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Exploring hand hygiene practices among healthcare workers in Ruiru Sub-County hospital

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Exploring Hand Hygiene Practices Among Healthcare Workers in Ruiru Sub-County Hospital

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other university. To the best of my knowledge and belief, the dissertation contains no material previously published or written or published by another person except where due reference is made in the thesis itself.

Esther Kamau

June 2018

Approval

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ABSTRACT

The individual, household and economic impact of Hospital Acquired Infections (HAIs) globally cannot be overstated; therefore, how healthcare workers perform and comply to hand hygiene practices is essential for mitigating its effects. The aim of this study was to understand the hand hygiene practices at Ruiru Sub-County Hospital, a level 4 facility in Kiambu County, Kenya. A cross-sectional descriptive study was done using a modified WHO hand hygiene questionnaire to assess knowledge, structural and individual factors that affect hygiene practices, and recommend potential interventions to improve hand hygiene; and a structured, unobtrusive observation of hand hygiene performance and compliance. Overall compliance rate with hand hygiene practices was found to be 54.1% among health care workers at the facility. The survey revealed acceptable training and knowledge standards among the healthcare workers but a disproportionate behavior gap. The significance of the study is to contribute to the prevention and elimination of hospital acquired infections, which are increasingly becoming among the top global burden of disease. The effects of HAIs goes beyond the infected patient, but also affects the family and the economy, because of loss of productive lives through disability and death.

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My deep appreciation goes out to the hospital administration of Ruiru Sub-County Hospital and my colleagues for their tremendous support throughout my two and a half years of studying at Strathmore Business School. It was a true testament that we are indeed ready to take up data

DEDICATION

I dedicate this thesis to my dear husband. He has and continues to be my greatest supporter. He stepped wonderfully into my roles and took care of the children when I was away studying and burning the midnight oil. I thank God for Him.

Special dedication as well to my Mum and Dad, for raising me to fly on my wings and wisdom to last me a lifetime. May God grant you long happy lives.

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ABBREVIATIONS

WHO – WORLD HEALTH ORGANIZATION

IPC- INFECTION PREVENTION AND CONTROL

HALs- HOSPITAL ACQUIRED INFECTIONS

HCALs- HEALTHCARE ASSOCIATED INFECTIONS

HH- HAND HYGIENE

UHC- UNIVERSAL HEALTH CARE

ICUs- INTENSIVE CARE UNITS

TPB-THEORY OF PLANNED BEHAVIOUR

HCWs- HEALTH CARE WORKERS

SPSS- STATISTICAL PACKAGE FOR SOCIAL SCIENCES

LMICs- LOW and MIDDLE-INCOME COUNTRIES

ABHR-ALCOHOL BASED HAND RUB

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

There is worldwide demonstrated effort and continued commitment by policy makers, administrators and health care workers to provide healthcare services that are accessible, affordable and of high quality. Entwined in quality healthcare is ensuring no patient acquires infections in the hospital setting while receiving medical care. Herein lies the role of Infection, Prevention and Control (IPC) programs in the various facilities. The mandate of IPC programs is to prevent and control healthcare-associated infections, with three principal goals: (I) Protect the patient; (ii) Protect the healthcare worker, visitors and others in the healthcare environment; and (iii) Accomplish this in a cost-effective manner whenever possible(Public Health Agency of Canada, 2010).

Prevention and control of infection in the health care setting is described by Johnson and colleagues as complex task with a variety of challenges, and a task that requires input from the various levels of health structures-government policy, finance, and the executioners at the points of care (Johnson, Reyes, & Zervos, 2009). They go on to summarize the numerous guidelines, policies and resources on Infection Prevention and Control (IPC) that exist and their variations among countries and organizations.

The purpose of such extensive guidelines is to deal with the growing burden of Hospital Acquired Infections(HAIs), also known as Healthcare Associated Infections(HCAIs). The World Health Organization (WHO) classifies Hospital Acquired Infections as a major cause of death and disability worldwide. HAIs affect not only the patient, but the patients' families, health systems at large and consequently the economy of a country. To put it into perspective, HAIs are placed among the top three killers causing approximately 3% of deaths worldwide. Estimates show that 1 in 10 hospital admissions result in HAIs. At any given time, 1.4 million people worldwide are affected. Developed countries carry a burden of between 5-15% of patients having HAIs whereas in the developing countries rates could be 2-20 times higher (World Health Organisation (WHO), 2009). At the core of IPC practices, is hand hygiene. Hand hygiene is ranked by the World Health Organization(WHO) as one of the primary modes to reduce Health Care Associated Infections, complete with evidence-based recommendations on hand hygiene in health care facilities(World

Health Organisation (WHO), 2009). Pittet and colleagues did a summary of these guidelines, which state that health care workers should wash their hand with soap and water or use an alcohol-based hand rub(Pittet, Allegranzi, & Boyce, 2009). The concept is further entrenched in "my five hand washing moments", that details methods and duration of hand washing that is ideal to achieve sanitization critical to preventing the transmission of pathogens.

1.1.1 History of hand hygiene

The importance of hand hygiene was recognized in the 1840s, by Dr. Ignaz Philip Semmelweiss of Vienna (popularly known as the pioneer of hand hygiene) and Dr. Oliver Wendell Holmes of Boston, USA(Lane, Blum, Fee, & Chang, 2010). Semmelweiss was the house officer in the maternity wing where he noticed that qualified doctors and medical students went straight to the labor rooms to deliver women, having come directly from handling cadavers, with no form of disinfection in between. He postulated that this was the cause of puerperal fever in women. He recommended that they wash their hands with chlorinated water before handling each patient. As a consequence of implementing this measure infection rates dropped dramatically to 3% from a high of about 16%. Unfortunately, both Semmelweiss and Oliver were unable to observe sustained behavior change in their colleagues. They had difficulties convincing their colleagues and administrators on the benefit of the procedure(Markel, 2015).

1.1.2 Surveillance

Despite these frightening statistics, most countries especially the low and middle-income countries(LMICs) lack surveillance systems for health care-associated infections. Those that do have a semblance of a surveillance system, often struggle with the complexity, lack of consistency and lack of standardized criteria for diagnosing the infections. This makes it difficult to gather reliable global information on health care-associated infections, and as is the trend globally, health care-associated Infections usually receive public attention when there are epidemics. This may be hidden from public attention but the very real endemic, ongoing problem is one that no institution or country can claim to have solved, despite many efforts.

1.1.3 Health worker compliance with hand washing

A study by Cookson and colleagues demonstrated that although many countries have guidelines regarding hand hygiene for healthcare settings(Cookson et al., 2009), overall compliance among

HCWs remains poor. A systematic review of 96 studies was conducted in high income countries and results showed a hand washing compliance rate of 40% among health care workers(Erasmus et al., 2010). Another study indicated that the compliance rates are much lower in developing countries, some reporting rates as low as 2.1% (Schmitz et al., 2014).Global compliance with hand hygiene practices, even in resource rich settings, can be as low as 0% with compliance levels most frequently well below 40%(Erasmus et al., 2010).There are very few studies on hand hygiene practices in developing countries. A study carried out in Embu referral hospital in Kenya (a level higher than Ruiru) showed that time spent washing hands by health care workers was 12.36% of the 40-60 seconds recommended by WHO (20-30 seconds if using an alcohol based hand rub) with only 28% of nurses and 23% of doctors following hand hygiene practices (Songa, Van Roekel, Mwangi, & Noel, 2015). A similar study carried out in Naivasha District Hospital in Kenya revealed an overall compliance of 32.5% (Isanda, 2014).

Again, the above local studies reinforced that compliance with hand hygiene practices was poor. But they did not extensively highlight the reasons why compliance is poor, particularly to do with individual and behavioral factors, which is what this study aimed to do

The World Health Organization in its mandate targets to have countries provide Universal Health Care (UHC) to its citizenry. UHC as defined by WHO encompasses three objectives: equity of access, quality of services and financial risk protection(WHO, 2013). The lack of, or inadequate hand hygiene definitely compromises on the ability of health workers to deliver quality care to patients, and therefore hinders progress to achieving UHC.

1.2 Problem Statement

A quality improvement audit done at the maternity department of Ruiru Sub-County Hospital in 2015 on infection prevention practices and focusing mainly on hand hygiene revealed a compliance rate of between 10-40%. The hand hygiene project was initiated and completed between the months of July and November 2015. This audit was prompted by the increasing rates of new born infection three days post-delivery. In addition to revealing the low compliance rates among providers, some factors contributing to the poor compliance were brought to light which will be discussed later. Implementation of some of the recommendations of this audit saw a significant drop in new born infections within a month of implementation.

Ideally, with the knowledge that health workers have, expected compliance should be near 100%. If poor compliance is not rectified, there will be an upsurge in hospital acquired infections which have a direct effect on morbidity and mortality rates, and indirectly contributing to the economic burden resulting from loss of otherwise productive lives.

This study aimed to explore particular prospects underlying hand hygiene behavior that would influence its practice and promotion among healthcare workers in order to develop targeted and appropriate interventions to improve hand hygiene. No formal study had been done at Ruiru Sub-County Hospital to assess hand hygiene practices of healthcare workers or their knowledge and attitudes regarding hand hygiene. The audit was conducted only in the Maternity department and involved nurses as the only professional category studied and no formal publication was done. The methods were also not adequate to appreciate hand hygiene efforts more so because maternity department has the highest risk of exposure to infections and would provide rich data if well studied.

1.3 Objectives

1.3.1 Main Objective

The main objective of this study was to understand current hand hygiene practices of Ruiru Sub-County Hospital.

1.3.2 Specific Objectives

i. To describe the current status of hand hygiene practices in Ruiru Sub-County Hospital;
ii. To analyze key factors, at individual and facility level, that influence hand hygiene practices at the Ruiru Sub-County Hospital;
iii. To recommend potential interventions that would improve hand hygiene practices at Ruiru Sub-County Hospital.

1.3.3 Research Questions

i. What are the current hand hygiene practices at Ruiru Sub-County Hospital?
ii. What are the key factors at individual and facility level that influence hand hygiene practices at Ruiru Sub-County Hospital?

iii. What potential interventions would be recommended to improve hand hygiene practices at Ruiru Sub-County Hospital?

1.4 Justification/Significance

The benefits of hand hygiene in the health care set up have been clearly demonstrated by many studies (Klevens, et al., 2007). Despite this, achieving and sustaining acceptable hand hygiene compliance rates among healthcare workers remains a major challenge.

Additionally, relatively few studies have been conducted in resource poor settings, especially concerning hand hygiene behavior (Vindigni, Riley, & Jhung, 2011). Kenya in particular has little published information on hand hygiene practices among Health Care Workers(Songa et al., 2015), with those few published studies having been carried out mainly in the National referral facilities and the level 5 hospitals, none if any in the lower level facilities. A better understanding of the reasoning behind health workers' behavior related to hand hygiene will provide better understanding as to why compliance rates are low and enable formulation of a more comprehensive framework from which interventions will be developed that have a better chance of being successful in effecting change in this group. Not only will it have a direct impact on improved patient care, but also create harmonious working relationships between management and workers, inform policy on the most appropriate measures to implement as well as have a positive impact on local, regional and global health economies.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

The review contains detailed theoretical and empirical literature on how microorganisms are transferred through health workers' hands, current recommended guidelines on hand hygiene as well as factors that influence hand hygiene in health care facilities. Literature for the review was sourced from World Health Organization reports and respected sites such as PubMed, Google Scholar among others. The review is divided into four sections:

i. Theory of Planned Behavior
ii. Micro-organism transfer through health workers' hands
iii. Recommended guidelines for hand hygiene practices in the healthcare setting
iv. Factors that influence hand hygiene practices

2.2 Theory of Planned Behavior

Theory of planned behavior(TPB), also known as theory of Reasoned Action, is a behavioral decision-making model that has been validated to be used to predict social and health behaviors(Armitage & Conner, 2001) . The theory was intended to explain all behaviors' over which people the ability have to exert self-control. To quote White and colleagues (2015) "TPB proposes that the best determinant of behavior is intention which is influenced by three factors: attitude, subjective norm, and perceived behavioral control; where attitude refers to positive or negative evaluations of the behavior (e.g., performing hand hygiene is good); subjective norm refers to perceptions of pressure from others to perform the behavior (e.g., it is important that others would want me to perform hand hygiene); and perceived behavioral control refers to perceptions of the ease or difficulty of performing the behavior of interest (e.g., it would be easy for me to perform hand hygiene)" (White et al., 2015).

A study of behavioral determinants in Brazil's pediatric intensive care units that applied the Theory of Planned Behavior revealed that perceived social pressure was a major determinant of compliance with hand hygiene. What this meant was that health workers were more likely to adhere to hand hygiene rules if they believed that important individuals or groups would approve

or disapprove of their actions(Belela-Anacleto A, Kusahara D, Peterlini M,& Pedreira M ,2015).This corresponds to the subjective norm as outlined in the framework below. Another study using psychosocial determinants determined that hand hygiene behavior is a habit that needs self-monitoring; that an individual can self-regulate against set guidelines-in this case, the hand hygiene guidelines (von Lengerke et al., 2015).

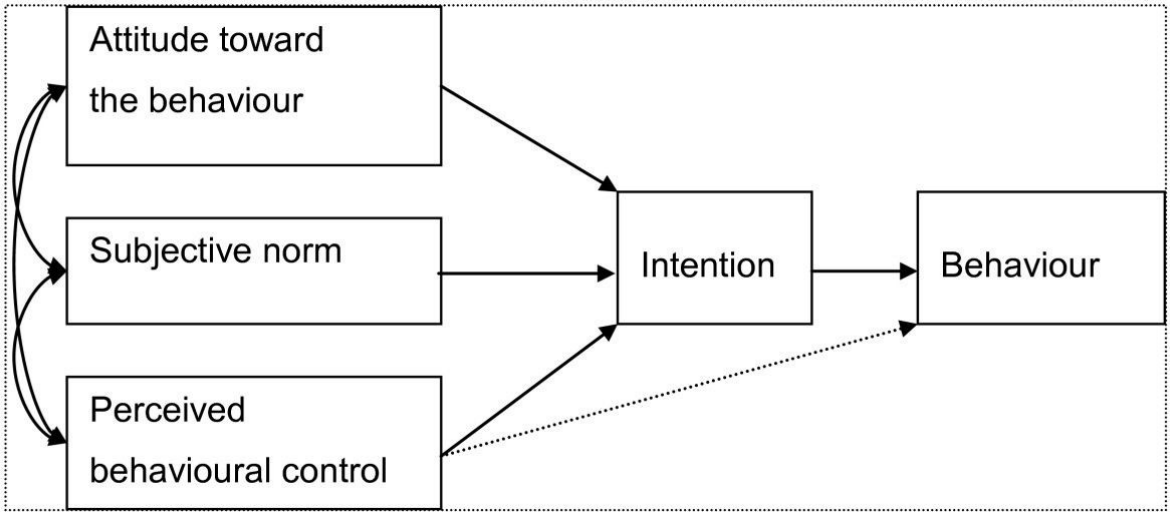

Figure 1: Conceptual framework of Theory of Planned Behaviour. Adapted from White, et al., 2015.

This conceptual framework helps in understanding both objective 1 and 2 of the study. In describing social and health behaviour, individuals' intention to act as desired will describe what current practices are there in the facility with regard to hand hygiene and will also highlight whether intention is a factor that affects hand hygiene. The above framework helps us to understand individuals and why they behave the way they do in relation to hand hygiene, beyond their skills and knowledge. Remember that despite this skills and knowledge acquired through training, compliance with hand hygiene practice among healthcare workers is still low. This psychological framework attempts to explain how individuals shape their intention to perform hand hygiene.

2.3 Micro-organism transfer through health worker hands

2.3.1 Normal bacterial flora on hands

There are two categories of bacteria that are normally recovered on hands assuming a random culture is done-resident or transient. Resident flora has been shown to be less likely to cause infections, unless in sterile body cavities like the eyes, which is still rare (Derakhshan & Sacidi, 2009).Transient bacteria on the other hand, has been found to colonize mainly the superficial layers of the skin and can be easily removed by routine hand hygiene. These transient microorganisms tend to survive rather than multiply on the skin and are often acquired by HCWs during direct contact with patients or contaminated environmental surfaces adjacent to the patient and most importantly they are the organisms most frequently associated with HCAIs.

2.3.2 Transmission of HCAIs through hands

Transmission can occur through droplets, direct contact or through a common vehicle (Isanda, 2014), but the hands of a HCW are the most common pattern and involve five sequential steps as outlined by Pittet and colleagues:

i. Organisms are present on the patients' skin or have been shed onto inanimate objects immediately surrounding the patient;
ii. Organisms must be transferred to the hands of HCWs;
iii. Organisms must be capable of surviving for at least several minutes on HCWs hands;
iv. Hand washing or hand antisepsis by the HCWs must be inadequate or omitted entirely, or the agent used for hand hygiene inappropriate;
v. And the contaminated hands of the care giver must come into direct contact with another patient or with an inanimate object that will come into direct contact with the patient(Pittet, Allegranzi, Sax, et al., 2006).

2.3.3 Organisms present on skin and inanimate objects

The human skin is colonized by a diverse range of organisms, both beneficial to humans and those with relevance to the health care setting(Kaya & Pittet, 2017).

Variation by body site is of obvious importance when considering the dynamics of organism transfer in the healthcare setting. Infected and draining wounds may be the obvious source of health

care-associated pathogens, but these pathogens can also be found on normal intact patient skin. WHO reports that about 106 skin squames containing viable microorganisms are shed daily from normal skin(World Health Organisation (WHO), 2009). It is therefore not surprising that the objects surrounding the patient become contaminated. This contamination extends to the hand wash/hand sanitizing stations, especially taps/ faucet handles (Grice & Segre, 2011).

2.3.4 Micro-organism transfer to health care workers' hands

Studies have not clearly outlined which patient-care activities result in bacteria and other microorganisms transfer from the patient to the HCWs hands. Some authors have attempted to stratify the patient-care activities into those with the highest chance of causing contamination of HCW hands but were not successful in quantifying the level of microorganism contamination that occurred. Important to note, however, is that the duration of patient-care activity had a strong association with the intensity of microorganism contamination of HCWs' hands(Maillard, 2012).

2.3.5 Organism survival on hands

Survival on hands depends on the type of microorganism, concentration of microbes, method of hand cleansing, duration of exposure and environmental temperature, objects handled including paper used for patient documentation(Weber, Rutala, Miller, Huslage, & Sickbert-Bennett, 2010).

2.3.6 Results of defective hand washing

The failure to perform appropriate hand hygiene in the healthcare setting is considered as the leading cause of HCAIs and the spread of organisms that are resistant to even the strongest available regimens. This directly translates to increased healthcare costs (Cummings, Anderson, & Kaye, 2010) due to repeated infections that are sometimes non-responsive to medication, prolonged admissions, morbidity, mortality and loss of work hours that cascade to the general economy of the country.

2.4 Recommended guidelines for hand hygiene practices in the healthcare setting

The World Health Organization in its publication of May 2009, outlined the two main ways to ensure hand hygiene in the healthcare setting: washing of hands using soap and water, or using an alcohol-based hand rub(World Health Organisation (WHO), 2009). These have been taken up as the universal modes of performing hand hygiene practices in healthcare settings and in most cases

serve as reference for local guidelines. The report goes further to illustrate moments that hand washing or rubbing should occur in the course of patient care and goes ahead to demonstrate the same as shown below:

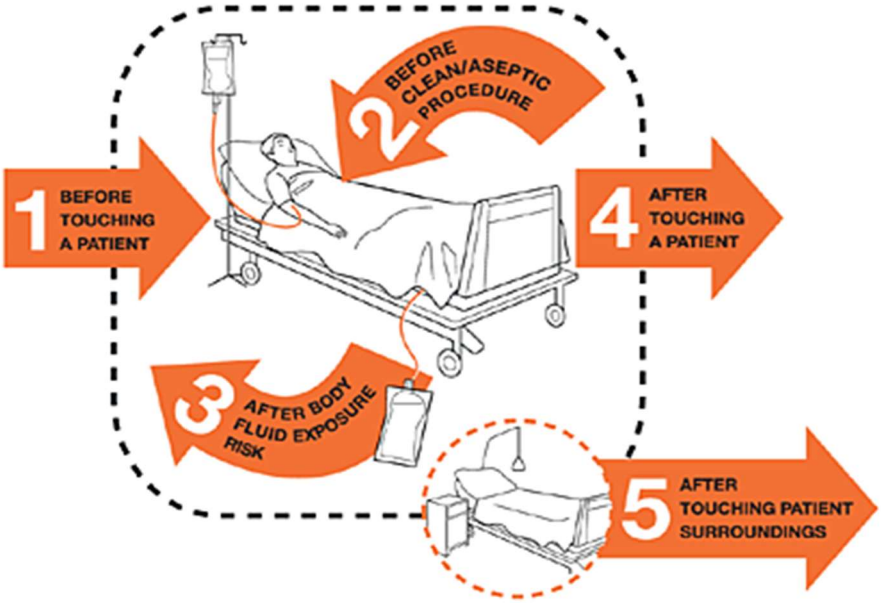

Figure 2: My Five Moments of Hand Washing. Adapted from WHO, Clean Care is Safer Care,2009.

Figure 3: How to wash hands. Adapted from WHO, Clean Care is Safer Care,2009.

Figure 4: How to hand rub. Adapted from WHO, Clean Care is Safer Care, 2009

Studies were conducted on the recommended elements, that is water and soap and alcohol hand rub, among other elements, and the two methods proved superior to be used for hand hygiene.

Water is essential for life, and for normal day to day activities and human consumption in most buildings, it meets drinking standards. However, water systems in healthcare buildings are complex, and can create fertile conditions for growth and multiplication of microorganisms, including waterborne pathogens that have been linked to healthcare-associated infections (HAIs).

While water can be referred to as a universal solvent, on its own it may not be able to get rid of all microbes plus hydrophobic substances. Tap water is increasingly being shown to be a vector source for nosocomial infections(Decker & Palmore, 2013). A study looking at tap water as a source of the pathogen P. aeruginosa infection to patients found that more than half of the pathogens' carriage in patients was acquired through tap water (Rogues et al., 2007). In a similar study, even the most sophisticated electronic faucets for hand washing were found to be contaminated with microbes(Merrer et al., 2005). Furthermore, there was no effect of water temperature on the removal of pathogens from hands(Jensen et al., 2017).

Strategies to reduce waterborne HAIs are multifaceted. Given the growing concern about water borne HAIs, water systems in the healthcare facility should be included in the IPC plans (E. R. Myers, Carbone, Thompson, & Hanlin, 2014). Hospital management should facilitate partnership with engineering department who are responsible for the operation and maintenance of water systems, aligning them with IPC strategies to reduce waterborne infections.

Alcohol hand rub has been demonstrated to be a fast and effective way to kill microorganisms in facilities or countries with an erratic supply of water. The alcohol content must be at least 60% for the sanitizer to be effective(Todd et al., 2010). A field study conducted in Tanzania showed that using an alcohol-based hand sanitizer logged in a higher reduction in bacterial counts on hands than just using regular soap and water(Pickering, Boehm, Mwanjali, & Davis, 2010). In a similar study involving a live influenza virus, it was found that all hand washing protocols containing alcohol achieved a large reduction of the influenza virus on human hands(Grayson et al., 2009). Alcohol-containing hand sanitizers have therefore proved revolutionary in the LMICs where resources tend to be scarce and poorly managed.

2.5 Factors that influence hand hygiene

Factors that influence hand hygiene are multifactorial in nature. General studies looking into factors that affect compliance of hand hygiene have attempted to make broad classifications of the factors. One study sought to understand healthcare workers' knowledge, attitude and practices of hand hygiene in a medical setting. Results showed that main barriers to hand hygiene were related to being overworked, lack of resources and lack of or inadequate training on the same (Diwan et al., 2016).In a similar study, the author categorized these factors into three main categories: one, healthcare staff related factors, two, clinical factors and three, environmental, institutional, behavioral and others(Mathur, 2011). A cross-sectional study among nurses in Kenya showed that level of education and training had a major impact on compliance with and attitudes towards hand hygiene(Moyo, 2013).Another local study carried out in Embu level 5 in Kenya categorized factors into several sub groups, and went into detail to describe findings in each grouping(Maingi, 2015).

2.5.1 Behavioural aspects of hand hygiene

Pittet and colleagues reviewed some of the interventions set in place to improve hand hygiene compliance among healthcare workers. They concluded improvement of hand hygiene practices was difficult to achieve and maintain (Pittet, Allegranzi, Storr, & Donaldson, 2006). Some thought that this difficulty was partly due to the failure to use behavioral theories in study designs (Gould, Moralejo, Drey, & Chudleigh, 2010). This suggests that behavior is a difficult thing to change. Behavior is influenced by many factors such as the environment, biology, culture and education(World Health Organisation (WHO), 2009), with some factors having more effect on behavior than others. Scientists have attempted to apply cognitive variables such as intentions, knowledge, perception of threat and motivation among others to try and understand what drives behavior. Some authors believed that insufficient application of behavioral theories in analysis of healthcare worker hand hygiene compliance has led to limited understanding of hand hygiene behavior (Fuller et al., 2014).They further argued that use of one theory of behavior was insufficient to create comprehensive understanding of behavior influencing hand hygiene. Another group did a study to assess factors that determined behavior leading to hand hygiene compliance in the intensive care units. Key findings were that knowledge of hand hygiene guidelines did not predict their use. Nurses with negative attitude, with negative social influence and low self-efficacy were shown to have poor compliance and had a tendency to understate the importance of washing

hands(De Wandel, Maes, Labeau, Vereecken, & Blot, 2010). A study in Lahore, Pakistan, revealed that less than half of healthcare practitioners were confident in their knowledge, attitudes and practices about hand hygiene. This meant that they obviously could not perform that which they were not well versed in(Zip-E-Ali, Cheema, Wajih Ullah, Ghulam, & Tariq, 2017). Additionally, if there were no senior role models at the workplace in regards to hand washing, health care workers were likely to not practice it. Another interesting study showed that chances of healthcare workers washing their hands was higher if they were prompted or when they knew someone was watching them than when they were left alone and expected to carry out the procedure as expected(Gluck et al., 2010). This is despite all hand hygiene items being properly placed within reach of the health worker. This is disconcerting seeing as the expectation would be that knowledge would be better as their training in medicine was. It's clear, great assumptions are made when it comes to this category of professional having such a sensitive job of handling human health.

2.5.2 Culture and religion and compliance with hand hygiene practices

Culture and religion plays a big role in affecting behavior of individuals. This must be considered because guidelines will be disseminated to various regions globally with different cultural practices. It is a well-known fact that religion or faith and medicine are intertwined. Religious beliefs are a strong motivating factor for determining health beliefs and behaviors(World Health Organisation (WHO), 2009). Religion tends to promote community wellbeing, and as such religious health care workers will tend to engage in positive activities that enhance wellness, including washing hands to prevent transmission of infections. In the Islamic community, alcohol is forbidden. It would be prudent therefore to anticipate resistance to the alcohol hand rubs especially in the very conservative Muslim communities. In some Hindu communities, using soaps with animal oil goes against religious beliefs therefore affecting behavior (World Health Organisation (WHO), 2009).

2.5.3 Availability of hand hygiene facilities and hand hygiene compliance

Structural factors that influence hand hygiene have to do with the organization. However, structure cannot be divorced from behavior because how the organization is set up affects how employees behave. An observational study conducted to identify predictors of non-compliance among health care workers showed that at the organizational level, absence of written guidelines, lack of suitable

hygiene agents, poor traditional culture of hygiene compliance and lack of motivators led to a 100% lack of compliance to hand washing among all cadres of health care workers(Suchitra & Lakshmidevi, 2006). A study conducted among health care workers in Pune, India, revealed unavailability of hand washing facilities as a major cause of non-adherence among health care workers(Kotwal, Anargh, Singh, Kulkarni, & Mahen, 2013). These facilities include presence of sinks, inconvenient placement of sinks, water, taps, soap dispensers, hand dryers and paper towels. Two authors(Marjadi & McLaws, 2010) identified longstanding water scarcity as among the top major barriers to hand hygiene compliance among healthcare workers in rural Indonesian hospitals. Another study demonstrated the huge impact availability of hand hygiene materials and facilities had on improving hand hygiene practices among health workers in the National Health Service (NHS) facilities (Aziz, 2013).

A study conducted in Nigeria cited non-availability of infection prevention equipment as the major reason for non-compliance with universal infection prevention precautions(Amoran & Onwube, 2013). In Ghana it was demonstrated that deficient facilities particularly alcohol-based hand rubs and liquid soap dispensers were responsible for poor compliance rates(Yawson & Hesse, 2013). A conference on Infection Prevention and Control held in Kenya highlighted the lack of basic infrastructure as one of the challenges facing infection prevention and control practices (Ndegwa, 2014).

2.5.4 Socio-demographic factors and hand hygiene compliance

According to WHO guidelines for hand hygiene in health care(World Health Organisation (WHO), 2009), belonging to a certain professional category ,that is being a doctor, nurse or nursing assistant, physiotherapist, technician, or ancillary staff, is an important predictor of compliance with hand hygiene guidelines. One study in Australia reported that nurses were more likely to understand and put into practice the five moments for hand hygiene than doctors who most often tend to avoid these opportunities, citing more urgent and important commitments(Gilbert, 2014). Another study found that doctors held influential positions in hospitals thus their attitudes and practices towards hand hygiene disproportionately influence practices of other health workers(Jang et al., 2010). Similarly , Erasmus and colleagues also reported a finding that doctors were consistently less compliant with hand hygiene guidelines than nurses(Erasmus et al., 2010).

Personal and demographic factors were found to be statistically significant determinants of compliance with IPC practices among nurses at Kenyatta National Hospital, Nairobi, Kenya(Omuga, 2011).By way of figures, (Ndegwa, 2014) reported significant variations in hand hygiene adherence rates among different cadres of healthcare providers with doctors(22%) and clinical officers (22%) having the lowest adherence rates compared to nurses (31%) and technicians (32%) respectively in three different Kenyan hospitals.

2.5.5 Type of work unit and hand hygiene compliance

The World Health Organization recognizes that working in specific health facility units such as ICUs ,surgical units and emergency department can be used to predict poor compliance with hand hygiene practices(World Health Organisation (WHO), 2009). A similar study reported higher compliance in the pediatric unit (84%) and ICU (84%) than medical(82%) and surgical(81%) units respectively(Kowitt, Jefferson, & Mermel, 2013).Further across Africa, a study reported the highest hand hygiene compliance rate in the neonatal ICU (43%) of a Ghanaian teaching hospital(Yawson & Hesse, 2013).

2.5.6 Hand hygiene knowledge and compliance with hand hygiene guidelines

All healthcare workers are required to undergo comprehensive training and education regarding the role and importance of hand hygiene. According to a survey on hand hygiene practices among general practice dentists, excellent or good knowledge of local hand hygiene guidelines was associated with acceptable hand hygiene behavior(Myers et al., 2008).

In Ireland, a study demonstrated that an increase in healthcare worker's knowledge on hand hygiene guidelines following a training had a significant association with improved practice and compliance among health care workers (Creedon, 2006). Similar conclusions were made in Ethiopia, that prior training and having knowledge about hand hygiene guidelines were important factors influencing compliance with recommended practices (Abdella et al., 2014).Another study was conducted on health professional's knowledge and areas for improvement using the hand hygiene knowledge questionnaire in Spain and it demonstrated that health workers with lower knowledge on hand hygiene practices tended to be younger, male and non-clinical staff. The study also concluded that previous training on hand hygiene matters did not necessarily ensure excellent knowledge on hand hygiene guidelines and practices(Perez-Perez et al., 2015). However, a study

carried out among Japanese dentists concluded quite the opposite-that knowledge of standard IPC precautions was the most significant predictor of compliance with infection control practices(Tada, Watanabe, & Senpuku, 2014).

2.6 Conclusion

Given the literature review above, the knowledge gap that my study will try to fill is on factors that influence hand hygiene compliance specifically factors that inform how health care workers behave in relation to hand hygiene.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter described the research methodology which was used in carrying out the research study. The following areas were discussed: research design, target population, sample size and sampling techniques, reliability and validity of research instruments, data collection procedures and data analysis techniques.

3.2 Research Design

The study was a simple descriptive survey. A self-administered questionnaire with closed ended items was used to collect primary data from the study participants. This was complemented by observation data using a structured observation form collected by the researcher.

3.3 Population

The study was carried out in Ruiru Sub-County Hospital, a level 4 facility located in the wider county of Kiambu, Kenya. It serves a catchment population of about 300,000. The facility has grown from an 8 to 50 bed capacity, owing to the construction of a 30-bed maternity block, with a maternity theatre, and renovation of the general and pediatric wards. Specialized clinics were also expanded and run for 4 days in a week. In terms of staffing, the hospital has 4 doctors, 50 nurses, 7 clinical officers. Total number of healthcare workers who come into direct contact with patients were 61 who formed the sampling frame for the study.

3.4 Sample Size Determination

The study used Krejcie and Morgan's table to determine the sample size for the quantitative component of the study. The table is based on a formula for calculating sample sizes for finite populations such as is the healthcare workers in Ruiru Sub-County Hospital. The formula appears as follows:

s=X2 NP (1-P) ± d2 (N—]) +X2 P (1—P)

s = required sample size.
*X*2 = the table value of chi-square for 1 degree of freedom at the desired confidence level

(3.841).

N = the population size.

P = the population proportion (assumed to be .50 since this would provide the maximum sample size).

d = the degree of accuracy expressed as a proportion (.05).

With a population size of 61, using the above formula, the required sample size will be 52. This is comparable to what the Krejcie and Morgan table indicates for the same population size.

For observation data, a structured unobtrusive kind of direct observation was used where the researcher did not interfere with the HCWs work and they were not informed that observation was ongoing in order to minimize bias. Observation was carried out in 2 departments: maternity and the general wards comprising of pediatric, male and female wards, before and after patient care. They were observed randomly for 10-20 minutes each until 4 hand hygiene opportunities occurred per health worker or until the HCW left. Observations were carried out during the following timings: Morning hours between 9am-12am and afternoon hours between 2pm-5pm.

3.4.1 Sampling technique

Representative sampling, where the population was characterized based on certain desired features, in this case professional category, was applied to each cadre in order to have a strong external validity in relation to the target population the sample was meant to represent. Formula is as indicated below:

N=61(total population of interest)

n=52(sample size)

N1=4(number of doctors)

N2=50(number of nurses)

N3=7(number of clinical officers)

Thus representative sample for each cadre will be calculated as follows:

n1= (N1/N) *n

For doctors= (4/61)52=3

For nurses= (50/61)52=42

For clinical officers= (7/61)52=5

Total= 50

3.5 Data Collection Approaches

3.5.1 Initiating contacts

Initial discussions with the hospital management committee were carried out, followed by a formal request to undertake the study among the health workers. Since the study involved work with human subjects, ethical clearance was sought from the Strathmore University Ethics Review Committee. A list of health workers who come into direct contact with patients was compiled. Once the respondents agreed to participate, they were required to sign a consent form administered by the researcher and or the research assistant.

3.6 Data Collection Tools

3.6.1 Questionnaire

The self-administered questionnaire filled by all health care workers who came into direct contact with patients was used to shed more light on the issues that were observed. It gathered information on current practices, knowledge, behavioral intentions and some potential interventions to improve hand hygiene compliance in the facility. The questionnaire was a modified version of the WHO knowledge and perception questionnaires for health workers.

3.6.2 A structured WHO Hand hygiene observation tool

Detection of hand hygiene compliance by direct observation is currently considered the gold standard in hand hygiene compliance monitoring (WHO, 2009). A structured WHO hand hygiene observation form was used. It is a tool that uses evidence-based model of hand transmission. As a standardized tool that uses the "my five moments for hand hygiene" approach, it allows comparison of hand hygiene performance across a broad range of health care settings and has been applied successfully by many hospitals worldwide. The data collected was all occurring hand hygiene opportunities and actions and assessment of the number of times and appropriate timing when hand hygiene was required in the sequence of care.

3.7 Data Management and Analysis

Data entries from both the observation form and questionnaires were cleaned by counterchecking entered data against the hard copy questionnaires. Data analysis was done by Statistical Packages

for Social Sciences (SPSS). In particular, to determine current hand hygiene practices and compliance as per objective one, through observation, the following basic formula was used, as indicated on the observation form (see appendix 1:

$$Compliance\ (\%) = \frac{Performed\ Actions\ x\ 100}{Opportunities}$$

This was broken down in form of professional category(cadre), departments and shifts. Objective 2 and 3 detailing factors affecting compliance with hand hygiene and potential interventions to improve the same, descriptive statistics was applied to analyze the data.

3.7 Reliability and Validity of the Study

Reliability and validity of the questionnaire was done by doing a pilot study using the WHO hand hygiene questionnaire. 12 members of the target population were identified at random. They were asked to fill out the questionnaire and give real time feedback of what they thought made sense and what did not. The researcher identified instrument deficiencies and either modified or discarded inconsistent items. Peer review was also done on the questionnaire by the study supervisor. The final questionnaire was then drafted as a modified version of the WHO questionnaire. Validity of the content of the questionnaire was further entrenched by peer review and by use of an additional tool, the observation form. The study did not apply inference statistics, it was purely descriptive and therefore coefficient calculations for reliability were not applicable.

CHAPTER FOUR: DATA ANALYSIS AND RESULTS

4.1 Introduction

This chapter focused on analysis, presentation and interpretation of collected data. The results were presented in the following order: participant response rate, profile of participants, current hand hygiene practices, factors that affect hand hygiene practices at individual and institutional level, potential factors that would improve hand hygiene among health care workers and conclusion.

4.2 Response rate

Out of a sample size of 52, 45 health workers agreed to take part in the study, giving a response rate of 86.5%.

4.3 Profiles of Participants

Table 1 summarized the profile of participants who took part in the study. The study involved healthcare workers who frequently came into direct contact with patients. These healthcare workers were grouped into three categories: Doctors, nurses and clinical officers. Nurses comprised the largest number of healthcare workers at the facility, representing 82.2% of all the participants. Doctors and clinical officers made up 6.7% and 11.1% respectively. Female participants represented the largest number at 75.6%, the remainder being males at 24.4%. In terms of age, majority of participants were in the 31-35-year age gap representing 40%. The least number were aged above 45 years representing 6.7% of all participants.

Table 1: Profiles of participants

Profession	**Count**	**Percentage**
Nurse	37	82.2
Medical doctors	3	6.7
Clinical officers	5	11.1
Gender		
Male	11	24.4
Female	34	75.6

Age (years)		
18-25	4	8.9
26-30	9	20.0
31-35	18	40.0
36-40	3	6.7
41-46	8	17.8
>46	3	6.7

4.3.1 Profiles of participants trained in hand hygiene

Table 2 below showed what percentage in each cadre had, in the last 3 years, been trained on hand hygiene practices. Out of 37 nurses who took part in the study, 20 of then hand undergone training on hand hygiene in the last 3 years. Of the 3 doctors who participated, only one had received training and out of 5 clinical officers, 3 had been trained in the past 3 years.

Table 2: Profiles of participants trained in hand hygiene

Profession	**Total participants**	**No. Trained in the last 3 years**	**Percentage %**
Nurses	37	20	54
Doctors	3	1	33
Clinical officers	5	3	60

4.4 Current Hand Hygiene Practices

This was assessed from unobtrusive observation of hand hygiene practices and responses gathered from specific questions on the questionnaire.

Tables 3, 4 and 5 presented results from observation data where compliance rates were calculated using the formula:

$$Compliance\ (\%) = \frac{Performed\ Actions\ x\ 100}{Opportunities}$$

During the monitoring session (maximum of 20 minutes), the observers registered the HH opportunities in the WHO collection form(see appendix 1), including moments (before patient contact, before performing an aseptic task, after exposure with body fluids, after patient contact, and after contact with patient's surroundings), staff cadre (nurse, doctor, clinical officer), and actions (hand rub, hand washing, missed HH, and gloves without HH).Total opportunities and total actions per unit of analysis (cadres, department or shift) were summed up from the observation form, and presented in the tables below.

Each cadre had 64 hand hygiene opportunities available to them. Overall compliance rate among the healthcare workers was 54.1%. Doctors had the highest compliance rate at 57.8%, while nurses and clinical officers were seen to have an equal compliance rate of 51.6%.

Table 3:Compliance rates according to cadre

Profession	**Total Actions**	**Total Opportunities.**	**Compliance Rates**
Nurses	33	64	51.6%
Doctors	37	64	57.8%
Clinical officers	33	64	51.6%
Total	104	192	54.1%(Overall Compliance)

Departmental comparison as per table 4 showed that the general wards had a higher compliance rate at 56% as compared to maternity which had a compliance rate of 51%. This could be explained by the fact that general wards are generally less busy than Maternity, so the staff have ample time to perform hand hygiene as required.

Table 4:Compliance rates according to departments

Department	Total Actions	Total Opportunities	Compliance Rates
Maternity (both morning and afternoon)	49	96	51%
Wards (both morning and afternoon)	54	96	56%

Compliance during the morning shift regardless of department was low at 41.6% as compared to the afternoon which revealed a compliance rate of 65.6%. Morning shifts are known to be the busiest in any department and could explain the low compliance, because staff do not have adequate time to perform adequate hand hygiene.

Table 5:Compliance rates according to shifts

Shift	Total Actions	Total Opportunities	Compliance Rates
Morning (both maternity and ward)	40	96	41.66%
Afternoon (both maternity and ward)	63	96	65.62%

Question 2 and 4 of the questionnaire sought to further describe the current hand hygiene practices at Ruiru. Participants were asked whether they routinely use alcohol hand rub and results as per table 6 showed that majority of them at 55.6% used Alcohol-Based Hand Rub(ABHR).

Participants were also given 4 out the 5 hand hygiene moments to choose which they performed hand hygiene practices. Performance of hand hygiene practices was highest after exposure to body fluids (42 out of 45 respondents to the question=95%). This was possibly due to the fact that the healthcare workers felt more vulnerable to acquiring infection and had to act in their best interest (self-preservation). Before performing aseptic procedure produced the second highest compliance at 62%, followed by after exposure to patient surroundings (60%).The least compliance was noted before touching a patient at 55%. The cascade of these results gives a hint on how as perception is translated into action, that only visible contamination receives greatest response in terms of hand hygiene performance despite all indications being given equal weight. (Table 7)

Table 6:Routine use of alcohol-based hand rub

	Frequency	**Percent**
Yes	25	55.6
No	20	44.4
Total	45	100.0

Table 7:Hand hygiene operations

Indications	**Number of Respondents**	**Total Responses**	**Percentage**
Before touching Patient	25	45	55
After body fluid Exposure	42	45	93
After exposure to patient Surrounding	27	45	60
Before Antiseptic Procedure	28	45	62

In summary, overall compliance rate was found to be 54.1% with doctors having the highest rate at 57.8%. The general wards revealed a higher compliance rate than maternity. In addition, morning shift (between 9-12am) recorded a low compliance rate at 41.6%. Majority of the participants reported that they routinely used ABHR in sanitizing their hands. Of the 5 hand hygiene moments, after exposure to body fluids recorded the highest compliance with hand hygiene practices.

4.3 Factors that Influence Hand Hygiene Practices

The following factors were analysed: sociodemographic factors, type of work unit, institutional/structural factors, knowledge and behavioural factors.

4.3.1 Socio-demographic factors

The demographic factors analysed in this study were differences in compliance rates between the cadres. This was calculated from the observation form and presented in table 3 above. It was found that doctors had the highest compliance rate at 57.8%, while nurses and clinical officers had an equal compliance rate at 51.6%. The higher compliance among doctors could reflect greater awareness of situations and applicability of knowledge than the other cadres.

4.3.2 Type of work unit

Work units compared were maternity department and the general wards (male, female and paediatric wards). This was illustrated from observation data (table 4) where maternity logged in a lower compliance of 51% as compared to the general wards which had a compliance rate of 56%. This is possibly due to the greater workload that is characteristic of maternity departments, leading to lack of adequate time in between patients to perform hand hygiene as required.

4.3.3 Institutional/structural factors

Participants were given a choice of four factors-lack of alcohol hand rub, preference for gloves, gloves are faster to use and lack of time (suggesting high workloads) as structural factors that affect hand hygiene. The biggest barrier to hand hygiene in the facility was lack of alcohol-based hand rub, with all 45 respondents having a unanimous response (100%). Second biggest factor preventing proper hand hygiene practices was lack of time (97.8). Gloves being faster to use scored

at 95.6%, and the lowest among the institutional factors was preference for gloves at 91.1%. Table 8 presents a summary of institutional and individual factors.

4.3.4 Knowledge on hand hygiene

Table 8 presented results on knowledge about hand hygiene among health care workers. Questions 4 through to 7 sought to assess health worker knowledge on hand hygiene and its relation to transmission of HAIs. Participants were asked whether health worker hands were the main route of transmission of harmful germs to patients. Majority (60%) reported no, showing a poor understanding of the relation of health worker hands and transmissibility of infections to the patient. A majority of the respondents were in agreement that wearing jewelry at work increased the likelihood of colonization of hands and that hand rubbing was faster than hand washing in sanitization of hands, at 62.2% and 97.8% respectively. Participants were also asked what they thought about the impact of HCAIs on patients' clinical outcome, which they ranked on a 5-point Likert scale. Two extremes of the scale had a tie, with 'low' and 'high' response having the same number at 37.8%. 'Very high' scored at 6.7% while 'very low' scored 17.8%. This result showed indicated that there was a majority number in-between who needed proper training in-order to impart the correct information, and this could make a big difference in creating a large pool of knowledgeable workers. In the same line, participants were asked what the effectiveness of hand hygiene was in preventing HAIs. Again, majority at 44.4% indicated that effectiveness was high, followed by 24.4% percent who thought it was low. Again, there seemed to be two extremes of knowledge that needed to be corrected.

Table 8:Hand hygiene knowledge

Variable	Response	Frequency	Percent
Health workers hand the major route of cross transmission of potentially harmful germs between patients in a health care facility	Yes No **Total**	18 27 **45**	40 60 **100**
Wearing Jewelry &hand Colonization	Yes No **Total**	28 17 **45**	62.2 37.8 **100**
Hand Rub is rapid for hand cleaning	Yes No **Total**	44 1 **45**	97.8 2.2 **100**

HCAI & Patient outcome	Very low Low High Very high **Total**	8 17 17 3 **45**	17.8 37.8 37.8 6.7 **100**
Effectiveness of HH in Preventing HCAI	Very low Low High Very high **Total**	4 11 20 10 **45**	8.9 24.4 44.4 22.2 **100**

4.3.5 Behavior and hand hygiene

On an individual level, there were hints on perceptions about hand hygiene practices and subsequent behavior about the same. If the health care worker perceived themselves at low risk of acquiring infections, then their performance of hand hygiene practices would be low, at indicated by 93.3% of the respondents. Questions were phrased in two different formats to see what kind of responses they would elicit. When given a list of choices to rank as factors that influence hand hygiene, they ranked lack of alcohol hand rub as the major cause of poor compliance. Among that list, was "that if nobody else does it" and that "it is not important" as barriers to low hand hygiene compliance. Both were ranked low at 53.3% and 24.4% respectively. Meaning that regardless of what other peers thought about hand hygiene, these respondents would perform hand hygiene as required. Additionally, they ranked forgetfulness quite highly at 91.1% as a cause of poor hand hygiene, meaning most times they forget to do it (see table 8).

However, when respondents were asked specific questions applying the Theory of Planned Behavior which they ranked on a 3-point Likert scale, the responses became interesting. On being asked whether they performed hand hygiene as recommended during patient care, majority of respondents (73%) said that they did. However, only 33% reported that it was easy to comply with the stated guidelines as they were. This contradicts the earlier response that they easily forget to perform hand hygiene, and they classified it as a major barrier to hand hygiene (see table 8). Further, 48% of respondents felt that their performance of hand hygiene did not at all serve as an

example to other healthcare workers. Only a small number (26%) thought they their compliance was a great determinant of how their colleagues performed. On the converse, 77% of the respondents revealed that their colleagues never performed hand hygiene as recommended. This is where it gets more interesting. Remember in previous question they ranked the fact that nobody else does it and that hand hygiene is not an important thing as quite a low determinant of their performance and compliance with hand hygiene. But here, they reveal the opposite. That peer behavior was a strong determinant of attitude and eventually intention to perform the behavior, hand hygiene. This highly suggested that hand hygiene was not taken seriously among peers and could possibly lead to low compliance.

Table 9:Hand hygiene perception

	Always	**Sometimes**	**Never**
	Percentage	**Percentage**	**Percentage**
Do you perform HH as recommended during patient care	73	11	15
Is it easy to Comply with HH according to recommended guidelines	33	55	11
Is your Behavior Towards HH an example to colleagues	26	24	48
Do your Colleagues Perform HH according to recommended guidelines	11	11	77

4.4. Recommended potential interventions to improve hand hygiene compliance

Table 12 below shows a summary of some of the actions deemed effective to permanently improve hand hygiene in the facility.

Table 10:Recommendations on improving hand hygiene

		Percent of Cases	
		N	%
Opinions	Senior Management Support	43	95.6%
	Availability of Water and Alcohol Hand Rub	44	97.8%
	Regular Hand Hygiene Continuous Medical Education	23	51.1%
	Hand Hygiene Reminder Posters	37	82.2%
	Feedback on Hand Hygiene Performance	35	77.8%

Availability of water and alcohol hand rubs is regarded as the most effective practice with a count of 44 which represents 97.8% of the respondent's views. Senior management support was also regarded as an effective way to improve hand hygiene (95.6%). The others were in the order; Hand hygiene reminder posters (82.2%), feedback on hand performance (77.8%) and lastly regular hand hygiene continuous medical education (51.1%). This played a role in informing some of the recommendations that would be suggested in-order to improve the practice at the facility.

4.5. Conclusion

From the results of objective 1, we see an overall hand hygiene compliance rate of 54.1% with most workers reporting that they use ABHR regularly. We also get insight into which of the 5 WHO hand hygiene moments receives the highest adherence. For objective 2, highest compliance is recorded among the doctors. We also see maternity work unit as having a lower compliance than the general wards. Most workers are seen to be competent in knowledge on hand hygiene practice However, there is a disproportionate gap in practice: This is explained in part due to the lack of

alcohol-based hand rub as the main structural deficit but also from the perceptions of healthcare workers, which has a big influence on their behavior.

CHAPTER FIVE: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this section findings in chapter 4 were discussed, comparing with similar or contrary results from other studies. It also gave ideas on recommendations from the health workers opinions about what they thought could improve hand hygiene compliance together with what was observed during the study.

5.2 Hand Hygiene Practices

From the results we see an overall compliance rate of 54.1%. This is above the global rate of 40% as outlined by the World Health Organization report (World Health Organisation (WHO), 2009). However, this rate quoted from WHO is mostly from systematic studies conducted in high income countries (Erasmus et al., 2010). The report cited that it was difficult to get data from low and middle-income countries because no research was conducted in those countries, and if there was, inaccurate documentation made data collection more difficult.

Authors who did studies in African countries representing the low and middle income countries like Schmitz and colleagues in Ethiopia(Schmitz et al., 2014) found an extremely low compliance rate of 2.1%, and even after implementation of multimodal improvement strategies, the rate only rose to 12.7%. In a limited resource setting in Indonesia, hand hygiene compliance rate of 19.5% was observed prior to instituting improvement measures(Santosaningsih et al., 2017).

With regard to the 5 moments of hand hygiene as stipulated in the WHO report (World Health Organisation (WHO), 2009), two moments are seen to elicit the greatest compliance with hand hygiene practices. Two studies, one in Taiwan(Wu et al., 2016) and another in Jamaica (Nicholson et al., 2016) showed highest compliance with hand hygiene practices during two moments: after patient contact and after body fluid exposure respectively, mirroring what was found in the study at Ruiru. A similar study in Kosovo found that nurses had the highest compliance after exposure to body fluids(93%) and lowest before touching a patient at 18.5% (Sopjani, 2016). This suggests that healthcare workers are more diligent in performing hand hygiene in situations where there is highest risk to them first, then to the patient. Interestingly though, despite these 5 moments having been tested and approved for use in healthcare settings, their feasibility has been questioned in

overcrowded settings as is the case in most healthcare facilities in low and middle income countries (Salmon, Pittet, Sax, & McLaws, 2015). The authors suggest a modification of the moments to focus on those that pose the greatest risk of contamination. This could see an improvement in compliance rates when the time pressure to perform in all five moments is reduced.

In comparing the two major clinical departments, findings from the study indicate a lower compliance in the maternity department, where there is the highest risk of contamination. This is also seen in a study in Colombia where complying with safety standards including hand hygiene was low in the obstetric units (Amaya-Arias et al., 2017). This was attributed to high workloads in the units compounded by overcrowding in the wards which led to inadequate time to perform hand hygiene as required.

This study also revealed a higher compliance rate among doctors than any other cadre. This result contrasts most studies as discussed in the literature review which have shown doctors to be the least compliant with hand hygiene practices. A study comparing senior and junior physicians and nurses revealed rates on hand hygiene among chief or more senior physicians at 14.6%, attending physicians at 9.2% and junior doctors at 5.6%, while nurses in chief had a rate of 25.0%, and senior nurses and junior nurses showed no significant differences with rates of 26.3% and 20.5% respectively (Han, Dou, Zhang, & Zhu, 2011). Similarly in an observational study in Istanbul, doctors had a lower compliance at 31.9% as compared to nurses whose compliance was 41.4% (Keralan et al., 2014). Most studies comparing cadre compliance with hand hygiene cited reasons such as the doctors feeling superior than other workers to be held accountable for such 'mundane' procedures, to claiming to have more pressing matters to attend to so they couldn't waste time on a repetitive process. The higher compliance among the doctors in this study could possibly be attributed to greater applicability of knowledge and self-awareness and is important because it serves as a good example to the other healthcare workers.

5.2 Factors affecting hand hygiene practices

Lack of Alcohol-based hand rub was the main causative factor of poor compliance with hand hygiene practices, followed closely by lack of time, the perception that the risk of acquiring infection was low, and forgetfulness. In comparing results for the same with other studies, some respondents indicated that inconvenient placement of hand hygiene facilities was the main reason for poor compliance (Abdella et al., 2014). Another study in Uganda highlighted that lack of hand

hygiene facilities was one of the main barriers to hand hygiene, as well as health workers' perceptions on the risk of infection and increased workload (Mearkle, Houghton, Bwonya, & Lindfield, 2016). The similarity was evident in these studies. The effect that the lack of hand washing facilities has on compliance is not in doubt, but it would be important to think of other factors that would be masked by this shortcoming, that could possibly require more exploration.

Knowledge on hand hygiene and its relation to transmission of HCAIs was found to be acceptable among health care workers at Ruiru. There is however more room to improve on the knowledge. Studies have shown that increased and up to date knowledge on hand hygiene translated to higher compliance rates(Creedon, 2006) and (Abdella et al., 2014). The converse is also true, that suboptimal knowledge resulted in poor compliance (Labrague, McEnroe-Petitte, van de Mortel, & AMA, 2017).

Behavior in relation to hand hygiene is an area that requires more study. From the results we get insights on health workers' attitudes and subjective beliefs about hand hygiene and can therefore draw on some conclusions as to why they behave the way they do in regards to hand hygiene in the healthcare setting. Despite knowledge on when it was prudent to perform hand hygiene, only 33% thought it was easy to comply with the guidelines as they were. As discussed above, factors such as overcrowding and time pressure could make it hard to follow the procedures step by step. Further, they did not feel that their performance of hand hygiene served as a good example for their colleagues to emulate, neither did they think that their colleagues performed had hygiene as required or at all. This shapes the attitude that healthcare workers have towards hand hygiene, and consequently the intention to perform the procedures, and may have a negative impact on compliance. Evidence demonstrates that cues and emotional drivers can impact behavior change. Researchers interested in psychology and behavior from as early as the beginning of the 20th century found that social behavior could be best understood as a function of people's perceptions rather than as a function of real life, where real life represented objective facts such as the widely acclaimed and accepted hand hygiene procedures. In simple terms, social norms are created and governed by the community, so people are more likely to wash their hands when they observe others doing so (Global Handwashing Partnership, 2017).

5.4 Conclusion

The study results highlight structural factors, such as the lack of ABHR as playing a big role in poor hand hygiene compliance. It also brings out comparisons between cadres, departments and shifts, where differences in compliance rates suggest an interplay of factors well beyond the lack of facilities. Perceptions and attitudes that influence hand hygiene action are also seen when psychological theories of behaviour are applied.

5.3 Recommendations on improving hand hygiene compliance

Prioritization of hand hygiene in the patient safety agenda in resource poor settings such as Ruiru should be a core mandate by senior management, so that scarce resources can be allocated effectively. There should be regular mandatory training and updates in order to challenge negative beliefs and practices. Management should look into providing low cost measures like availing alcohol-based hand rubs at all patient care points. In general, though, no one single strategy is effective, rather, a multifaceted approach is preferred. Like Gould and colleagues (Gould et al., 2010) found, addressing product issues to instituting measure to involve medical practitioners in decision making had a positive impact on hand hygiene compliance. Most studies use an integrated approach to identify interventions that would improve compliance with hand hygiene. What is clear is that there is no one intervention that can solve the problem of poor compliance, as evidenced by Rong and colleagues (Rong, Neo, Sagha-Zadeh, Vielemeyer, & Franklin, 2016)

5.5 Limitations of the Study

Observation bias also known as Hawthorne effect is one of the major barriers in an observational study. This is when participants tend to behave differently when they know that they are being observed. This was mitigated by doing unobtrusive observation and not announcing the timings of the observation.

The study was also limited to healthcare workers who came into direct contact with patients in two major departments, leaving out the outpatient departments and other auxiliary staff due to anticipated study timelines and financial constraints. Compliance in other areas of Infection Prevention and Control such as waste segregation was not included in this study

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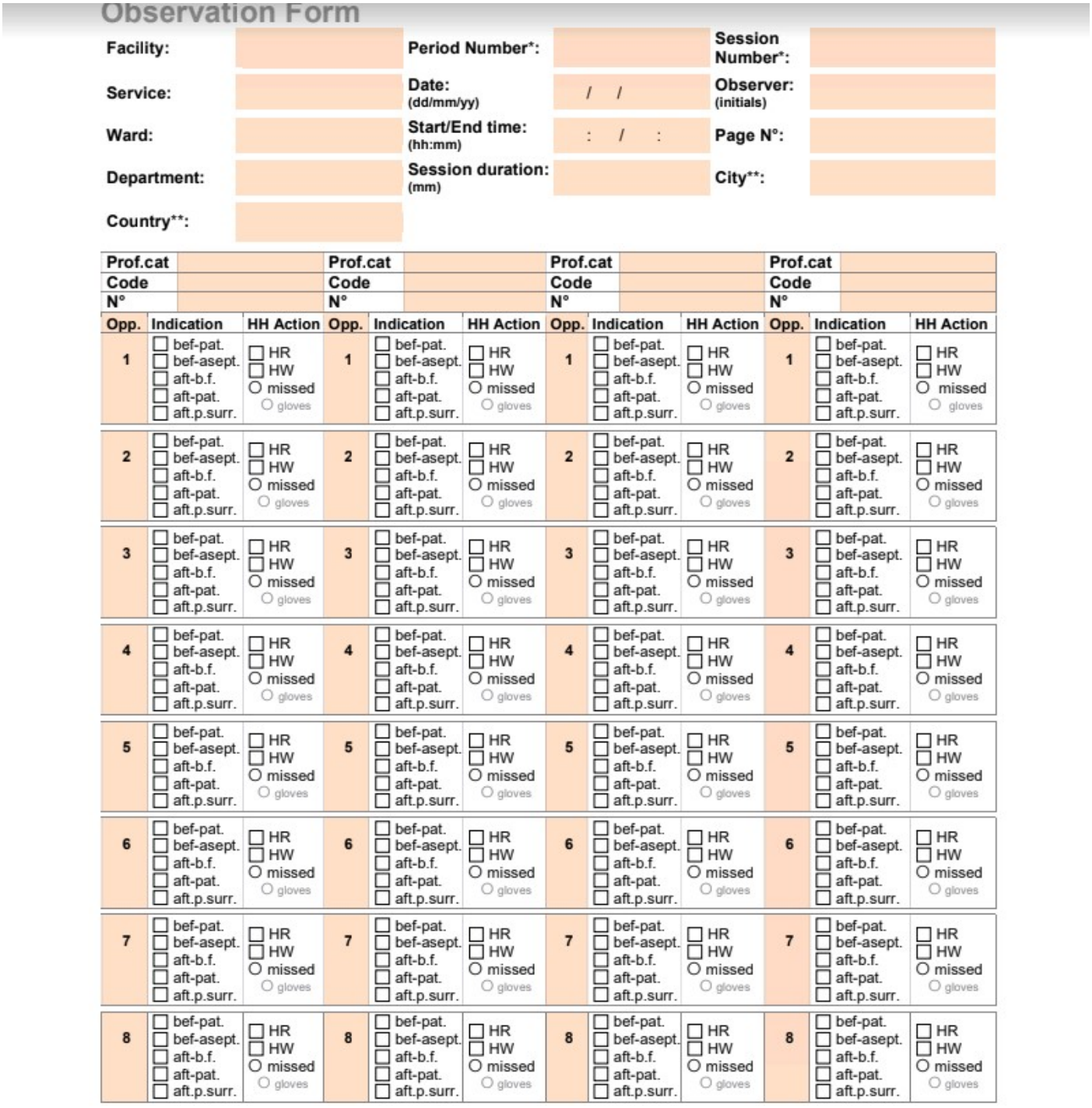
APPENDICES

APPENDIX 1: WHO OBSERVATION FORM.



Observation Form

Facility:		**Period Number*:**		**Session Number*:**	
Service:		**Date:** (dd/mm/yy)	/ /	**Observer:** (initials)	
Ward:		**Start/End time:** (hh:mm)	: / :	**Page N°:**	
Department:		**Session duration:** (mm)		**City**:**	
Country:**					

Prof.cat		Prof.cat		Prof.cat		Prof.cat	
Code		Code		Code		Code	
N°		N°		N°		N°	

Opp.	Indication	HH Action	Opp.	Indication	HH Action	Opp.	Indication	HH Action	Opp.	Indication	HH Action
1	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	1	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	1	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	1	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves
2	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	2	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	2	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	2	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves
3	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	3	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	3	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	3	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves
4	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	4	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	4	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	4	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves
5	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	5	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	5	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	5	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves
6	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	6	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	6	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	6	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves
7	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	7	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	7	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	7	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves
8	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	8	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	8	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves	8	☐ bef-pat. ☐ bef-asept. ☐ aft-b.f. ☐ aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW O missed O gloves

The header allows observations to be precisely located in time and place. The grid consists of columns indicating professional category e.g. nurse, doctor and code if any, or to individual health

workers whose category in indicated. Each box in the column has three columns: Opportunity for hand washing is indicated by the 5 moments-before touching patient, before aseptic procedure, after body fluid exposure, after touching patient and after touching patient surroundings. Third column indicates what action was taken. Note that if hand washing occurs and there was no indication, it should not be recorded.

Start/end time:	Hour (hh) /minute (mm).	
Session duration:	Difference between start and end time, resulting in minutes of observation.	
Session N°:	Attributed at the moment of data entry for analysis.	
Prof.cat:	Professional category	
Number:	Number of observedhealth-care workersbelonging to the sameprofessionalcategory (same code) as they enter the field of observation and youdetectopportunities.	
Opportunity:	defined by one indication at least	
Indication:	reason(s) thatmotivate(s) hand hygiene action; all indications thatapplyat one moment must berecorded	
	bef.pat: beforetouchinga patient	aft.b.f: after body fluidexposurerisk
	bef.asept: before clean/asepticprocedure	aft.pat: aftertouchinga patient
		aft.p.surr: aftertouching patient surroundings
HH action:	response to the hand hygiene indication(s); itcanbeeither a positive action by performinghandrub or hand wash, or a negative action by missinghandrub or hand wash	
	HR: hand hygiene action by handrubbingwith an alcohol-based formula HW: hand hygiene action by handwashingwith soap and water	Missed: no hand hygiene action performed
Comments :	Any comment about thatparticularobservational session.	

APPENDIX 2: HAND HYGIENE QUESTIONNAIRE

INSTRUCTIONS:

i. **Please tick one answer in every question**
ii. **Please read the question carefully before you answer**
iii. **Your answers will be kept confidential**

GENDER **MALE** ☐ **FEMALE** ☐

AGE (yrs.): 18-25 ☐ **26-30** ☐ **31-35** ☐ **36-40** ☐ **41-45** ☐ **46-50** ☐

PROFFESSION: NURSE ☐ **MEDICAL DOCTOR** ☐ **CLINICAL OFFICER** ☐

1. Did you receive formal training in hand hygiene in the last 3 years?

Yes ☐ No ☐

2. Do you routinely use alcohol-based hand rub for hand hygiene?

Yes ☐ No ☐

3. At which of the following hand hygiene indication do you perform hand hygiene?

a) Before touching a patient? Yes ☐ ☐

b) Immediately after body fluid exposure? Yes ☐ ☐

c) After exposure to immediate surroundings of a patient? Yes ☐ ☐

d) Immediately before a clean /aseptic procedure? Yes ☐ No ☐

4. Is health workers hand the major route of cross transmission of potentially harmful germs between patients in a health care facility?

Yes ☐ No ☐

5. Which of the following statement is true?

a) Wearing jewelry increases likelihood of colonization hands with harmful germs

Yes ☐ No ☐

b) Hand rubbing is more rapid for hand cleaning than hand washing

Yes ☐ No ☐

6. In general what is the impact of health associated infection on a patient clinical outcome?

Very Low ☐ Low ☐ High ☐ Very High ☐

7. What is the effectiveness of hand hygiene in preventing health care associated infection?

Very Low ☐ Low ☐ High ☐ Very High ☐

8. What factors prevent you from performing hand hygiene as recommended?

a) Lack of time? Yes ☐ No ☐

b) Lack of alcohol hand rub /water and soap? Yes ☐ No ☐

c) Forgetfulness? Yes ☐ No ☐

d) Nobody else does it? Yes ☐ o ☐

e) HH is not important? Yes ☐ No ☐

f) Preference for gloves? Yes ☐ No ☐

g) Gloves are faster? Yes ☐ ☐

h) Low perceived risk of infection? Yes ☐ ☐

9. a) Do you perform hand hygiene as recommended during patient care?

Always ☐ Sometimes ☐ Never ☐

b) Do your colleagues perform hand hygiene according to the recommended guidelines?

Always ☐ Sometimes ☐ Never ☐

c) Do you think that your behavior towards hands hygiene is taken as an example by your colleague?

Always ☐ Sometimes ☐ Never ☐

d) Is it easy to comply with hand hygiene according to recommended guidelines?

Always ☐ Sometimes ☐ Never ☐

10. In your opinion are the following actions effective to permanently improve hand hygiene in the facility

a) Senior management support Yes ☐ No ☐

b) Availability of water and alcohol hand rubs Yes ☐ No ☐

c) Regular hand hygiene continuous medical education and regular trainings

Yes ☐ No ☐

d) Hand hygiene reminder posters and clear simple instructions easily for every health care worker

Yes ☐ No ☐

e) Health care workers regularly receives feedback on their hand hygiene performance

Yes ☐ No ☐

THANK YOU VERY MUCH FOR YOUR TIME

APPENDIX 3: TIME PLAN

Time 2017-2018 / Activity	November 2017-January 2018	February 2018	March 2018	April 2018
Problem identification and proposal development				
Data collection				
Data analysis and presentation				
Report writing and presentation				

APPENDIX 4: RESEARCH BUDGET

ITEM	QUANTITY	PRICE(Ksh)	TOTAL COST
Questionnaires and observation forms	70	10	700
Printing and binding proposal	3	1000	3000
Research assistant for survey administration	1	2000	2000
Data Analysis		10000	10000
Printing and binding dissertation	3	2000	6000
Miscellaneous		10000	10000
TOTAL COSTS			31,700

APPENDIX 5: KREJCIE AND MORGAN TABLE

Table 3.1

Table for Determining Sample Size of a Known Population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	1000000	384

Note: N is Population Size; S is Sample Size *Source: Krejcie & Morgan, 1970*

APPENDIX 6: INTRODUCTION LETTER

Strathmore University Business School,

Strathmore University, Ole Sangale Road,

P.O. Box 59857-00200 Nairobi.

1st March, 2018.

Dear respondent,

RE: Research Project Questionnaire

I am a student at Strathmore University Business School, Nairobi, pursuing a post-graduate degree in Masters of Business Administration in Healthcare Management. In partial fulfillment of the requirement for the award of the above-mentioned degree, I am required to carry out and submit an academic research on exploring hand hygiene practices among healthcare workers in Ruiru Sub-County Hospital. Kindly assist by allowing my research assistant to take you through the consent form and filling in the questionnaire as distributed by the same.

I would like to assure you that this research is purely for academic purposes. Your response will be treated with extreme confidentiality and all responses will be coded into numbers and no one will be individually identified. Only general, statistical and aggregate analysis will be performed on the data. Therefore, no one can trace the results back to the responses of any individual respondent. Thank you for your time and cooperation.

Yours faithfully,

Dr. Esther Kamau

Researcher.

APPENDIX 7: PARTICIPANT INFORMATION AND CONSENT SHEET

TOPIC: EXPLORING HAND HYGIENE PRACTICES AMONG HEALTHCARE WORKERS IN RUIRU SUB-COUNTY HOSPITAL

SECTION 1: INFORMATION SHEET

Investigator: Dr. Esther Kamau

Institutional affiliation: Strathmore Business School (SBS)

You are invited to take part in this research project in regard to the topic above. The study will involve about 60 healthcare workers in Ruiru Sub-County hospital. This Participant Information Sheet will help you decide if you'd like to take part. It sets out why we are doing the study, what your participation would involve, what the benefits and risks to you might be, and what would happen after the study ends. We will go through this information with you and answer any questions you may have. You do not have to decide today whether or not you will participate in this study, feel free to take your time.

SECTION 2: INFORMATION SHEET-THE STUDY

2.1: Why is this study being carried out?

The study is being carried out because it has been demonstrated through a departmental quality improvement audit that there was poor compliance with hand hygiene practices among healthcare workers leading to increased cases of hospital acquired infections among patients. This study is being carried out as a follow up to the problem identified in the audit but on a larger scale, to cover the whole hospital.

2.2: Do I have to take part?

No. Taking part in this study is entirely optional and the decision rests with you. If you decide to take part in the study, you will be asked to complete a questionnaire to get information on knowledge, attitudes and practices concerning hand hygiene in hospital setting. You are free to decline to take part in the study at any time without giving explanations.

2.3: Who is eligible to take part in the study?

All healthcare workers who come into direct contact with patients.

2.4: Who is not eligible to take part in this study?

Healthcare workers who do not come into direct contact with patients and those on temporary/locum assignments.

2.5 What will be taking part in this study involve for me?

You will be approached by the principle investigator and requested to take part in the study. If you are satisfied that you fully understand the goals behind this study, you will be asked to sign the informed consent and then taken through a questionnaire to complete.

2.6: Are there any risks or dangers in taking part in this study?

No. There are no risks in taking part in this study. All the information you provide will be treated as confidential and will not be used in any way without your express permission.

2.7: Are there any benefits of taking part in this study?

The study will be used to improve quality of service delivery as well as improve outcomes of patients admitted at the facility now and in the future. In addition, it will add to the growing wealth of research knowledge in low and middle-income countries such as Kenya.

2.8: What will happen to me if I refuse to take part in his study?

Participation in this study is entirely voluntary. There are no repercussions for withdrawing from the study even if at first you had decided to take part.

2.9: Who will have access to my information during this research?

All research records will be stored in securely locked cabinets. That information may be transcribed into our database but this will be sufficiently encrypted and password protected. Only the people who are closely concerned with this study will have access to your information. All your information will be kept confidential.

2.10: Who can I contact in case I have further questions?

You can contact me, Dr. Esther Kamau, via phone(0721284134), or email (esthermarigu@gmail.com). You can also contact my supervisor Dr. Vincent Okungu at the Strathmore Business School, Nairobi, or by email (vokungu@starthmore.edu).

If you want to ask someone independent anything about this research, please contact:

The Secretary-Strathmore University Institutional Ethics Review Board, P.O.BOX 59857-00200, Nairobi. Email: ethicsreview@stratmore.edu Telephone number +254703034375

APPENDIX 8: CONSENT FORM

Please tick to indicate you consent to the following:

I have read, and I understand the Participant Information Sheet.	Yes ☐	No ☐
I have been given sufficient time to consider whether or not to participate in this study.	Yes ☐	No ☐
I am satisfied with the answers I have been given regarding the study and I have a copy of this consent form and information sheet.	Yes ☐	No ☐
I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without this affecting my job and workplace relations.	Yes ☐	No ☐
I consent to the research staff collecting and processing my information.	Yes ☐	No ☐
I understand that my participation in this study is confidential and that no material, which could identify me personally, will be used in any reports on this study.	Yes ☐	No ☐
I know who to contact if I have any questions about the study in general.	Yes ☐	No ☐
I understand my responsibilities as a study participant.	Yes ☐	No ☐
I wish to receive a summary of the results from the study.	Yes ☐	No ☐

Declaration by participant:

I hereby consent to take part in this study.

Participant's name:

Signature:	Date:

Declaration by member of research team:

I have given a verbal explanation of the research project to the participant and have answered the participant's questions about it.

I believe that the participant understands the study and has given informed consent to participate.

Researcher's name:

Signature:	Date: