



RESEARCH ARTICLE

KNOWLEDGE OF HAND HYGIENE AND COMPLIANCE AMONG CLINICIANS- AT A LEVEL SIX HOSPITAL IN KENYA: A CROSS SECTIONAL STUDY

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Abstract

Background: Healthcare-associated infection (HCAI) is a significant cause of morbidity and mortality among hospitalized patients, Compliance with hand hygiene (HH) recommendations is the simplest and most effective measure in preventing this infection. These infections are a cause of 37,000 deaths in Europe and 100,000 deaths in the United States annually. Thus, prevention of their spread is of utmost importance.

Aim/Objectives: The study sought to determine the knowledge and compliance of hand hygiene among clinicians in a level six hospital in Kenya.

Methods: A cross-sectional study was conducted among 140 clinicians using a multistage sampling technique. Data were collected with a set of self-administered, modified WHO questionnaire and analyzed using IBM and SPSS version 25 statistical package

Results: A total of 140 respondents, (121 nurses and 19 doctors) participated in the study, of which 93 were females. Compliance to hand-disinfection was found to 65% (n=19) for doctors and 64% (n=121) for nurses. The mean age of respondents was 35.2±9.3 years, and majority of them were between 31-40years (50%). The male to female ratio was 1.9: 1. Most of the respondents were nurses 121 (86.4%). There was statistical relationship (association) between professional cadre on the knowledge on hand hygiene i.e. those received formal training on hand hygiene in the last 4 years Chi p=0.022). From the survey results, it was seen that more nurses (88; 73%, expected=84) had received formal training on hand hygiene in the last 4 years more than Doctors (9; 47%, expected=13).

Conclusion:- There was an average compliance to hand hygiene practices with a knowledgeable staff; however more effort is needed to improve this through generation of standard operating procedures and guidelines with equitable and consistent supply of hand hygiene accessories.

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Introduction:-

Healthcare-associated infections (HCAIs) also known as nosocomial infections or hospital infection happens to patients during the process of care in a hospital setting which was not present or incubating at the time of admission. This can also appear after discharge and any time of setting where they receive care and consequently this includes

occupational infections in staff, therefore posing a serious menace in health-care set up (Isanda, 2014; WHO, 2018). HCAs represent the most frequent adverse event during care delivery. It is estimated that each year, in several countries, hundreds of millions of patients are affected. This significantly causes prolonged hospital stay, additional costs, emotional distress to both the patients and their families, long-term disability, massive additional financial burden on the healthcare system, and worse still mortality (WHO, 2018, Maingi, 2015, Klevens et al., 2007).

Studies have demonstrated that the exact worldwide burden of healthcare-associated infections is unknown. In developing economies, the exact burden of HCAs remains unknown majorly because of the complexity of the diagnostic criteria and weak national surveillance systems (WHO, 2011, Gichuhi 2015, Maingi, 2015, WHO, 2018). There is a growing evidence demonstrating that hand hygiene plays a pivotal role in patient safety by reducing prevention of healthcare associated infection (HCAI). On average, HCWs clean their hands less than half of the times they should and on a given day, 1 in 25 hospital patients has at least one HCAs (CDC, 2017).

In middle and low-income economies, healthcare-associated infections account for approximately 15-31% of all hospital admissions (WHO, 2011). A study conducted in Naivasha, Kenya by Isanda, (2014) showed that the HCW's compliance to hand hygiene was 32.5% a figure lower than the recommended global adherence rate of 39.0

Adherence to hand hygiene promotion presents a challenge that requires multi-modal strategies especially in developing countries where limited resources and cultural issues strongly influence the practices. Inadequate supplies, frequent water shortages, and inactive infection prevention committee have also been posited to influence the practices (Mahmoud, 2015; Gichuhi et al., 2015 (Adero et al., 2016). Cleaning your hands can prevent the spread of germs, including those that are resistant to antibiotics and impossible to treat (CDC, 2017). Based on this account, there is a need for doctors and nurses to adhere to hand hygiene among. This study, therefore, will be used to establish the baseline hand hygiene compliance among clinicians at the level six hospital.

Statement of the Problem

Whereas hand hygiene is the easiest and most effective measure in prevention of healthcare-associated infections, compliance to hand-hygiene by medical professionals has been reported to be low. It is, therefore, important to understand the enablers and challenges of compliance to handwashing by the medical staffs in hospitals.

Hand hygiene is the simplest and most effective measure for preventing healthcare-associated infections. Despite the simplicity of this procedure and advances made in infection control, hospital health care workers' compliance to hand hygiene recommendations is generally low. Nurses have the most frequent patient care interactions, and thus more opportunities to practice hand hygiene. As such, it is important to identify and understand determinants of nurses' reported compliance. Formative research was undertaken to assess the potential impact of several unexamined factors that could influence HH among nurses: professional role and status, social affiliation, social norms, and physical modifications to the work environment (as well as institutional factors like safety climate).

Healthcare-associated infections are very common and this has been attributed to poor resource settings especially in developing countries as evidenced by low hand hygiene compliance. (Engdaw et al., 2019). The National Infection Prevention and control Guidelines for health Care Services in Kenya were published and disseminated in 2010. Moi Teaching and Referral Hospital adopted this policy in the year 2012. However, there are no evidence of adherence and compliance on infection control especially with hand hygiene practices. Therefore, this study will act as the baseline data of hand hygiene practices among nurses and doctors at a level six hospital.

Significance/Rationale

The findings will describe baseline hand hygiene practices among health nurses and doctors working at this level six which is a 2nd national Referral Hospital in Kenya. This is important since the hospital is also expanding to become a Multi-Specialty hospital. These findings will enable key stake-holders in various departments to reorganize the existing intervention strategies for improving hand hygiene compliance among Nurses and Doctors within the health facility.

The findings will evaluate clinicians' uptake of hand hygiene practices in preventing the development of anti-microbial resistance.

Research Question

The study will be guided by the following research questions:

1. What is the level of compliance with hand hygiene practices among clinicians at a level six hospital?
2. What is the staff knowledge on hand hygiene practices among clinicians at a level six hospital?

Objectives:-**General objective**

The objective of this study is to determine the uptake of hand hygiene practices among clinicians at a level six hospital?

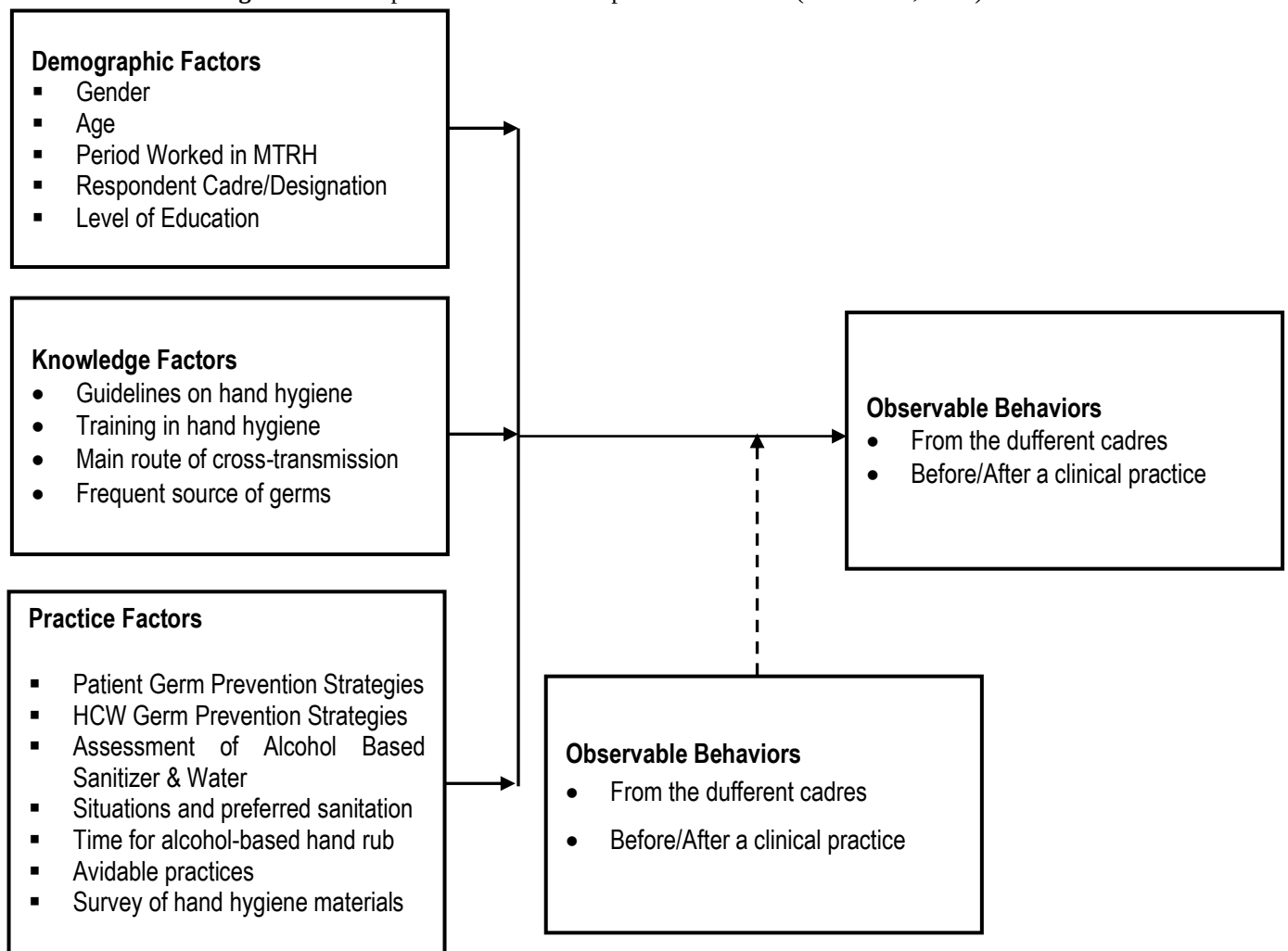
Specific Objectives

1. To determine the level of compliance with hand hygiene among clinicians at a level six hospital.
2. To determine staff knowledge on hand hygiene practices at a level six hospital

Conceptual frame work

The Conceptual Framework of this study will be based on the relationships between the inputs or independent variables and this include socio-demographic factors, level of knowledge on hand hygiene and availability of hand hygiene materials and facilities. Dependent variable (compliance with hand practices). Figure 1 illustrates this relationship between independent variables and the dependent variable.

Figure 1:- Conceptual framework: Adopted from Source: (Researcher, 2018).



Chapter Two: Literature Review:-

Introduction

Hand washing refers to the act of washing hands with an un-medicated detergent and water to remove dirt and transient flora to prevent cross-infection whereas hand hygiene an antiseptic agent is added to the detergent. (Pittet, 2017). Hand hygiene has been singled out as the most effective measure for preventing healthcare-associated infections. (Ogugu, 2015). However, despite the simplicity and compliance of hand hygiene practices by HCWs, remains unacceptably low below 50% in most healthcare settings. (Hillier, 2020). This has been supported by AbouZakith that very low hand hygiene compliance rate and in-sufficiency has exhibited from both developed and developing countries. (Abou et al., 2020).

The most important moment for preventing cross transmission of infections before touching a patient is through practicing hand hygiene. (Hillier, 2020). A study performed in India revealed hand hygiene compliance rate ranged from 26%-80% and recommended need for the development of strategies to improve hand hygiene. (Rynga et al., 2017). Consequently, another study done by Ahmed on hand hygiene non-compliance among intensive care health workers comprising of physicians and nurses working in ICU, medical wards, HDU, cardiac care unit, paediatric unit showed that hand hygiene non-compliance was observed at 41% giving a compliance rate of 59%. (Mahfouz et al. 2013).

Majority of HCAI are thought to be transmitted by hands of HCWs. So assessment of knowledge, attitude and practices of hand hygiene among HCWs is paramount. (Khaled, 2011). An observational study done in Japanese Teaching Hospitals on hand hygiene adherence/compliance internal medicine wards, intensive care unit, surgery and emergency department indicated a hand hygiene adherence rate of 19% generally with 15% among physicians and 23% among nurses. Ranges of adherence were 11%-31% between units. (Sakihama et al., 2016). Contrary, a study done in Ghanaian teaching hospital using an infection prevention check-list based on WHO Guidelines on hand hygiene practices documented low care-related hand hygiene compliance rates among doctors and nurses which ranged 9.2% to 57% and 9.6% to 54% respectively. The compliance was higher when risk was perceived to be higher with intensive care unit showing the highest level of compliance among health care workers. Facilities like hand hygiene like alcohol hand rub were found to be deficient. (Amissah et al., 2016).

A research done in Nigeria by Braomoh and Udeabor reported high hygiene compliance among HCWs, hand washing before patient contact was 60% and after patient contact was at 97%. Before interacting with patients example clerking and routine nursing procedures 76% of HCWs never washed their hands, while 9.3% always washed their hands. Meanwhile before performing simple procedures like cannulation, wound dressing and glucose check, 69.7% health workers never wash their hands while 13.6% always washed their hands. (Alex-Hart & Opara, 2011). In addition to this, a study done by Gilbert revealed that nurses were more likely to appreciate and put into practice the five moments for hand hygiene than doctors who often abstained from these chances asserting that more pressing essential obligations. (Gilbert, 2014).

A study done by Ndegwa (2014) to assess hand hygiene practices in three Kenyan hospitals revealed a baseline adherence rate of 28%, with ICU having the highest compliance rates while surgical and pediatrics units had the lowest rates. Consequently another study done katama in Kenya on hand hygiene among health care workers at a referral hospital showed hand hygiene adherence rate at 30.8%. (Ndegwa & Amb, 2014).

A study done on knowledge of nurses in Canada portrayed that nurses had good level of knowledge, but the knowledge enhancement was realized through holding educational classes and courses in cases where a breach was recognized. (Sharif et al., 2015). A research done in a tertiary hospital in Nigeria depicted good knowledge to hand washing which was higher after patient contact than before. Startlingly, hand drying practices were meager which customarily risked the comparatively good hand washing practices. Demanding work program in between patient care was singled out as a probable limitation to hand washing. (Ekwere, 2013).

World Health Organization (2011) highlights numerous factors associated with poor adherence to standardized hand hygiene practices among HCWs. Consequently, a study done by Pittet 2006, showed casual attitude among HCWs towards bio-safety enhancing poor compliance among others. (Pittet, 2006).

Similar studies were also cited by Jang, who observed that despite the doctors influential positions in hospitals, their attitudes and practices towards hand hygiene disproportionately influence practices of other HCWs (Pittet et al

2004). An Australian audit data on hand hygiene reported average compliance rates for doctors and nurses were 66% and 83% respectively (Hand hygiene Australia, 2013). Furthermore a study done in Nigeria revealed that doctors significantly more possibly than nurses wash hands before patient contact. The greatest inspiration for hand washing was fear of contracting diseases whereas lack of soap, water and forgetfulness were the major hindrances to hand washing compliance. (Ekwere, 2013)

Chapter Three: Research Methods:-

Introduction

This chapter presented the design and methods that were used to collect the relevant data for this research. The data was analyzed so as to answer the research questions. This was included in the research design, description of the target population, sample size and sampling technique procedures that were applied, research instruments and their administration on the participants, data collection methods, data analysis procedures and ethical considerations

Research Design

The study adopted descriptive and observational cross-sectional study design. The study design was considered appropriate for this study for several reasons. First, it attempted to collect data from members of a population in order to determine their current knowledge with respect to one or more variables. Secondly, it was an appropriate way of eliciting the most complete response from a sample of individuals presumed to have experienced the phenomena of interest. Besides, it collected information from a large number of respondents and relies on the individual self-report of their knowledge.

Study Setting

The study will be carried out at Moi Teaching and Referral Hospital (MTRH), a level six Hospital situated along Nandi Road in Uasin-Gishu County, Kenya. The Hospital has 1000 bed capacity, and a staff of about 2000 providing preventive, curative and rehabilitative services and the hospital also serves as a teaching hospital to various institutions notably MTRH, Moi University, University of Eastern Baraton, Kenya Medical Training college among others.

Study Population

The study population comprised of all Nurses and Doctors working in internal medicine unit comprising of CCU, Emergency Unit, general female ward and general male ward. Surgery unit in ICU, the directorate of reproductive unit comprised of nurses and physicians in labour ward. The nurses and doctors included medical doctors and registered nursing officers.

Sample Size Determination

The following formula was used to determine the sample size as recommended by Fisher et al (1983);

$$n = \frac{z^2 pq}{d^2}$$

Where:

n - Desired sample size

z^2 - Standard normal deviate at the required confidence interval

p - The proportion in the target population estimated to have the characteristic being measured

q = 1 - p

d - Marginal error (degree of confidence)

Hence;

$$n = \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.05)^2}$$

$$\equiv 384$$

Since the population was less than 10,000 the following formula was used

$$nf = \frac{n}{1 + \frac{n}{N}}$$

Table 1:- Sample size.

Serial no	Directorate	Nurses (N)	Doctors (N)
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1.	Internal medicine(medical wards, CCU and Emergency department)	131	30
3	Reproductive Health-Labour Ward	45	15
4	Surgery-ICU,	40	10
	Total	216	55

Table 2:- Sample size determination (n).

Serial no	Directorates	Nurses (n)	Medical doctors (n)
1	Internal medicine	98	20
3	Reproductive health- labour ward	30	8
4	Surgery-ICU	30	6
Total –sample size (n)		158	34

Sampling Procedure

Stratified random sampling was applied to select participants for the survey. Consent was sought from the hospital administration prior to carrying out the observational study and or directly from the Nurses and Doctors. Observations were carried out without the knowledge of the Nurses and medical doctors on the specifics of the study to minimize bias. A record was kept by the researchers of the number of times each Nurse or medical Doctor has been observed so as to avoid over/under observations. After the observational study, the Nurses and Doctors willing to participate in the study were given questionnaires to fill after obtaining both verbal and written consent from them.

Inclusion and Exclusion Criteria**Inclusion Criteria**

All nurses and medical doctors working in the directorate of internal medicine (CCU, Emergency department, and general medical wards). Surgery directorate (ICU) Reproductive directorate (Labour ward)
All nurses and medical doctors who were willing to participate were included in the study

Exclusion Criteria

On study leave and annual leave during the study period.

Data collection procedure

Data was collected in two phases

Observations of Hand Hygiene

Waiver of consent was obtained from IREC to assist in the observational study of this project to avoid change of behavior in a forum of both nurses and doctors within the unit that there was an ongoing study. Observation checklist was used to assess the hand hygiene practices as per WHO standards (Appendix V).

Nurses and doctors in direct conduct with patients were observed randomly for 10-20 minutes at pre-specified times on the week-day until hand hygiene an opportunity occurs or the nurses and doctors who left the room. An opportunity for hand hygiene was defined as the occurrence of any of the five indications for hand hygiene recommended by the WHO during the observed care sequences; that is-Before patient contact, before a clean/aseptic procedure, after patient contact, after risk of body fluid exposure and after contact with patient's surroundings. At certain instances more than one nurse or doctor was observed during these sessions depending on the density of activities. Hand hygiene action was then observed for the different opportunities and these included: hand washing with soap and water or use of alcohol based hand rub (ABHR). Hand hygiene actions was defined as either hand washing with soap and water or hand rubbing with alcohol-based hand rub and these were recorded on the observation card separately for each nurse and doctor. During each session availability of soap, free flowing water and ABHR was noted Data collection will take approximately three months and a record of those observed were kept strictly confidential.

Questionnaires

Questionnaire: After the participants' consents he/she was assigned with a participant study code (to protect the participant's identity) The participant was requested to complete the questionnaire. The questionnaire consists of bio-data that was filled and 19 multiple choice question test (appendix IV).

The self-administered questionnaires were given to the nurse and doctor observed earlier to assess their knowledge and perceptions regarding HCAs and importance of hygiene. They were counterchecked on collection for completion.

Validity

The researcher will use WHO-standardized hand hygiene knowledge survey instrument with scoring guide and ward hand hygiene facilities survey whose content validities will be established at the design stage.

Reliability

The researcher selected a pilot group of 10 clinicians from various departments at the Uasin-Gishu district Hospital who did not participate in the main study to test the reliability of the research instruments (appendix I and II).

Data Analysis and Presentation

The raw data entries from both observation and questionnaires was edited to detect errors and omissions and to correct errors where possible. After all data was collected, cleaning and coding preceded entry done in SPSS software. Descriptive statistics such as means, frequencies, and percentages was computed. Paired t-test analysis was carried out on selected variables to test for significance between expectation and perception. Frequency and percentage was used to identify the least and most scored dimension. Results were presented in form of tables, pie charts and bar graphs.

To determine hand hygiene practices among HCWs compliance to hand hygiene was calculated as Compliance (%) = Performed actions * 100

Study Frame

The study was done for a period of 3 months starting from July, August and September and there after stated in the table below:

Table 3:- Study frame.

Activity	Estimated Period	Month
Proposal writing	4 weeks	July 2018
Proposal submission and ethical committee approval	4 weeks	August 2018
Data collection and entry	8 weeks	August and September 2018
Report writing	4 weeks	October 2018
Dissemination to MTRH and publication	4 weeks	November 2018

Ethical Considerations

A number of measures will be put in place to ensure that the rights of participants were not violated. These measures include; permission to carry out the study was obtained from the management of MTRH and a verbal consent was obtained from the nurse manager in charge of various directorates. The study was conducted in the units. There were no threat of potential risk since no drugs or chemicals was administered. The participants benefited from the study since interventions from improvement were put in place. The privacy and confidentiality was ensured during data collection process since the information was kept by the principal investigator and anonymity of participants was assured. The participation of participants was voluntary and verbal informed consent was sought before interviewing them and maintaining anonymity to participants. The nature and purpose of the study will be explained to the respondents during data collection.

Study Implications

Proper hand hygiene is the most important, simplest and least expensive means of reducing prevalence of health associated infections and spread of antimicrobial resistance. Most studies have shown that adherence to hand hygiene has significantly reduced the rate to acquired pathogens on hands and HAIs in a hospital.

Chapter Four: Study Findings

Descriptive Findings

Socio-Demographic Characteristics

The study, which attracted total of 140 participants (46 male and 93 female). Of these, 19 participants were doctors (10 male and 9 female) and 121 were nurses (36 male and 84 female). Majority of the participants (70%) were aged between 30-50. Only 3% (n=4) of the participants were aged above 50 years. Whereas majority of the respondents were above 30 years, most of them (56%; n=75) had worked in the facility for under 6 years.

Fortyseven (43) of these were male and 93 were female. This included 19 Doctors and 121 Nurses who were working in the following wards; Emergency, Intensive Care Unit (ICU), Umoja, Amani, CCU and Labor ward. Medical wards or intensive care units (ICUs). The rest of the Demographic information is summarized in Table 1 below.

Table 4:- Demographics.

Variables	Measure	Frequency	Percentage
Gender	Male	47	33
	Female	93	67
	Total	139	100
Age	Upto 20 years	1	1
	21-30 years	37	26
	31-40 years	70	50
	41-50 years	28	20
	Above 50 years	4	3
	Total	140	100
Years worked at MTRH	Less than 3 years	39	28
	3-6 years	36	26
	7-10 years	39	28
	11-14 years	25	18
	More than 10 years	1	1
	Total	140	100
Professional cadre/Designation	Doctor	19	14
	Nurse	121	86
	Total	140	100
Level of Education	Masters	5	4
	Bachelors	53	38
	Higher Diploma	27	19
	Diploma	52	37
	Certificate	3	2
	Total	140	100
Departmental unit	Emergency	44	31
	ICU	30	22
	Umoja	17	12
	Amani	14	10
	CCU	3	2
	Labour ward	32	23
	Total	140	100

Seventeen (n=17; 85%) doctors had worked at the facility for less than 6 years with 63% (n=13) having worked at the facility for less than 3 years. The study noted that only one doctor had worked at the facility for more than a year.

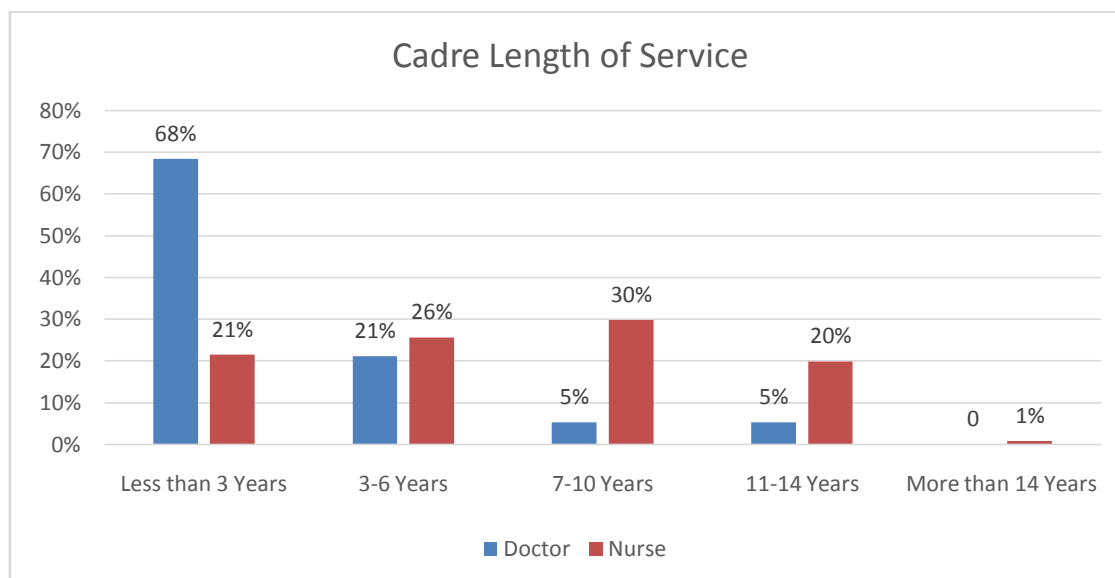


Figure 2:- Cadre Length of Service.

Forty six respondents (n=58) had at least a bachelors degree. Majority of the respondents (n=80; 57%) had either a diploma or higher diploma and all were nurses. Majority of the doctors (n=16; 84%) had a bachelors degree whereas 32% of the nurses had at least a bachelors degree.

Knowledge Characteristics

In assessing respondent knowledge on hand hygiene practices, the study reviewed posed four questions to all cadres. The responses were as illustrated in the table below

Table 5:- Knowledge Characteristics.

		Frequency	Valid Percent
Have you had any guidelines on hand hygiene practices in health care services	No	5	3.6%
	Yes	135	96.4%
	Total	140	100%
Have you received any formal training on hand hygiene in the last 4 years	No	42	30.2%
	Yes	97	69.8%
	Total	139	100%
Main route of cross transmission of potentially harmful germs between patients in health care facility	Fail	66	47.1%
	Pass	74	52.9%
	Total	140	100%
What is the most frequent source of germs responsible for health care associated infections	fail	68	48.6%
	pass	72	51.4%
	Total	140	100%

Whereas, the majority (96.4%; n=135) of respondents stated that they had guidelines on hand hygiene practices in health care services, fewer (69.8%; n=97) respondents said that they had undergone formal hand hygiene training within the last 4 years. Close to half (47.1%; n=66) of the respondents did not know the main route of cross transmission of potentially harmful germs between patients in a health facility set-up. With an almost similar

number (48.6%; n=68) not able to correctly state the most frequent source of germs responsible for health care associated infections.

The study further sought to disseminate the level of knowledge based on the respondent's cadre and findings were as documented in the table below.

Table 6:- Cross-Tabs Knowledge Characteristics.

Question	Professional Cadre	Measure	Response		Total
			No	Yes	
Have you had any guidelines on hand hygiene practices in health care services	Doctor	Count	2	17	19
		Percentage	10.5%	89.5%	100.0%
		% of Total	1.4%	12.1%	13.6%
	Nurse	Count	3	118	121
		Percentage	2.5%	97.5%	100.0%
		% of Total	2.1%	84.3%	86.4%
Total			5 (3.6%)	135(96.4%)	140(100%)
Have you received any formal training on hand hygiene in the last 4 years	Doctor	Count	10	9	19
		Percentage	52.6%	47.4%	100.0%
		% of Total	7.2%	6.5%	13.7%
	Nurse	Count	32	88	120
		Percentage	26.7%	73.3%	100.0%
		% of Total	23.0%	63.3%	86.3%
Total		Count	42	97	139
		% of Total	30.2%	69.8%	100.0%
Question	Professional Cadre	Measure	Response		Total
			Fail	Pass	
Main route of cross transmission of potentiality harmful germs between patients in health care facility	Doctor	Count	9	10	19
		Expected Count	9.0	10.0	19.0
		Percentage	47.4%	52.6%	100.0%
		% of Total	6.4%	7.1%	13.6%
	Nurse	Count	57	64	121
		Percentage	47.1%	52.9%	100.0%
		% of Total	40.7%	45.7%	86.4%
Total		Count	66(47.1%)	74(52.9%)	140(100%)
What is the most frequent source of germs responsible for health care associated infections	Doctor	Count	11	8	19
		Percentage	57.9%	42.1%	100.0%
		% of Total	7.9%	5.7%	13.6%
	Nurse	Count	57	64	121
		Percentage	47.1%	52.9%	100.0%
		% of Total	40.7%	45.7%	86.4%
Total		Count	68(48.6%)	72(51.4%)	140(100%)

All respondents (N=140; 100%) targeted respondents responded to the four knowledge questions (19 doctors and 121 nurses). The first question sought to determine if nurses and doctors had any guidelines on hand hygiene practises in health care services. Seventeen (n=17; 89%) of the Doctors and 118 (98%) Nurses showed that they had had handwashing guidelines in their work environments. The majority of nurses (73%) had received formal training on hand hygiene in the last 4 years. However, few doctors (47%) indicated that they had been trained on the same.

Table 7:- Nurses Knowledge Analysis.

Question	Professional	Measure	Response	Total
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	Cadre		No	Yes	
Have you had any guidelines on hand hygiene practices in health care services	Doctor	Count	2	17	19
		Percentage	10.5%	89.5%	100.0%
		% of Total	1.4%	12.1%	13.6%
	Nurse	Count	3	118	121
		Percentage	2.5%	97.5%	100.0%
		% of Total	2.1%	84.3%	86.4%
Total			5 (3.6%)	135(96.4%)	140(100%)
Have you received any formal training on hand hygiene in the last 4 years	Doctor	Count	10	9	19
		Percentage	52.6%	47.4%	100.0%
		% of Total	7.2%	6.5%	13.7%
	Nurse	Count	32	88	120
		Percentage	26.7%	73.3%	100.0%
		% of Total	23.0%	63.3%	86.3%
Total		Count	42	97	139
		% of Total	30.2%	69.8%	100.0%
Question	Professional Cadre	Measure	Response		Total
			Fail	Pass	
Main route of cross transmission of potentiality harmful germs between patients in health care facility	Doctor	Count	9	10	19
		Expected Count	9.0	10.0	19.0
		Percentage	47.4%	52.6%	100.0%
		% of Total	6.4%	7.1%	13.6%
	Nurse	Count	57	64	121
		Percentage	47.1%	52.9%	100.0%
		% of Total	40.7%	45.7%	86.4%
Total		Count	66(47.1%)	74(52.9%)	140(100%)
What is the most frequent source of germs responsible for health care associated infections	Doctor	Count	11	8	19
		Percentage	57.9%	42.1%	100.0%
		% of Total	7.9%	5.7%	13.6%
	Nurse	Count	57	64	121
		Percentage	47.1%	52.9%	100.0%
		% of Total	40.7%	45.7%	86.4%
Total		Count	68(48.6%)	72(51.4%)	140(100%)

Practice Factors

From the study findings, a total of 23 practice questions driven from 6 thematic areas were answered. Responses were categorized as pass or fail to denote right and wrong responses to the questions. The highest scored question got an average 96% whereas the lowest scored question got an average 23% with only 17 nurses (14%) and 2 Doctors (11%) scoring it right. The average score of passes for both nurses and doctors was 64% and 65% respectively bringing a total average score of 64.5%.

Whereas majority (64%) of the respondents demonstrated good hand hygiene practices, the study noted that most of the respondents lacked requisite knowledge in; the use of alcohol swabs, the hand hygiene method required in specific situations, and the hand hygiene actions that would prevent transmission of HCAI-causing germs both to the healthcare worker and the patients. As demonstrated in the table below, majority (n=96; 68.6%) of the respondents did not know the minimal time needed for alcohol-based hand rub to kill most germs on a user's hand. Similarly, majority (n=121; 86.4%) of the respondents could not identify the best hand hygiene method required in after making patients bed and before giving an injection (n=72; 51.8%). The study also noted that the majority of respondents could not tell whether hand washing and hand rubbing are recommended to be performed in sequence

(n=96; 69.1%). On hand hygiene actions that prevent transmission of HCAI-causing germs to both the patient and the healthcare worker; majority of the respondents (n=94; 69.6%) did not know the hand hygiene actions to perform after exposure to the immediate surrounding of the patient and an even bigger proportion (n=104; 78.2%) did not know the hand hygiene actions to perform immediately before a clean/aseptic procedure (See table below).

Table 8:- Practice Factors.

Thematic Area	Question	Response	Frequency	Percent
Hand hygiene actions that prevent transmission of HCAI-causing germs to the patient?	Before touching the patient	Fail	12	8.6
		Pass	127	91.4
		Total	139	100.0
	Immediately after a risk of body fluid exposure	Fail	50	36.8
		Pass	85	62.5
		Total	136	100.0
	After exposure to the immediate surrounding of the patient	Fail	94	69.6
		Pass	41	30.4
		Total	135	100.0
	Immediately before a clean /aseptic procedure	Fail	35	25.9
		Pass	100	74.1
		Total	135	100.0
Hand hygiene actions that will prevent transmission of HCAI-causing germs to the healthcare worker	After touching a patient	Fail	9	6.7
		Pass	125	93.3
		Total	134	100.0
	Immediately after a risk of body fluids exposure	Fail	11	8.3
		Pass	122	91.7
		Total	133	100.0
	Immediately before a clean/aseptic procedure	Fail	104	78.2
		Pass	29	21.8
		Total	133	100.0
	After exposure to the immediate surroundings of the patient	Fail	16	12.0
		Pass	117	88.0
		Total	133	100.0
Identification of true statements on alcohol-based hand rub and hand washing with soap	Hand rub is more rapid than hand washing	Fail	57	41.3
		Pass	81	58.7
		Total	138	100.0
	Hand rubbing causes skin dryness more than hand washing	Fail	63	45.3
		Pass	76	54.7
		Total	139	100.0
	Hand rubbing is more effective against germs than hand washing	Fail	39	28.3
		Pass	99	71.7
		Total	138	100.0
	Hand washing and hand rubbing are recommended to be performed in sequence	Fail	96	69.1
		Pass	43	30.9
		Total	139	100.0
Identification of hand hygiene method required in the following situations.	Before palpating the abdomen	Fail	44	31.4
		Pass	96	68.6
		Total	140	100.0
	Before giving an injection	Fail	72	51.8
		Pass	67	48.2
		Total	139	100.0

	After emptying the bed pan	Fail	5	3.6
		Pass	135	96.4
		Total	140	100.0
	After removing examination gloves	Rubbing	66	47.1
		Washing	73	52.1
		None	1	.7
		Total	140	100.0
	After making patients bed	Fail	121	86.4
		Pass	19	13.6
		Total	140	100.0
	After visible exposure to blood	Fail	9	6.5
		Pass	130	93.5
		Total	139	100.0
Use of alcohol-based hand rub	What is the minimal time needed for alcohol based hand rub to kill most germs on your hands?	Fail	96	68.6
		Pass	44	31.4
		Total	140	100.0
Practices to be avoided as they are associated with increased likelihood of colonization of healthcare workers' hands with harmful germs	Wearing jewellery	Fail	23	16.7
		Pass	115	83.3
		Total	138	100.0
	Damaged skin	Fail	17	12.4
		Pass	120	87.6
		Total	137	100.0
	Artificial fingernails	Fail	9	6.4
		Pass	131	93.6
		Total	140	100.0
	Regular use of hand cream	Fail	37	27.0
		Pass	100	73.0
		Total	137	100.0

Table 9:- Maximum and Minimum passes.

	Nurses	Percent	Doctors	Percent	Total Passes
Maximum Passes	116	96%	19	100%	135
Minimum Passes	17	14%	2	11%	19

Hand Hygiene On-site Observation by Professional cadre Before Managing Patients

From the observation, more nurses were observed using hand rub and hand wash before touching a patient than the Physicians. However, Physicians who missed and those who used gloves were more compared to nurses.

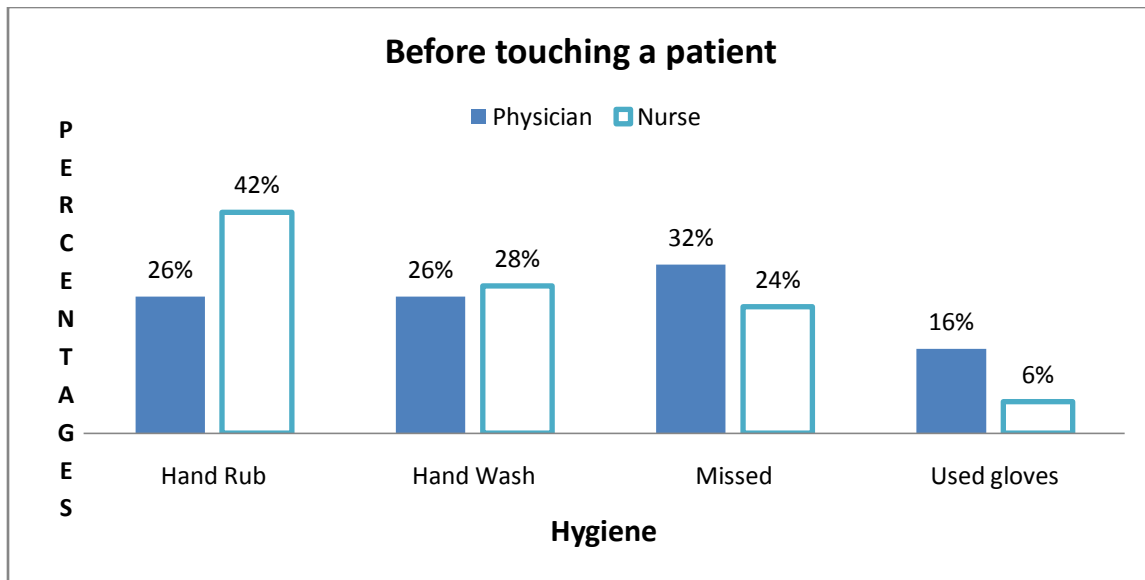


Figure 3:- Before touching a patient.

Before Aseptic Procedure

Almost half (58%) of physicians were observed using gloves before aseptic procedure than their counterparts (40%). Those who missed was almost the same, 5% and 4% by physicians and nurses respectively. For the hand wash and hand rub, more nurses were observed using than physicians, 44% (Hand wash) and 12% (hand rub) by nurses, 32% (hand wash) and 5% (hand rub) by physicians.

After Body Fluid Exposure

From the observation, majority wash their hands after body fluid exposure. This was shown by 79% (Physicians) and 71% (Nurses). However, none of the Physicians used a hand rub on the same. The rest of the information is summarized in figure 9 below;

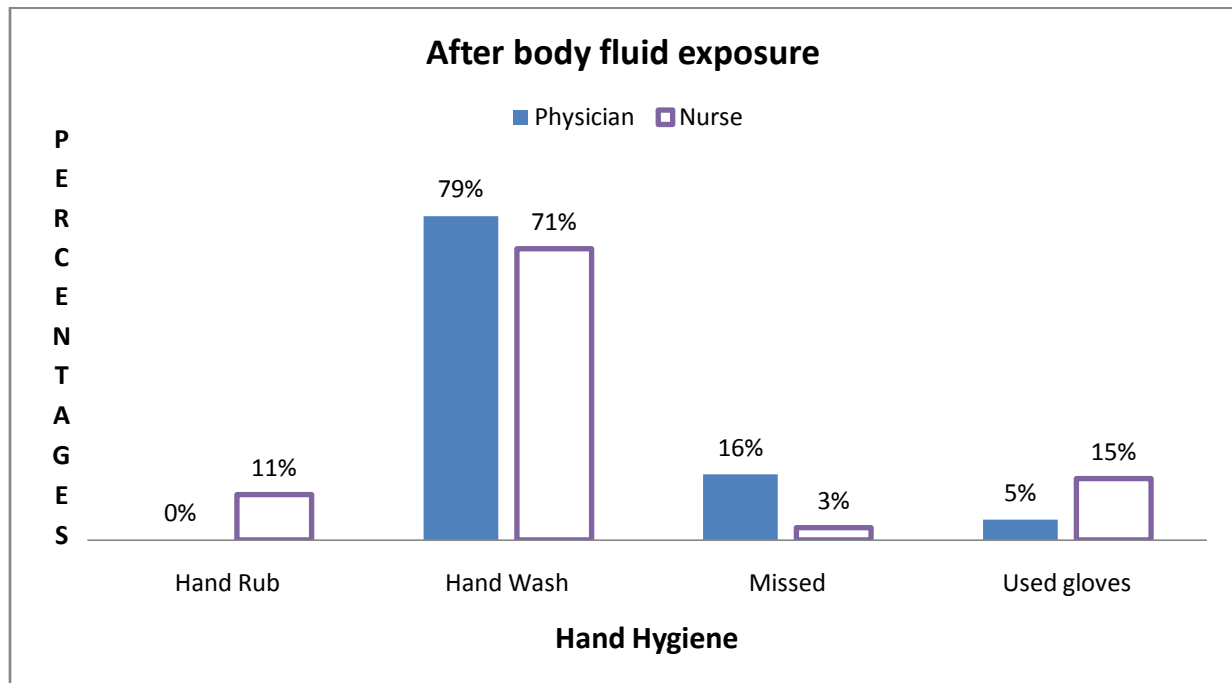


Figure 4:- After body fluid exposure.

After Touching the Patient

From survey findings, the most observed hand hygiene practice 'after touching a patient' was Hand rub whereby 63% and 43% of the Physicians and nurses were observed respectively. The least observed hand hygiene indication was the use of gloves 'after touching a patient' where 4% of the nurses were observed using and none of the physicians was (0%) observed. The information is summarized in the figure 10 below;

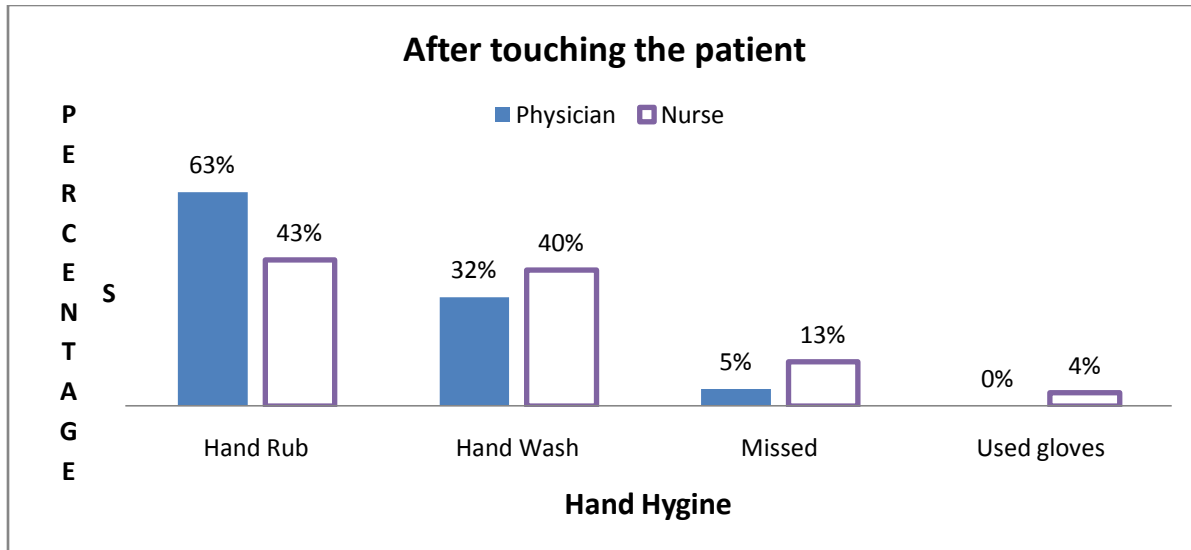


Figure 5:- After touching the patient.

After Patient Surrounding

Most of the Physicians (68%) were not observed using any hand hygiene 'after Patient surrounding' as compared to 30% nurses who also missed. However, none of the physicians (0%) used gloves 'after Patient Surrounding' and the other hand hygiene summary observed is shown in the figure 11 below;

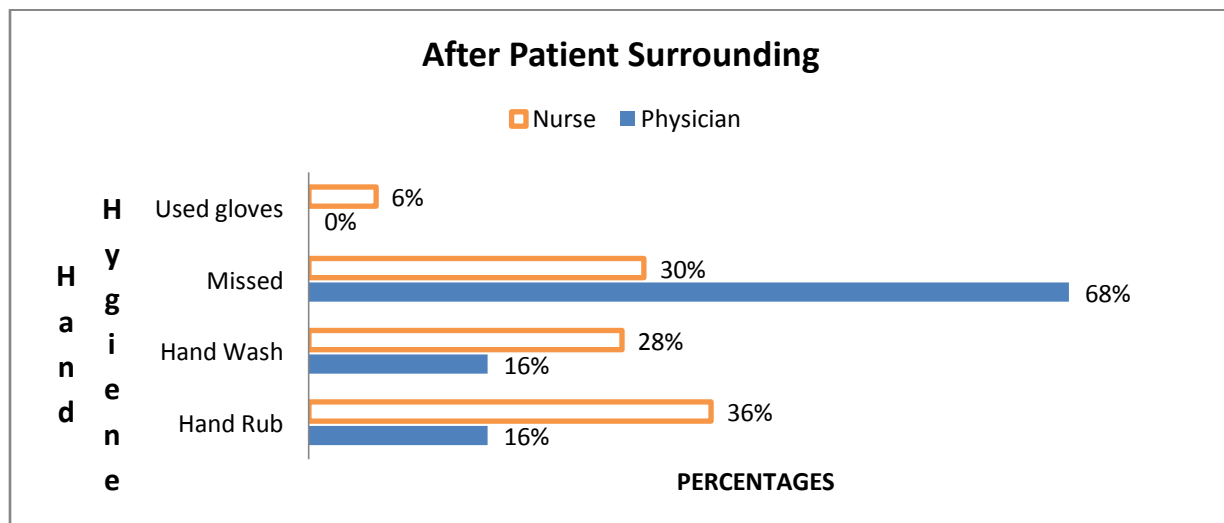


Figure 6:- After patient surrounding.

Conclusion:-

Based on this study, majority of the study participants were knowledgeable and the hand hygiene practice was good, nurses being more knowledgeable than Doctors.

There is an improved hand hygiene compliance compared to previous studies, hand driers, towels and sporadic supply of soap are some of the factors affecting effective hand hygiene practices in the study area

Recommendation:-

There is need to improving the knowledge and practice of HCWs on hand washing. Equal and consistent Supply of hand hygiene materials and infrastructure like soap, water, dryer, disposable hand towel, sinks and sanitizers will increase ease of access and compliance to hand hygiene practices in the hospital.

To improve staff knowledge there is need to promote continuous education and use of posters and pictures to act as constant reminders and guidelines on hand hygiene.

A more scientific study is recommended to establish the effectiveness of soap and sanitizers in relation to specific bugs and flora.

Data Availability

The data used to support the findings of this study are available for provision upon request.

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Appendix III: Consent Form

You are being asked to take part in a research study. Before agreeing to participate in this study, it is important that you read and understand the following explanation of the proposed study procedures. The following information describes the purpose, benefits, risks and confidentiality associated with the study. It also demonstrate your right to refuse to participate or withdraw from the study anytime.

Purpose

This study is designed to provide a better understanding of hand hygiene practices among nurses and doctors. Issues related to knowlegded and behaviours related to hand hygiene will be asked. Data collected will be used in developing programs to support hand hygiene practices at Moi Teaching and Referral hospital and other acute care hospitals.

Procedures

You will participate by being observed for 10-20 minutes at pre- specified times on the week day until hand hygiene opportunity will be defined of any of five indications for hand hygiene recommended by WHO during the observed care sequence. Thereafter, a self administered questionnaire will be administered on voluntary basis. A record of those observed will be kept strictly confidential by the investigators.

In the questiostionnaire you will be asked about yourself and knowledge on hand hygiene practices.

Risks

There will no risks associated with participation of the study

Benefits

Information gathered will provide a better understanding of knowledge and practices towards hand hygiene and adherence to practice as well as guidance to healthcare decision makers wishing to facilitate the development of successful hand hygiene practices and changing attitudes towards hand hygiene and prevention of hospital acquired infections.

Confidentiality

All information will be held in strict confidence. No names or identifying information will be used in any publication or presentations. Participants will not be identified by name or occupation and investigators will not have information about who participated in the research study.

Participation

Your participation in the study will be voluntary. You can chose to participate or you may withdraw at any time without risk of penalty. I acknowledge that I have had the opportunity to discuss this study and my questions have been answered to my satisfaction. I consent to take part in the study with the understanding I may withdraw at any time without risk of penalty. I have received a signed copy of this consent form.i voluntarily consent to participate in this study.

Appendix IV: Questionnaire For Healthcare Workers

Instructions: Please tick your response(s) in the space(s) provided.

Part A: Socio-demographic characteristics

1. Gender

☐ Male ☐ Female

2.Age ☐ Up to20years ☐ 21-30 years ☐ 31-40 years ☐ 41-50 years ☐ Above 50years

3.How long have you wo rked in MTRH

☐ Less than 3 years ☐ 3-6 years ☐ 7-10 years

☐ 11-14 years ☐ more than 14 years

4. Professional cadre/designation: ☐ Doctor ☐ Nurse

5. Level of education

☐ Master's degree ☐ Bachelor's degree ☐ Higher Diploma ☐ Diploma

☐ Certificate ☐ Others specify (.....)

		No	Yes
6	Have you heard of any Guidelines on hand hygiene practices in Health Care Services?		
7	Have you received any formal training on hand hygiene in the last 4 years?		

Part B: Knowledge on Hand hygiene Among Healthcare Workers

8. Which of the following is the main route of cross-transmission of potentially harmful germs between patients in a health care facility? (Tick one answer only)

- ☐ Healthcare workers' hands when not clean
☐ Air circulating within the hospital
☐ Patient's exposure to colonized surfaces (i.e. beds, chairs, tables)
☐ Sharing non-invasive objects between patients

9. What is the most frequent source of germs responsible for healthcare-associated infections? (Tick one answer only)

- ☐ The hospital's water system
☐ The hospital air
☐ Germs already present on or within the patient
☐ The hospital environment (surfaces)

Practice

10. The practice of the following hand hygiene actions prevents transmission of HCAI-causing germs to the patient? (Answer each statement separately)

		No	Yes
i	Before touching a patient		
ii	Immediately after a risk of body fluid exposure		
iii	After exposure to the immediate surroundings of the patient		
iv	Immediately before a clean/aseptic procedure		

11. The practice of the following hand hygiene actions prevents transmission of HCAI-causing germs to the healthcare worker (Answer each statement separately)

		No	Yes
i	After touching a patient		
ii	Immediately after a risk of body fluid exposure		
iii	Immediately before a clean/aseptic procedure		
iv	After exposure to the immediate surroundings of the patient		

12. Which of the following statements on alcohol-based hand rub and hand washing with soap and water are true? (Answer each statement separately)

		False	True
i	Hand rub is more rapid for hand cleansing than hand washing		
ii	Hand rubbing causes skin dryness more than hand washing		
iii	Hand rubbing is more effective against germs than hand washing		
iv	Hand washing and hand rubbing are recommended to be performed in sequence		

13. What type of hand hygiene method is required in the following situations?

		Rubbing	Washing	None
i	Before palpating the abdomen			

ii	Before giving an injection			
iii	After emptying a bed pan			
iv	After removing examination gloves			
v	After making a patient's bed			
vi	After visible exposure to blood			

14. What is the minimal time needed for alcohol-based hand rub to kill most germs on your hands?

☐ 20 seconds ☐ 3 seconds ☐ 1 minute ☐ 10 seconds

15. Which of the following should be avoided as it is associated with increased likelihood of colonization of healthcare workers' hands with harmful germs?

		No	Yes
i	Wearing jewelry		
ii	Damaged skin		
iii	Artificial fingernails		
iv	Regular use of hand cream		

Availability of hand hygiene materials and facilities in the units

		Always	Intermittently	Rarely	Never	Not applicable
16	Survey of hand hygiene materials and facilities in the units Statement					
17	Clean, running tap water is available in this ward/unit					
18	Hand washing soap is available at all sinks in this ward/unit					
19	Disposable paper or sterile cloth towels are available at all hand washing stations					
20	Do you routinely use an alcohol-based hand rub for hand hygiene?					

Posters

		No	Yes
21	Are posters illustrating indications (opportunities) for hand hygiene displayed in multiple areas of the ward/unit?		
22	Are posters illustrating hand wash and/or hand rub technique displayed beside each sink and/or close to hand rub dispensers and in multiple areas of the ward/unit?		

Appendix V: Observation hand Hygiene checklist

Professional category	☐ Physician ☐ Nurse	
Indications	Hand hygiene Action	Comments
Before touching a patient	☐ Hand Rub ☐ Hand Wash ☐ Missed ☐ Used Gloves	
Before aseptic procedure	☐ Hand Rub ☐ Hand Wash ☐ Missed	

	☐ Used Gloves	
After body fluids exposure risk	☐ Hand Rub ☐ Hand Wash ☐ Missed ☐ Used Gloves	
After touching the patient	☐ Hand Rub ☐ Hand Wash ☐ Missed ☐ Used Gloves	
After patient surrounding	☐ Hand Rub ☐ Hand Wash ☐ Missed ☐ Used Gloves	

Note

Indication-reason (s) that motivate (s) hand hygiene action, all indications that apply at one moment must be recorded.

HH action: response to the hand hygiene indication (s) it can be either a positive action by performing hand rub or hand wash

Missed opportunity: no hand hygiene action performed

HR: hand hygiene action by hand rubbing with an alcohol-based formula.

Appendix VI: Proposal Signature Sheet.

The proposal has been done by the following Investigators:

Principal Investigator: BilhaAnjaoAmdany**Signature& Date:**

Co- Principal Investigator: Mercy NyanchamaAbere**Signature& Date:**.....

Co- Principal Investigator: Daniel AmdanyKomen**Signature& Date:**.....

Inferential Analyses

Test of independence between gender and the statement “Hand rubbing causes skin dryness more than hand washing”

A chi square test was performed across all the questions to see whether there was relationship (association) and gender. Therefore, it was noted that there was relationship between gender and the question “hand rubbing causes skin dryness more than hand washing” with $\chi^2(1, N=138)=4.73; p=0.03$. Hence from the findings, more female passed (56, expected=50) more than male (19, expected=50)

In addition, there was statistical relationship (association) between professional cadre on the knowledge on hand hygiene i.e. those received formal training on hand hygiene in the last 4 years $\chi^2(1, N=139)=5.24; p=0.022$. From the survey results, it was seen that more nurses (88; 73%, expected=84) had received formal training on hand hygiene in the last 4 years more than Doctors (9; 47%, expected=13)

Man Whitney U Test between Gender and Professional Cadre

Statistically, it can be concluded that nurses who participated in the survey were significantly more than the Doctors group (Nurses, $U_1 = 72.15$, Doctors $U_2 = 56.42; p = .05$, $N=139$), where U_1 and U_2 were the mean ranks of nurses and Doctors respectively.