centers in Massachusetts (Sandora et al., 2005). Eligible families for the study had one or more children who were 6 months to 5 years old and were enrolled in child care for 10 hours a week. The families who met the eligibility requirements for the study provided written consent (Sandora et al., 2005). The intervention families received a supply of hand sanitizer and biweekly educational materials for 5 months. The educational materials addressed hand hygiene and hand hygiene practices. The control families received materials promoting good nutrition and did not receive hand sanitizer (Sandora et al., 2005). During the study, there were a total of 1,803 secondary respiratory infection and 252 GI infections. Secondary respiratory and GI infections were significant in the control group (Sandora et al., 2005).

McGuckin et al. (2001) evaluated a patient education behavioral model for improving hand hygiene compliance and patients' empowerment to take responsibility for their care in an acute care hospital in Oxford, United Kingdom. This was a controlled intervention study that compared medical and surgical patients. Ninety patients were found eligible for the study. 39 agreed to participate in the program, partners in your care by asking the following questions of health care workers who were going to have direct care contact with them, "Did you wash your hands?" Compliance was measured through soap/alcohol usage and hand washing per day before and after the intervention (McGuckin et al., 2001). The authors found that the program increased hand washing by an average of 50%. Health care workers washed their hands more than often with surgical patients than with medical patients. The partners in your care program increased hand washing in the United Kingdom (McGuckin et al., 2001).

A similar 6-weeks pre and post-intervention program was conducted at a rehabilitation unit at a university in Philadelphia, Pennsylvania, for healthcare workers, patients, and families (McGuckin et al., 2001). The program empowered patients with responsibility for their own care. Thirty five patients enrolled in the intervention phase after agreeing to ask healthcare workers who had direct contact with them, "Did you wash your hands?" Within 24 hours of admission, patients were visited by a premedical graduate to discuss the importance of hand hygiene in preventing health-care-related infections (McGuckin et al., 2001). Patients were given hand hygiene brochures. Study participants were shown video on the importance of hand hygiene. There was a three months follow- up after the study. Compliance with hand hygiene with the program was measured through soap or sanitizer usage per resident day before, during, and after the intervention (McGuckin et al., 2004). Authors found that patient education increased hand

hygiene compliance to 94% during the 6-week's intervention, 34% after the intervention, and 40% at the 3-months'follow-up.

A study to investigate the impact of an education program on hand hygiene compliance and nosocomial infection incidence was conducted by Brug et al. (2010) in an urban neonatal intensive care unit in the Netherlands. The intervention/observational study involved two pretests and two posttests or measurements. The participants were health care professionals who had physical contact with very low-birth-weight patients. The study lasted for 4 years. Hand hygiene practices before and after the education program was compared by guided observations. The incidence of nosocomial infections was compared as well (Brug et al., 2010). The authors found that hand hygiene compliance before patient contact increased from 65% to 88%. The number of low birth weight with infection decreased from 44% to 36% after intervention. The improvement of hand hygiene practices among health care professionals due to education program resulted in a reduction in nosocomial infections (Brug et al., 2010).

A study to evaluate the impact of a comprehensive training program about hand hygiene on nursing assistants' knowledge and compliance, as well as on the infection rate of nursing home residents, was conducted in northern Taiwan at three long-term care facilities (Hung & Wu, 2008). Forty nursing assistants participated in the program. The program consisted of a 1 hour in-service class and 30 minutes of practice. Baseline data for the nursing assistants' knowledge of hand hygiene and infection rate for nursing home residents were calculated (Hung & Wu, 2008). After the training, the nursing assistants' knowledge, and compliance, and the nursing home residents' rate of infection were calculated. The researchers found that the nursing assistants' hand hygiene knowledge significantly increased from 13'82% to 15.4% and hand

hygiene compliance increased from 9.34% to 30.36%. There was also a reduction in the residents' infection rate, from 1.74% to 1.52% (Hung & Wu, 2008).

In 2001, Naikoba and Hayward conducted a systematic review of 21 studies published before 2000. Seventeen of these articles were classified as uncontrolled trials. Fifteen took place in critical care units. Articles detailing many different interventions and combinations of interventions to improve hand hygiene were discussed. The reviewers concluded that multifaceted approaches promoted hand hygiene compliance more effectively than single interventions (Hayward & Naikoba, 2001).

A multifaceted hand hygiene education program with a 9- month follow- up was conducted with health care workers at the neonatal unit of a children's hospital in Geneva by Pessoa –Silva et al. (2008). The study lasted for 3 years from 2001 to 2004. Compliance with hand hygiene was assessed during successive observation surveys. HCAIs were assessed using pulsed field gel electrophoresis (Pessoa-Silva et al., 2008). A comparison of observed hand hygiene compliance and infection rates before, during, and after the intervention was conducted. The authors found that overall hand hygiene compliance improved from 44% to 55%. A 9-month follow-up survey indicated a sustained 54% improvement in compliance with hand hygiene protocols. There was a significant reduction in infection among very low-birth-weight neonates after the intervention (Pessoa-Silva, 2008).

A 4-year multimodal "Clean Your Hands" campaign organized in England by the National Patient Safety Agency found improvement in healthcare professionals' hand hygiene knowledge and compliance along with reduction in nosocomial infection (Storr & Kilpatrick, 2013).

Lau et al. (2012) conducted a hand hygiene intervention in two Chicago elementary schools in 2009 and 2010 to determine the effect of hand hygiene, infection, and absenteeism. The study was conducted in the months of October and May during flu season. The participants were elementary school children between the ages of 4 and 14 years. The control and intervention groups were provided with hand hygiene facilities (soap, sanitizer) for all students. The intervention group was also given short, repetitive instructions on hand hygiene every 2 months. Absenteeism percentages for students with access to hand hygiene facilities and students with both hand hygiene facilities and instruction were calculated and analyzed. The researchers found that students who had access to hand hygiene facilities and hand hygiene instruction had lower absenteeism due to respiratory and gastrointestinal infections than students who had access only to hand hygiene facilities. The authors concluded that adding instruction to existing hand hygiene practices improves compliance and reduces infection (Lau et al., 2012).

General Literature

A host of studies have indicated that hand hygiene reduces HAI occurrence (Aiello et al., 2008; Garrett, 2013; Madrazo et al., 2009; Marra et al., 2009; McGuckin et al., 2004; Pittet, 2001; Rogers et al., 2009; Seo, 2011). WHO (2007) stated that hand hygiene is the single most effective action to prevent HAI in order to ensure patient safety. According to WHO, hand hygiene compliance is unacceptably low, and this situation has contributed to the transmissions of microorganisms that are cable of causing avoidable HAIs.

The first hand hygiene guidelines were published in the United States, Canada, and Europe (Mishra et al., 2013). Between 1995 and 1996, CDC and the Health Infection Practices Advisory Commission (HIPC) recommended the use of antimicrobial soap or waterless antiseptic agents for hand cleaning (Mishra et al., 2013). In 2007, the Joint Commission on

Accreditation of Hospital Organizations (Joint Commission) formed national "patient safety goals" that require health care organizations to comply with CDC and WHO based hand hygiene guide lines. In 2010, the joint Commission urged that "a culture of hand hygiene" be fostered by monitoring compliance. Many studies have indicated that health care workers have difficulty adhering to hand hygiene protocols to reduce the spread of infection (Allegranzi & Pittet, 2009; Allegranzi et al., 2013; Martin-Madrazo et al., 2009; McGuckin et al., 2004).

A majority of health care workers have reported barriers to hand hygiene compliance, according to studies. Some of these barriers are lack of knowledge of the importance of hand hygiene in preventing nosocomial infections, lack of knowledge of appropriate techniques involved in hand hygiene, lack of access to sinks, difficulty locating supplies or products, time constraints, work overload and understaffing, irritation from repeated hand washing, lack of patient participation and empowerment, lack of belief in the value of hand hygiene, lack of motivation/incentives, lack of disciplinary actions for noncompliance, interference with worker – patient relationships, patient needs being viewed as a priority, wearing gloves, and forgetfulness (Martin-Madrazo et al., 2009; Pittet, 2001; Squires et al., 2013; WHO, 2007). Sax, Uckay, Herve, Allegranzi, and Pittet (2007) indicated that poor training for healthcare workers on why, when, and how to perform hand hygiene during routine care is also a significant barrier.

Allegranzi et al. (2013) implemented WHO hand hygiene recommendations in six pilot studies (55 departments in 43 hospitals) in Costa Rica, Italy, Mali, Pakistan, and Saudi Arabia. They assessed health care workers' hand hygiene compliance and knowledge of microbial transmission and hand hygiene principles. Each site received instructions about WHO hand hygiene strategy and associated methods, and followed a stepwise implementation approach (Allegranzi et al., 2013). They found that compliance was higher in lower and middle income

countries than in higher income countries. Additionally, they found that the knowledge of health care workers significantly improved after the intervention (Alegranzi, 2013).

In 2008, the Joint Commission Center for Transforming Health Care had a meeting with eight experts in performance improvement and infectious diseases from eight hospitals for its hand hygiene quality improvement project. The project took 2 years. The Lean Six Sigma, and change management tools approaches were used to measure the magnitude of hand hygiene noncompliance, assess causes of non-compliance, and develop an intervention. The average baseline compliance was 47.5% across all 8 hospitals. Initially, there were 41 different causes of non-compliance among the hospitals found, and these were condensed to 24 groups of causes (Chissin, Mayer, & Nether, 2015). Each participating hospital developed an intervention targeting its most important causes of noncompliance. Compliance improved to 70.5 after intervention.

Alemangno et al. (2010) assessed the effectiveness of an online continuing education program in increasing healthcare workers' hand hygiene awareness, hand hygiene knowledge, and adherence to hand hygiene guideline. The study was conducted in two northern Ohio hospitals. A total of 256 healthcare workers participated in the educational program (Alemagno et al., 2010). Most of the participants had a 4-year college degree and more than 15 years of work experience. Some worked on pediatric units, and some worked on medical-surgical units (Alemagno et al., 2010). The program addressed the three dimensions of hand hygiene behavior (behavioral, normative, and control beliefs). The intervention consisted of three sessions, a registration module, a pre-test, and a 10-munite instructional video on hand hygiene facts and practices, a post-test on health care knowledge of hand hygiene, a hand hygiene self-assessment, and a hand hygiene self-improvement plan (Alemagno et al., 2010). The program lasted for 6

weeks. The researchers found that health care workers reported significant improvement in hand hygiene knowledge and self-assessment compliance with hand hygiene behavior. A total of 97 % of the participants reported that the program was effective (Alemangno et al., 2010).

An observational study was conducted by Creedon (2006) to investigate health care workers' compliance with hand hygiene guidelines. The study was conducted in an ICU in Ireland. A convenience sample of nurses, doctors, therapists, and care assistants participated in the study. The study concluded that healthcare workers' compliance with hand hygiene was suboptimal (Creedon, 2006).

Numerous other studies have documented poor hand hygiene compliance by health care workers. Richard (2005) reported that health care workers' hand hygiene compliance fell below 50%. Stone (2001) and Rogers et al. (2010) also stated that health care workers' hand hygiene compliance was very poor. Allegranzi and Pittet (2009) reported that health care workers' compliance with hand hygiene was suboptimal. Pittet (2003) reported that the importance of hand hygiene was not recognized by health care workers and that adherence to recommended guidelines was unacceptably low. Rodriguez et al. (2015) reported that health care workers' compliance with a recommended hand hygiene procedure was less than expected.

Conceptual Model

The health belief model was appropriate for this project. Hand hygiene involves behavioral considerations (Baidyanath et al., 2013). Health care workers enjoy motivational approaches of any kind. The health belief model was used to influence and motivate health care workers (Jeong Seo, 2011). The health belief model is a psychological model that helps in predicting health behavior by focusing on the attitudes and behavior of individuals. It was originally developed in 1950 and updated in 1980 by Hochboun, Rosen-stock, and Kegels

(Boskey, 2014). The key components of the model are perceived susceptibility, perceived severity, perceived benefits, and perceived barriers (Jeong-Seo, 2011). According to the model, health care workers will show hand hygiene compliance if they believe that they are susceptible to infection if they do not wash their hands (Jeong Seo, 2011). Health care workers will perceive severity by understanding the seriousness of the consequences of infections caused by poor hand hygiene compliance, such as prolonged hospital stays, high medical costs, and increased morbidity and mortality (Jeong Seo, 2011). Health care workers may perceive benefits of hand hygiene practices such as decreased infections among patients and staff which decrease health care workers heavy workloads. Health care workers may also perceive barriers if they think that complying with hand hygiene are socially and physically difficult requiring effort, and time (Boskey, 2014).

The Role of the DNP Student

As the chief project manager, I played a critical role in this project. After identifying a problem in a practice area of interest, I chose a topic. The project topic was selected at the beginning of the program. The topic was approved by the faulty. I selected this topic because of the interest I have for safety of the patients and the staff. I began immediately researching for resources on the topic. I reviewed numerous existing literature related to the topic. I developed a proposal or prospectus with the topic. The proposal was submitted to the faculty for review and critique. When the proposal was approved by the committee, it was orally defended.

For any study that involves humans, one has to obtain permission from the International Review Board (IRB). I took on-line training on human subject for research. I applied for permission to conduct a project and it was granted. My first choice of site to conduct the project was controversial. I started looking for another site. I consulted the Infection Control and

Prevention Department (ICPD) of my organization about my project since the project is significant for infection. ICPD recommended that ICU should be the unit that would require such a project. I met with the ICU manager. She was exceedingly excited about the project. She called or arranged for a meeting of the staff. At the meeting I was offered an opportunity to talk to the staff about the project and procedures.

Staff was given enough time to think about participation in the project or not. Staff willing to participate was given consent forms to sign. The participants were staff nurses from ICU. I was motivated to choose this project because of the increasing incidence of HAIs. As a nurse, my main goal is the safety and wellbeing of the patients. Hand hygiene is generally acknowledged as the most single means of controlling infections (Mahfouz et al., 2013; Rogers et al., 2010; Rosenthal et al., 2005). I chose this project to make a difference in the lives and wellbeing of our patients. I collected various materials needed for the project and finally implemented the project, collected data and analyzed. The final copy of the project was written and submitted to the committee for approval. If approved by the committee, I will orally defend the project.

Summary

In section 2, I discussed various studies that have been done to improve staff and patients' hand hygiene knowledge and compliance to reduce nosocomial infections. I described studies that indicated that improved hand hygiene reduced infections. I also talked about studies that confirmed that healthcare workers hand hygiene compliance is low, below 50%. I enumerated various reasons health care workers cite for not washing their hands. Furthermore, I discussed the theoretical frame work upon which the project was based. Finally, I described the role of a DNP student as the principle project manager.

Section 3: Approach

Introduction

HAIs are serious complications of health care (Javis, 1996; Jean Seo, 2010) that affect people in developed as well as undeveloped countries (WHO 2007, 2010). The costs of treating HAIs are very high, and many of the infected patients die each year (WHO 2007, 2010). Numerous studies have indicated that rates of HAIs infections are higher in ICUs than in other hospital populations (Dasgupta et al., 2015; Yost & Martin, 2017). The association between hand hygiene and transmission of infection was established centuries ago (Barton, 2017, Mishra et al., 2013). The aim of this project was to improve ICU health care workers' hand hygiene knowledge and practices to reduce infections.

Project Design/Method

According to Pittet (2003), education or training is one of the corner stones for improving hand hygiene knowledge and practices. The design of this project involved an education/training intervention using the staff education manual. The project was divided into three phases: a base line hand hygiene knowledge survey, a 25 minutes Power Point presentation on hand hygiene facts and practices, and a post-test to evaluate participants' understanding of the presentation. At the end of the project, participants completed an evaluation survey about the effectiveness of the project. The entire class session for the project lasted 45 minutes.

Population and Sampling

The project implementation commenced on April 13, 2017, upon approval from the Walden University Institutional Review Board (IRB) and the ICU manager at the study site. A convenience sample of 25 ICU nurses participated in the training program. Two males and 23 females participated in the study. I carefully articulated the process for the project, as well as anticipated benefits, and any potential harms for the participants. Participants were assured of

confidentiality and anonymity. Participants were told that participation was voluntary and that failure to participate would not affect their employment, salary, or status. Participants were also told that they could withdraw from participation without penalty at any time if they felt uncomfortable. ICU nurses who felt reluctant to participate were excluded from the study. Nurses who were willing to participate were asked to provide informed consent to participate in the project (Picheansathian et al., 2008). Patients were not included in this study.

Program/Project Description

The project focused on improving ICU healthcare workers' hand hygiene knowledge, attitudes, and practices to promote infection reduction in an ICU. It included a 25 minutes PowerPoint presentation and hand hygiene techniques demonstration. The Power Point presentation and discussions included the origin and importance of hand hygiene, the availability of guidelines for hand hygiene, hand hygiene techniques, hand hygiene in daily care practices, hand hygiene agents, potential risks of infection from poor hand hygiene, patterns of microorganism transmission and prevention, hand hygiene barriers, and burdens of HCAIs (Uneke et al., 2014). Each participant received training handouts before the presentation. A questionnaire on hand hygiene was used to assess participants' baseline knowledge, attitude, and practices (Uneke et al., 2014). A post-/quiz to evaluate participants' understanding and retention of the material presented or discussed was administered. A questionnaire was also used to evaluate the effectiveness of the project.

The class session was held in an ICU classroom. Posters with phrases such as "hand hygiene saves lives", "stop the spread of infections", "clan care is a safer care", "5 moments for hand hygiene", "healthy hand washing", were posted at strategic places on the unit. The project

started on April 13 and ended on July30, 2017. McGeer (n.d.) recommended that snacks and drinks (coffee/tea/juice) be provided during class sessions to make the class more comfortable.

Data Collection

The unit's infection base line rate before intervention on April 13th, 2017 and infection rate after intervention on July 30th, 2017 were collected from the hospital infection prevention and control department. The infection rate for this project was based on a quarterly infection rate report. The effect of the project on infection rates was determined by comparing the rates after the project with the rate before the project.

Infection control activities on the ICU were focused on two major areas: central-line – associated blood-stream infections (CLABSs), and catheter-associated urinary tract infections (CAUTIs), Alp et al., (2014). Participants' baseline hand hygiene knowledge and opinion data were collected through a questionnaire, and participants' hand hygiene knowledge attainment data after intervention were collected through a multiple-choice quiz/test and analyzed. An overall evaluation of the effectiveness of the project was based on data collected through a questionnaire. A 5-point Likert scale was used (Grove, Burns, 7 Gray, (2013). A Likert scale provides a range of responses to a specific question, such as *agree, disagree or neutral.* Each response to a statement is assigned to a number or coded, and each respondent's score is determined by adding the point values of the statements (Crossman & Ostrom, 2011). The questionnaire scores were collected and entered into IBM SPSS Statistics 23. The participants' post-test/quiz score were collected and entered into a mathematical calculator.

Project Evaluation Plan:

The program evaluation plan involved determining participants' reactions to the project, achievement of the goals and objectives of the project through hand hygiene knowledge

attainment after in-service (intervention), the overall effectiveness of the project, and ICU rates of infection before and after the project. Participants evaluated the effectiveness of the project one quarter (3 months) after project implementation (Sandora et al., 2005). The evaluation provided information that was helping in considering whether to continue with the development and improvement of the program or not.

The evaluation of the effectiveness of the educational program was based on Kirkpatrick's four levels of training outcome: reaction, learning, behavior, and result (Winfry, 1999). The model developed by Kirkpatrick in 1999, is considered the best known method for learning process. It provides actual learning behavior changes, minimizes resources, and maximizes results (Winfrey, 1999). Each level of the model provides valuable information that, together, creates a chain of evidence for the effectiveness of the project (Winfrey, 1999).

In this project, level 1 of the evaluation focused on hand hygiene and how it was addressed. Level 2 focused on the hand hygiene implementation process (education/training) activities to ensure that it was progressing as planned. Level 3 focused on results/outcomes of the project to ensure that hand hygiene goals and objects were met. It assessed how the newly acquired hand hygiene skills, knowledge, behaviors, and attitudes of the participants were being used to promote increase in hand hygiene compliance to reduce HAIs. Level 4 focused on the impact of the hand hygiene education project on the lives of the participants, the target population, and the community as a whole. It addressed whether the hand hygiene project improved quality of life for the target population by reducing the incidence of nosocomial infections.

Summary

This section addressed the design of the project, the population involved, and the sample selection process. I discussed project procedures, confidentiality of information, inclusion and exclusion criteria, the type of intervention pursued, and the phases of the intervention. Additionally, this section covered the project's power Point presentation, questionnaire, and quizzes. I described the distribution of handouts to participants and the placement of reminder posters at strategic points on the unit. Finally, I addressed the project evaluation plans and Kirkpatrick's four levels of training outcome.

Section 4: Findings and Recommendations

Introduction

HAIs are important public health problems around the globe (Picheansathian, et al., 2008). People in developed and undeveloped countries suffer from HAIs (WHO, 2007; 2010). HAIs are associated with morbidity, mortality, costs, and increased length of hospital stays (Picheansathian, et al., 2008; Rogers et al.,2010; Vincent et al.,2009; Dasgupta et al., 2015; WHO 2007, 2010). The association between hand hygiene and infection transmission was established about 200 years ago (Burton, 2007; Mishra et al., 2013). Health care workers' compliance with established hand hygiene protocols to reduce HAIs is abysmally low, at less than 40% (Sax et al., 2007; Sharir et al., 2001; Ott, & French 2009). The aim of the project was to increase ICU health care workers' knowledge and practices in relation to hand hygiene to ameliorate the incidence of nosocomial infections.

A convenience sample of 25 nurses from an ICU received hand hygiene in-service to improve their hand hygiene knowledge and practices in order to promote infection reduction. There were Power Point presentations and discussions on hand hygiene, hand hygiene technique demonstrations, distribution of hand hygiene handouts to the participants, and poster placement at strategic points. Participants' hand hygiene base-line knowledge and opinions were assessed by questionnaire prior to intervention. A 5-point Likert scale was used. Participants' hand hygiene knowledge attainment after presentation was assessed using a post-test /quiz. The overall effectiveness of the project was evaluated using a questionnaire as well. Infection rates before and after the project was collected from the hospital's infection control and prevention department, which monitors infections for the organization and provides quarterly infection

rates. The quarterly infection rate is obtained by dividing the number of infection events by 1,000 days multiplied by 100.

Data Analysis

Data from survey response pre-and post-intervention were collected on clean forms and entered into SPSS Vol. 23 for analysis. The individual post-test scores were entered into –a mathematical calculator. The mean, variance, and standard deviation of the scores were obtained.

Result of the project

The study involved 25 nurses in ICU. There were 23 females and 2 males. Among the females, one was African American and the rest were Caucasians. Age, qualifications, and years of experience were not considered for this project. All 25 participants completed the study, which began in April, 2017 and ended in July, 2017. According to post implementation test scores, the survey responses of the participants (Tables 2 and Figure 1), and comparison of ICU infection rates before and after the intervention (Tables 3 and 4), the aims and objectives of the project were met. The aim of the project was to evaluate the effects of a comprehensive educational training program on hand hygiene in relation to ICU health care workers' knowledge and practices. The aim was successfully achieved through the implementation of a comprehensive educational training program on hand hygiene for ICU health care workers (Appendix D). The implementation took approximately 14 weeks. The success of the educational training was evidenced by the participants' high scores on the post-implementation knowledge attainment evaluation of the test or quiz (Figure 1). The lowest score on the quiz was 67%, and the highest was 100%. Ninety-six percent of the participants received high scores. The average score on the test/quiz was 86%. About half of the people surveyed before the intervention had good knowledge of hand hygiene. After the intervention, the percentage increased to 86%. Of the

participants (N=25), 24 %(N=6) scored 100%, 8% (N=2) scored 92%, 20% (N=5) scored 88%, 24% (N=6) scored 83%, 20% (N=4) scored 71%, and 4% (N=1) scored 67%.

One of the objectives of the project was to improve ICU healthcare workers' knowledge, attitude, and behavior in relation to hand hygiene. The objective was achieved by educating ICU health care workers on the origin and importance of hand hygiene, hand hygiene techniques, occasions for hand hygiene, hand hygiene in daily care practices, hand hygiene agents, hand hygiene barriers, availability of hand hygiene guidelines, and burdens of HAIs (Appendix D). This objective was evaluated by analyzing the participants' responses on the post project evaluation survey (Table 2) and test scores (Figure 1). The survey specifically asked about the relevance of the project to ICU healthcare workers, the project usefulness in identifying needed education for ICU, the project bringing a change in the way in which ICU workers view hand hygiene, the project increasing participants' knowledge about hand hygiene, what participants liked about the project, and whether it would be beneficial to continue the project. All of the participants answered "yes" in response to the question of whether to continue the project (Table 2). Objective 1 was also evaluated by analyzing the class evaluation test/quiz scores (figure 1). Individual participants' knowledge attainment quiz scores ranged from 67% (lowest) to 100% (highest). The average score was 86 as stated above.

Objective 2 for the project was to increase hand hygiene knowledge and practices for ICU health care workers to reduce the spread of HCAIs. The objective was achieved by implementing an educational program on hand hygiene for ICU health care workers. The implementation lasted for 14 weeks. The educational project featured the importance of hand hygiene, the origin of hand hygiene, hand hygiene techniques, moments of hand hygiene, hand hygiene agents, and reminder posts at strategic places (Appendix D). The objective was also

evaluated by analyzing participants' responses to a post-project survey – questionnaire (Table 2) and test scores on the post- implementation evaluation (Figure 1). The objective was also evaluated by comparing ICU infection rates prior to project implementation with those post-implementations. There was a complete reduction or elimination of infection in the ICU after implementation (see Table 3 and Table 4). Increased hand hygiene knowledge enhanced hand hygiene practices resulting in total elimination of infection in the ICU after project implementation, with rates decreasing from 1.4% to 0% after the program.

Table1:

Pre-intervention Survey Questionnaire Analysis

	Responses				
Variables	SA	A	N	D	SD
HAIs occur in undeveloped countries of the world only	0	0	0	2	22
HCAIs are transmitted by the hands of health care workers	8	13	0	2	1
HH is the most effective way to prevent infections	21	3	0	0	0
HH is required before and after patient contact	23	1	0	0	0
Optimal hand hygiene takes 15 minutes	16	6	1	1	0
Wearing gloves substitutes hand washing	0	0	0	6	18
HCAIs have impact on patient clinical outcomes	19	4	0	0	1
HH is not considered as patients' safety by HCWs	0	3	1	11	9

Note. SA = *strongly agree*, A = *agree*, N = *neutral*, D = *disagree*, SD = *strongly disagree*

Table 2:

Project Effectiveness Evaluation Questionnaire Analysis

	Responses				
Variables	SA	A	N	D	SD
The project was relevant to ICU health care workers	14	11	0	0	0
The project was useful in identifying needed area of edu.	13	12	0	0	0
The project brought a change to the way ICU HCWs view HH	4	14	7	0	0
The training increased your knowledge about hand hygiene	7	8	6	4	0
Do you think that it is beneficial to continue the project?	Yes			No	
	25			0	

What part of the project do you like best?

Note. SA = *strongly agree*, A = *agree*, N = *neutral*, D = *disagree*, SD = *strongly disagree*

Figure1: Hand Hygiene Post Class Presentation Quiz/Test and Evaluation

1. Hand hygiene refers to:

A. Hand washing with soap and water

B. Using an alcohol -based rub

C. Hand washing with antimicrobial soap and water

D. All of the above

E. None of the above

2. What reasons do healthcare workers cite as being problematic to washing hand with soap and Water?

A. Inconvenient

B. Time consuming

C. Causes skin irritation and dryness

E. None of the above

F. All of the above

3. Alcohol-based hand rub is more effective in reducing germs on hands than soap and water hand washing

A. True

B. False

4. How long should your scrub your hands together when washing with soap and water?

A. 5 Seconds

B. 10 Seconds

C. 15 Second

D. 1Minute

5. Many infections transmitted by the hands of healthcare workers can be prevented by hand washing.

A. True

B. False

6. Health care workers are exposed to germs on their hands by doing the following:

A. Pulling patients up in bed

B. Taking vital signs

C. Touching equipment in patient's vicinity

D. All of the above

E. None of the above

Intensive Care Unit Infection Rate Before and after Intervention

Before the intervention, the catheter –associated urinary tract infection (CAUTI) rate was 3 episodes/1,000 patient days or 1.4%. The incidence of infection rate after the intervention was 0 episodes/1,000 patient days, or 0% (2017 data). The overall, CAUTI rate among ICU patients decreased significantly from1.4% pre-intervention to 0% post-intervention (Hung & WU, 2008), as presented in table 3

Table 3:

Catheter- Associated Urinary Tract Infection (CAUTI) Rates in ICU

Quarter/Year	Rate
1Q ’16	1
2Q ’16	0
3Q ’16	0.5
4Q ’16	2.5
1Q ’17	1.4
2Q ’17	0

Note. Rate of infection per 1,000 Foley days

Central –line-associated bloodstream infections (CLABSIs) remained relatively stable, no change. Both before and after the intervention, the rate was 0 episodes/1,000 patient days, or 0% 2017 data (Alp et al., 2014), as presented in Table 4

Table 4:

Central- Line-Associated Bloods- Stream Infection (CLABSI) Rates

Quarter/year	Rate
1Q ’16	1.6
2Q ’16	0
3Q ’16	0.5
4Q ’16	0
1Q ’17	0
2Q ’17	0

Note. Rate of infection per 1,000 central line days

The hand hygiene knowledge attainment of the participants increased after the intervention according to participants’ test results and survey responses. The amount of alcohol-based hand hygiene rubs and liquid soaps used increased from 30 to 45 liters, according to participants. However, these were not being investigated. The frequency of hand washing with

soap and water increased significantly, according to participants. ICU health care workers reported a significant improvement in hand hygiene knowledge and behaviors. More than 85% of the participating ICU health care workers reported that the program (project) was effective in improving their hand hygiene knowledge and practices. The findings were consistent with findings from Alemagno et al. (2010). More than 80% of the participating ICU health care workers reported that reminder posters were highly motivating factors in hand hygiene. All of the participants wanted the program to continue. This is consistent with findings by previous investigators (Picheansathin, et al., 2008).

Implication from the Findings

Improved hand hygiene impacts hospital infection rates. HAIs are critical problems affecting the quality of patient care provided at health care facilities around the globe. The contaminated hands of healthcare workers represent the main route of transmission of microorganisms that cause infections (Pittet, 2001). The findings highlight the importance of effective hand hygiene. Health care workers should wash their hands before and after coming into contact with patients to reduce HAIs. It is imperative that health care workers adhere to hand hygiene guide lines to prevent infections and save lives. A culture of hand hygiene should be instituted in all health care facilities to promote the safety of patients or staff through infection prevention. Health care managers and policy makers play critical roles in sustaining good hand hygiene practices by providing healthcare professionals with hand hygiene products.

Effective hand hygiene by health care professionals prevents complications of treatment, morbidity, and mortality, in addition to lowering duration of stay and costs. The findings emphasize the critical need for health care professionals to improve hand hygiene practices to decrease the spread of infections in healthcare facilities

Interpretation of the Result /Finding

The project produced improvements in hand hygiene knowledge, attitude, behavior, and practices in ICU nurses. ICU infection rates after the program were 0% both for CAUTIs as well as CLABSIs. The provision and availability of sinks at strategic corners, and in patient rooms, and along with the promotion of antiseptic and hand rubs, significantly enhanced compliance with hand hygiene protocols by healthcare workers. The result of this project demonstrated that ICU healthcare workers could and would use self-assessment to achieve improvement in hand hygiene knowledge and compliance (Alemagno et al., 2010). When health care workers become very knowledgeable about the effectiveness of hand hygiene in elimination of infections, they will change their behaviors and attitudes about hand hygiene. Strict compliance with CDC, WHO, and Joint Commission hand hygiene guidelines which would in turn, reduce morbidity, mortality, duration of stay, and costs of treatment.

Recommendations

The results of the project are consistent with current literature indicating that education is the principle avenue for enhancing hand hygiene knowledge and that effective hand hygiene is the single most effective means of preventing HAIs. It is recommended that healthcare institutions at all levels implement measures that will promote hand hygiene knowledge and compliance in order to ameliorate HAI rates. Doctors, managers, and policy decision makers should ensure that hand hygiene guidelines, protocols, or standards developed by CDC and WHO are strictly maintained by health care workers for patients' safety. Yearly mandatory hand hygiene education should be enforced if hand hygiene knowledge and practice are to be sustained. Continuing education on hand hygiene should be developed and implemented to enhance healthcare workers' hand hygiene knowledge and practices to control infections (Ghezeljeh et al., 2015). Periodic in-services on hand hygiene should be provided to staff to

reinforce hand hygiene knowledge attainment. Hand hygiene products should be made available in every room and at strategic corners. Health care organizations should provide hand hygiene feedback to staff and motivate them to wash their hands regularly when in contact with patients to save lives. Healthcare workers should be taught why, when, and how to wash hands to prevent infections. Nursing leaders and health policy makers should look for ways to promote sustained compliance with hand hygiene recommendation to reduce HAIs in health care facilities (Stone et al., 2007).

Strengths and Limitations of the Project

One of the notable strengths of the project is that the findings are consistent with current literature that effective hand hygiene reduces infections. Data collection was well organized. Data were properly secured in a safe box. I paid strict attention to the confidentiality of information from participants throughout the implementation process. The questionnaires and quizzes were standard questions written by distinguished authors in the field with little modifications to suit participants' knowledge.

However, the study has some limitations. I used convenience sample technique to recruit participants. This might not be a true representative of ICU nurse population. The individual participant's qualifications and experience were not considered in this training. This affected individual's understanding and overall scores. Some data were collected through self - assessment procedures. This affected the validity of the data. I did not include cost effectiveness of the project as one of the objectives. Including it as one of the objectives would add relative worth to the results. Some health care workers did not participate, they felt that their hand hygiene knowledge and practices should not be studied (Martin-Madraz et al., 2009). There was inadequate supply of necessary resources and this impacted implementation progress. The

intervention was conducted in one hospital ICU. The findings would be interpreted with care as it did not represent what happens in other ICU units, or elsewhere. The evaluation instruments were modified by the project manager and this may affect the content validity of the instruments. The study was limited to ICU nurses only, other ICU personnel could be potential sources of infection as well (Marieke, 2016). Further study is recommended using a wide pool of participants to explore the effects of hand hygiene education of healthcare professionals on infection rates.

Section 5: Dissemination Plan

The results from this project could be translated into evidence-based practice through the process of disseminating the information to ICU health care professionals, and other health care workers. Study results could be shared through oral presentations, posters, or publication to a wider audience. The results will be shared with ICU manager before being made public. The results will be shared with ICU nurses and other personnel at a monthly meeting. The results will then be posted on the unit's bulletin board and in the organization's newsletter for a wider audience. Finally, the results will be published in a nursing journal.

Analysis of Self

I have always loved caring for people. The love of caring for people emanated from my father, a native doctor. My father cared for patients with emotional and psychological problems. I came to United States to study medicine. After completing a degree in premedical sciences, I could not pursue my dreams, owing to financial predicaments as a foreign student at the time. I was forced to pursue a master's degree in biology education, the only master's degree then offered in the Department of Math and Science, at the University of Central Oklahoma. To keep my dreams and aspirations alive, after completing master's degree in biology education, I decided to go back to school to study nursing. Nursing would bring me closer to medicine and caring. When I completed a bachelor's degree in nursing and passed the nursing board examination. I began working in hospitals. Working as a nurse taking care of patients drew me closer to my dreams and desires. After working for some years as a nurse, I went back to school for master's degree in nursing. The master's degree program broadened my nursing knowledge so that I could better take care of patients.

With the advent of the DNP degree in nursing education, I became excited about the program. My initial impression was that I would sit for the licensure examination after completing the program, but the reverse was the case. I applied for admission to a school that offered the program in my home State. However, that program was a BSN-to-DNP degree program; because I already had a master's degree in nursing, I started to look elsewhere. I searched for schools that offered post-master's degree programs in nursing leading to a DNP. Fortunately, one day at a book lunch party, someone mentioned Walden University as one of the schools that offers an on-line DNP program. A few days later, I applied for admission to Walden University, even though I was not good at computers. I was well received by the admission representative. Soon after, I was offered admission.

One of the requirements to graduate from a DNP program is the development and implementation of a final scholarly evidence –based project in a specific area of interest (Mayo, 2011). The evidence –based project synthesizes the knowledge gained from DNP classes and practicum. The DNP evidence-based scholarly project enables the student to apply the skills acquired through practice and education to solve clinical problems. DNP experience can be seen as interaction involving student, faulty, colleagues, and the community where the project is implemented (Redhage, 2014).

The DNP program at Walden is tough and challenging. Some of the courses offered are Foundations and Essentials for Nursing, Methods for Evidence-Based Nursing, Transforming Nursing, Organizations and System Leadership, Epidemiology and population Health, and Health Policy and Advocacy. These courses and skills in practicum prepared me for the evidence-based project that one must complete before graduating. My project focusing on improving hand hygiene in ICU to reduce infections was approved by the faculty. Walden's

Institutional Review Board approved implementation of the project. The project involved multiple hours, stakeholders, research utilization, and evidence-based practices (Wasman, 2010). I conducted an extensive research review and learned as much as possible about hand hygiene and infections.

The implementation of the project began in April, 2017. There were survey administrations, Power Point presentation, hand hygiene discussions and demonstrations, tests to evaluate knowledge attainment, handouts, and posters on hand hygiene. The project was successfully completed in July, 2017. Initially, there were some challenges. Some staff members, for instance, were reluctant to participate in the project. The ICU education coordinator was not cooperative. Getting stakeholders buy-in was a major challenge. After persuasively articulating the importance of the project and the confidentiality of information gathered, I was able to win over more participants. The ICU manager was highly interested in the project and played a critical role for the success of the project. Finding a site for project implementation was challenging as well.

A DNP is a practice –based terminal degree in nursing as opposed to a research-based PHD. DNP program prepares graduates as experts in nursing practice. A DNP degree prepares a nurse leader at the graduate level to promote excellence in clinical practice. DNP graduates can function as researchers, health policy advocates, nursing leaders, educators and clinicians (Wasman, 2010).

I am happy to have undertaken the DNP program. The program has helped me to meet my personal and professional goals. Now, I know how to analyze nursing research and clinical guide –lines to establish evidence-based practices. According to Redhage (2014), DNP education empowers students to make intellectual judgments in relation to clinical issues. My DNP

education has broadened my knowledge and experience to provide quality care to the population I serve. I will use this knowledge and experience to serve as a clinician, an educator, and a health policy advocate. The DNP education at Walden is rewarding and challenging. Irrespective of the costs of education at Walden, other major challenges I encountered were finding practicum preceptors and practicum sites.

Summary

Numerous studies have indicated that healthcare workers' hands are the most common vehicles for the transmission of HCAIs from healthcare workers to patients within the healthcare environment (Allegranzi & Pittet, 2009; Martin-Madrazo et al., 2009; Seo, 2011). Hand hygiene has been proven the single most important means of reducing HCAIs. Unfortunately, health care workers' compliance with optimal hand hygiene has been abysmally low. This project was designed to increase ICU health care workers' hand hygiene knowledge and practices. The project reviewed the origin and the importance of hand hygiene and its impact on HCAIs. It involved discussion of occasions of hand hygiene, and effects of poor hand hygiene. It also included discussion of guidelines for hand hygiene, available hand hygiene products, and barriers to hand hygiene compliance by healthcare workers. It is interesting to note that a program focused on education is effective in promoting hand hygiene and reducing the nosocomial infection rates (Rosenthal al., 2005). However, combining education with other elements, such as performance feed-back, peer pressure, and institutional support, would produce an excellent and efficacious result (Koff et al., 2011).

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Appendix A:

Hand hygiene Baseline Survey Questionnaire

It will take about 5 minutes to complete the survey.

Each question requires only one answer

1. Health care associated infections occur in undeveloped world only
   Strongly agree Agree Neutral Disagree Strongly disagree
2. HCAIs are mostly transmitted by contact by health care workers
   Strongly agree Agree Neutral Disagree Strongly disagree
3. HH is a means of reducing the number of microorganisms on the skin of hands
   Strongly agree Agree Neutral Disagree Strongly disagree
4. Hand hygiene is the most effective way to prevent the spread of infections
   Strongly agree Agree Neutral Disagree Strongly disagree
5. HH is required before and after coming in contact with any one requiring care
   Strongly agree Agree Neutral Disagree Srrongly disagree
6. Optimal hand hygiene should take at least 15 seconds
   Strongly agree Agree Neutral Disagree Strongly disagree
7. Wearing gloves is a substitute for hand hygiene
   Strongly agree Agree Neutral Disagree Strongly Disagree
8. HCAI has big impact on a patient's clinical outcome

   Strongly agree Agree Neutral Disagree Strongly disagree

9. Alcohol –based hand rub is not as effective as hand washing with soap and water in reducing infections
   Strongly agree Agree Neutral Disagree Strongly disagree
10. HH is not considered by many healthcare workers as patient and staff safety
    Strongly agree Agree Neutral Disagree Strongly disagree

Appendix B:

Hand hygiene Post-Intervention Evaluation Test/Quiz

1. Hand hygiene refers to:
   A. Hand washing using plain soap and water
   B. Using an alcohol-based hand rub
   C. Hand washing with antimicrobial soap and water
   D. All of the above
   E. None of the above
2. What reasons do HCWs cite as being problematic to washing hands with soap and water
   A. Inconvenient
   B. Time consuming
   C. Causes skin irritation and dryness
   D. None of the above
3. Alcohol-based hand rub is more effective in reducing germs on hands than soap and water hand washing
   A. True
   B. False
4. How long should you scrub your hands together when washing with soap and water?
   A. 5 seconds
   B. 10 seconds
   C. 15 seconds
   D. 1 minute

5. Many infections transmitted by the hand of HCWs can be prevented by hand washing

    A. True

    B. False

6. HCWs are exposed to germs on their hands by doing the following:

    A. Pulling patients up in bed

    B. Taking vital signs

    C. Touching equipment in patient's vicinity

    D. All of the above

    E. None of the above

Appendix C:

Post-Project-Implementation Evaluation Questionnaire

1. The project was relevant to ICU

   Strongly agree Agree Neutral Disagree Strongly disagree

2. The project was useful in identifying needed area of focused education

   Strongly agree Agree Neutral Disagree Strongly disagree

3. The project brought a change to the way ICU health care workers view hand hygiene

   Strongly agree Agree Neutral Disagree Strongly disagree

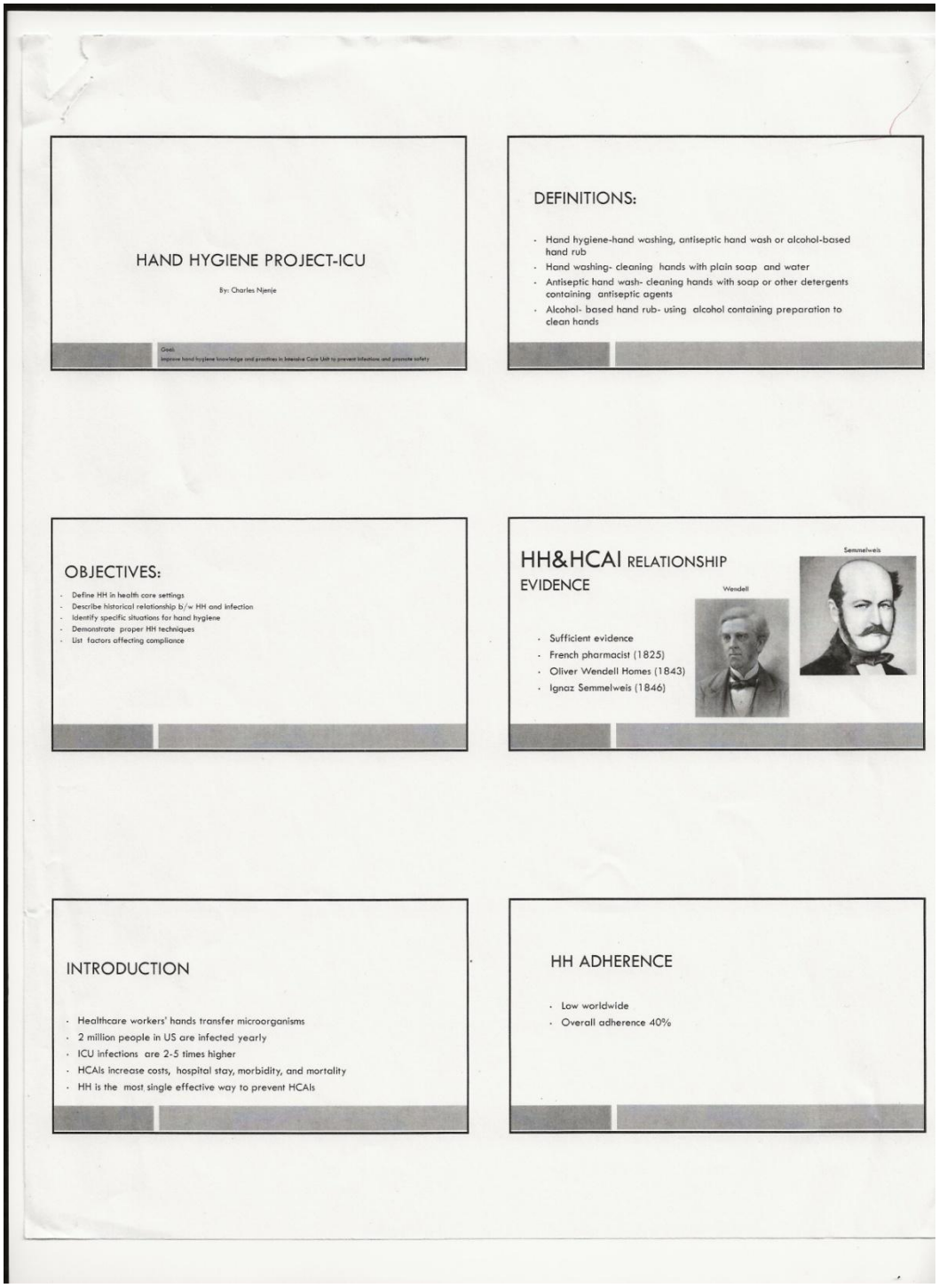
4. The training increased your knowledge about hand hygiene

   Strongly agree Agree Neutral Disagree Strongly disagree

5. Do you think it is beneficial to continue this project?

6. What part of the raining do you like best and why?

Appendix D: Sample of Hand Hygiene PowerPoint Presentation



HH AGENTS

- Plain (non-antimicrobial) soap- removes transient microorganisms
- Antimicrobial soap-reduces microbial flora
- Alcohol -based hand rub-ethanol or isopropyl alcohol- effective and convenient

HH TECHNIQUES

Hand rub:

- Apply to the palm of one hand, rub together, cover all surfaces until dry

Hand washing:

- Turn on faucet, wet hands, apply soap, rub together 15 seconds
- Rinse and dry with disposable towel
- Turn off faucet with disposable towel

HH INDICATORS

- Hands visibly dirty, soiled or contaminated- use soap and water
- Hands not visibly soiled- use alcohol based hand rub

BARRIERS TO ADHERENCE

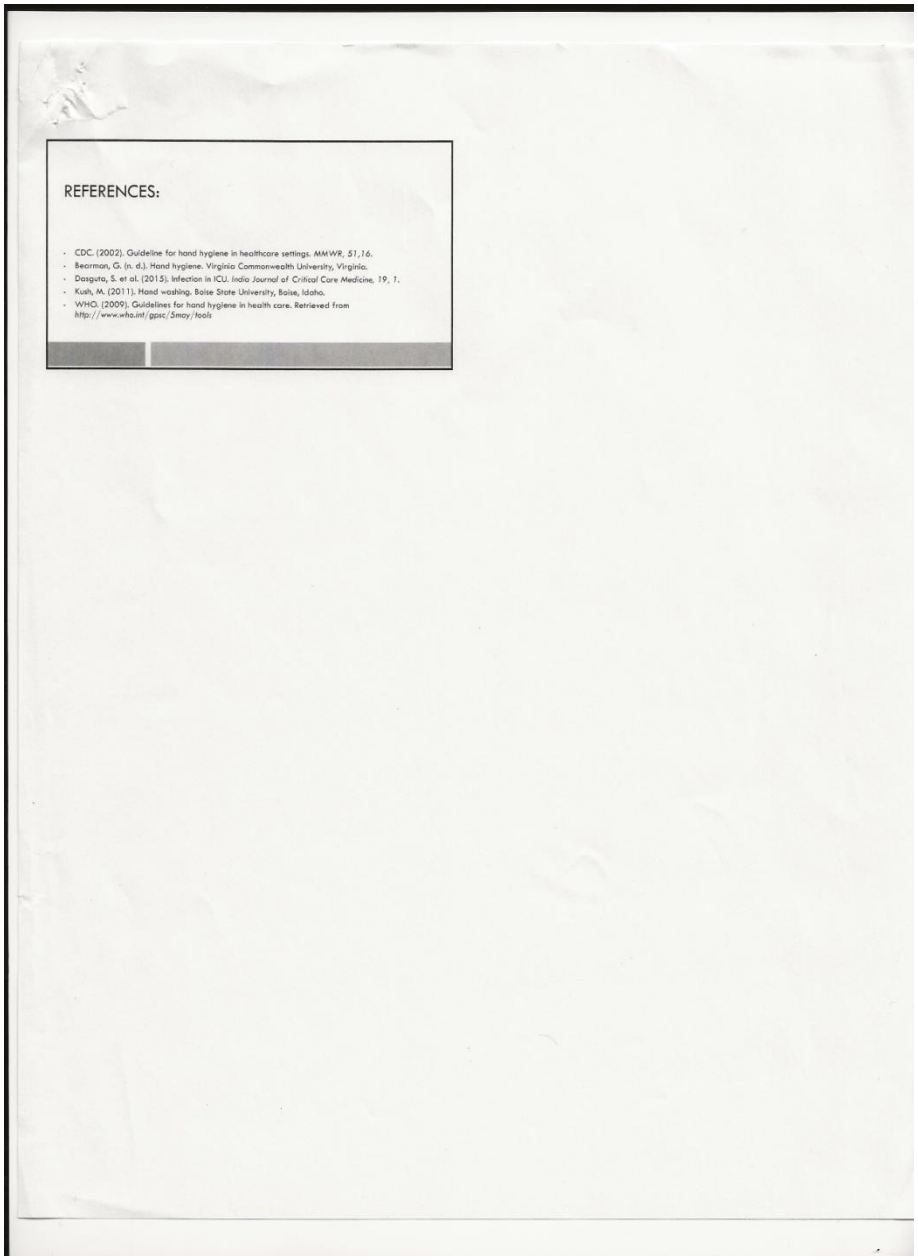
- Lack of knowledge of appropriate techniques involved
- Difficulties locating supplies or products
- Inconvenient location of sinks
- Irritation and dryness
- Patient needs
- Too busy/insufficient time
- Lack of knowledge of guidelines

HH SPECIFIC INDICATORS

- Before and after patient contact
- Before donning sterile gloves and after removing gloves
- Before and after inserting invasive devices e.g. catheters
- Before and after wound care
- After contact with blood or body fluids
- After touching patient's vicinity/surroundings

CONCLUSION

- HH most single means of preventing infections
- Cross transmission facilitated by poor hh
- HH- hand washing and alcohol- based hand rub
- Alcohol-based hand rub is easy, quick, and effective
- Education is the key to improving hh



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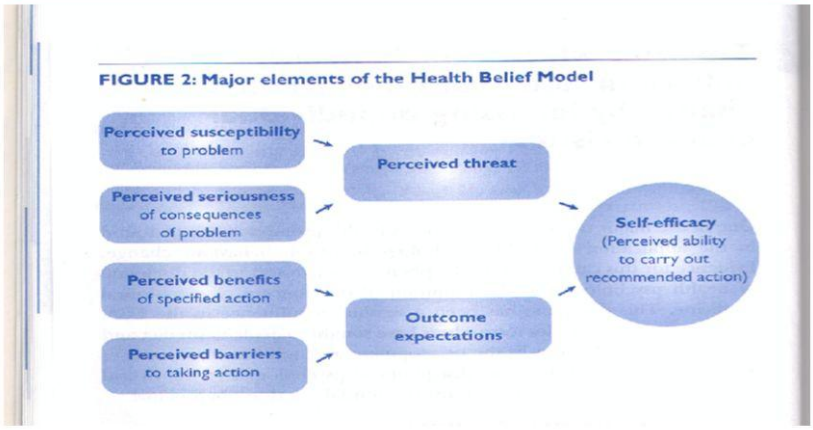
Appendix E: Sample of Hand Hygiene Poster

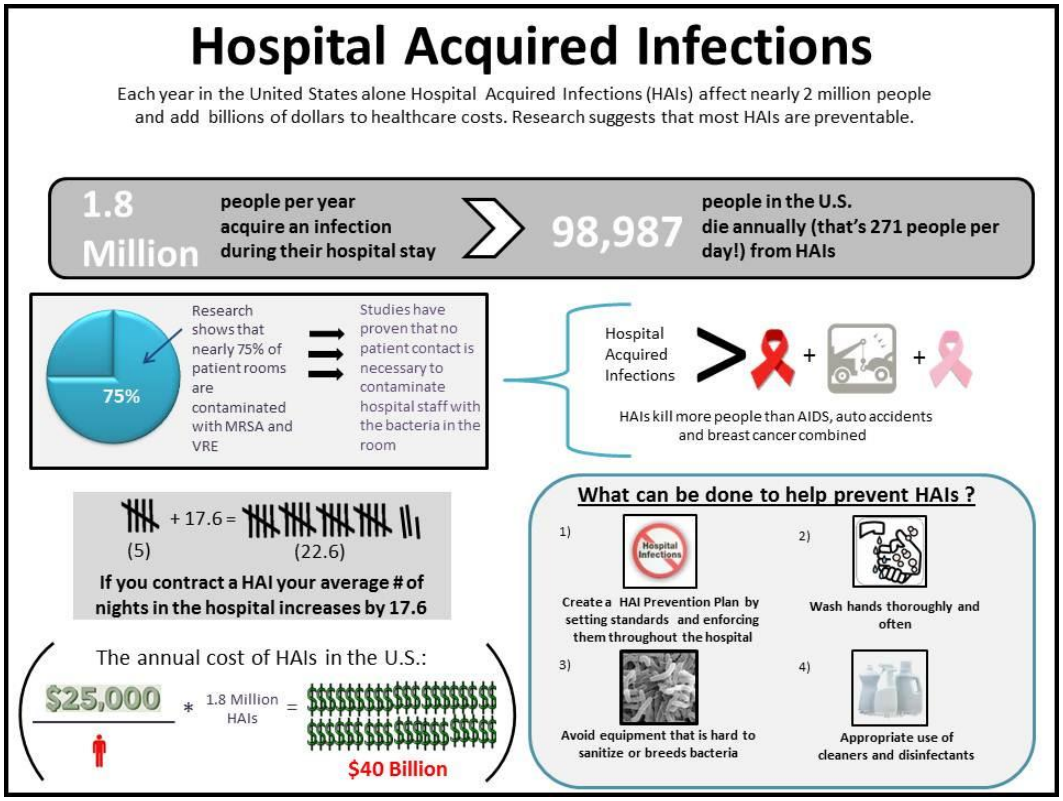
Appendix F: Diagram of Health Belief Model

Health Belief Model

(Nutbeam 1999)



Appendix G: Hospital-Acquired Infections Report



Appendix H: Consent Form

You are invited to take part in a project study about "Improving Hand hygiene knowledge and practices to reduce Hospital Acquired Infections in Intensive Care Unit. Health care workers who are working in ICU will be recruited for the study. This form is a part of the process called "informed consent" to allow you to understand this training before deciding whether to participate or not.

This study is being conducted by Charles Njenje who is a doctoral student at Walden University. You might already know him as a nurse but this study is separate from that.

Back ground Information:

The purpose of this training is to evaluate the staff training process of Intensive Care Unit workers regarding hand hygiene protocol, its importance, and the consequences of poor hand hygiene.

Procedure:

- Initial ICU infection rate is collected before the training
- You will be required to complete hand hygiene baseline knowledge and practice survey before the training. This will take about 5 minutes.

Here are Samples of questions:

1. Health care associated infections occur only in undeveloped parts of the world.

Strongly agree Agree Neutral Disagree Strongly disagree

2. Health care associated infections are mostly transmitted by the hand contact of healthcare workers

Strongly agree Agree Neutral Disagree Strongly disagree

3. Hand hygiene is the single most effective way to prevent the spread of infections in hospital:

Strongly agree Agree Neutral Disagree Strongly disagree

4. Healthcare associated infections have a big impact on the patient's clinical outcome

Strongly agree Agree Neutral Disagree Strongly disagree

Voluntary Nature of the Study:

This study is voluntary. Everyone will respect your decision of whether or not you choose to be in the training. No one at the hospital will treat you differently if you decide not to be in the study. If you decide to join the study now, you can still change your mind later. You may stop at any time. Please, note that not all volunteers will be contacted to take part in the study

Risks and Benefits of being in the study:

Being in this type of study involves some risks of the minor discomfort that can be countered in daily life, such as fatigue, stress, and frustration. Being in this study would not pose risk to your safety or wellbeing.

This evaluation offers benefits in understanding how staff training can impact best practices in the following:

- Increasing hand hygiene knowledge and practices
- Preventing hospital acquired infections
- Improving patient safety and outcomes
- Decreasing number of call INS due to staff sickness
- Decreasing costs of treatment and the duration of hospital stays
- Reducing workload for staff
- Improving patient satisfaction
- Improving staff satisfaction and retention
- Reducing morbidity and mortality

Payment:

There will be no payments, thank you gifts or reimbursements to participate. Snacks and drinks (coffee/tea/juice) will be provided.

Privacy:

Any information you provide will be kept confidential. The study organizer will not use your personal information for any purpose outside the study. Also the study organizer will not include your name or anything else that could identify you in the project. Data on the computer will be kept secured by using password and encryption, using codes in place of names. Data will be kept for a period of at least 5 years, as required by the university.

Contacts and Questions:

You may ask any questions you may have now. Or if you have questions later, you may contact the project manager via phone: 405-410-2551. If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Walden University representative who can discuss this with you. Her phone number is 612-312-1210. Walden University's approval number for this study is_____and it expires on_____

The project manager will give you a copy of the form to keep.

Obtaining your Consent:

If you feel you understand the study well enough to make a decision about it, please indicate your consent by signing below.

Printed Name of Participant _____

Date of Consent _____

Participant's Signature _____

Project Manager's Signature _____