HAND HYGIENE PRACTICES AMONG HEALTH CARE WORKERS AT NAIVASHA DISTRICT HOSPITAL MATERNAL AND NEONATAL UNITS.

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H58/65501/11

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A DISSERTATION SUBMITTED FOR THE PARTIAL FULFILLMENT OF A MASTERS OF MEDICINE IN PAEDIATRICS AND CHILD HEALTH, UNIVERSITY OF NAIROBI.

2014

DECLARATION

This dissertation is my original work and has not been presented for the award of a degree in any other university

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DEDICATION

This work is dedicated to my beloved mother Jane Kadenyi Oweya, sister Faith and brothers; Mike, Keith and Nigel who have been a true inspiration and a source of encouragement and great support throughout this project.

You are truly appreciated.

ACKNOWLEDGEMENTS

Special thanks to my lecturers and supervisors, Professor Ezekiel Wafula and Dr. Donald Oyatsi for your invaluable support, guidance and insights during the course of this work. You have patiently and consistently imparted in me principles of research for current and future work.

I am grateful to the administration of the University of Nairobi through the Dean of students, school of medicine for granting me study leave to undertake this study with and regards to the chair, Department of Pediatrics. Special thanks to the administration of Naivasha District Hospital and in particular the Medical Superintendent as well as the hospital pediatrician, Dr. Kimotho for allowing me to carry out this study at the facility.

Special thanks also go to the PRIME –K for funding this study and providing the relevant resources to carry out this study smoothly. I am also grateful to my research assistants, Dr. Pauline Kamau and Ms. Loise Wakonyo for your invaluable assistance.

And last but not least to all the Health Care workers at Naivasha District Hospital for their participation in this study.

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ABBREVIATIONS

ABHR	:	Alcohol based hand rub
CFU	:	Colony forming units
Dept.	:	Department
GIT	:	Gastrointestinal tract
HCAIs	:	Health Care-associated Infections
HCW	:	Health Care Workers
HH	:	Hand Hygiene
HR	:	Hand rub
HW	:	Hand wash
MCH	:	Maternal and child health
MRSA	:	Methicillin resistant staphaureus
NBU	:	Newborn Unit
NDH	:	Naivasha District Hospital
RSV	:	Respiratory syncytial virus
VRE	:	Vancomycin-resistant Enterococci
WHO	:	World Health Organization

DEFINITION OF TERMS

1. **Hand hygiene action**–this is defined as the response to hand hygiene indication(s):it can either be a positive action by performing a hand wash or hand rub or it could be negative action by missing HR or HW.

2. **Hand hygiene indication-**Reason(s) that motivate(s) hand hygiene action e.g. before an aseptic procedure.

3. **Hand hygiene opportunity**- this is defined as at least one opportunity to perform a HH action.

4. **Hand transmission** –Healthcare workers' hands touch a sequence of surfaces; with each hand-to-surface exposure, microorganisms can be transmitted from the donor surface to the receptor surface.

5. **Health care workers**- These are the staff at NDH who will be the study subjects and will include: doctors, clinical officers, nurses, nurse assistants and medical students).

6. **Missed opportunity-** corresponds to an opportunity for hand hygiene that was not met by a hand hygiene action.

7. **Observation session-**Period of hand hygiene observation in a care setting during 20 $\pm$10 minutes; each observation form equals one observation session.

8. **Patient zone**-Narrow geographical zone around the patient that is exclusively dedicated to that patient and increasingly colonized with patient flora; this zone typically contains the patient's intact skin, bed or chair, bedside table, outside surface of medical devices, monitors, and so on.

9. **Health care workers on temporary assignment**: these are HCWS who will be assigned to work in the maternal and newborn units for less than one week.

1. ABSTRACT

Background

Health care associated infections are a major cause of morbidity and mortality especially among the vulnerable groups like the neonates and a majority of these infections are due to contamination of HCWs hands. Hand hygiene is a simple cost effective measure for preventing infections related to healthcare. Morbidity and mortality resulting from healthcare associated infections (HCAIs) can greatly be reduced by adherence to the recommended hand hygiene guidelines.

Objectives

The objectives of this study were to determine the hand hygiene practices among healthcare workers (HCWs) in the maternal and neonatal units at Naivasha District Hospital and assessing their knowledge and attitudes regarding HCAIs and the importance of hand hygiene.

Study design

A descriptive cross sectional study where HCWs were observed using a standard WHO observation tool to assess hand hygiene practices and later a questionnaire administered to assess knowledge and attitudes as well as barriers to effective hand hygiene.

Conclusion

Theoverall compliance on hand hygiene among the HCWs was at 32.5 % a figure lower than the global one of 39%. The highest compliance rates were commonly seen after patient procedures. The overall knowledge on hand hygiene was good at 75%.The common barriers to effective hand hygiene noted were lack of alcohol based hand rub 68/79(86.1%), forgetfulness 48/79(60.8%) and 51/79(64.6%) opted to use gloves.

Recommendations

The hospital's senior management team should support and openly promote hand hygiene.
There should be clear and simple instructions on hand hygiene made visible for every health worker at their work stations. Health care workers should receive regular training on correct hand hygiene practices and alcohol based hand rubs and towels should be made available in the units.

2. INTRODUCTION AND LITERATURE REVIEW

2.1. Background

Health care-associated infection (HCAI), also known as nosocomial infection is a significant cause of morbidity and mortality in hospitalized patients[1]. The World Health Organization (WHO) estimates that at any time, over 1.4 million people worldwide suffer from infections acquired in health-care settings[2]. Neonates are particularly vulnerable for acquiring HCAIs as well as experiencing more severe illness due to their intrinsic susceptibility to infections.

In industrialized countries, the risk of acquiring HCAI is 5% - 10% among patients admitted to acute care hospitals. In developing countries, the risk is 2-20 times higher, and the proportion of patients infected may exceed 25%[3-7]. Similarly, neonatal infections are reported to be 3-20 times higher among hospital-born babies in developing countries, and in some countries the case fatality rates may reach 52%[8].Millennium development goal 4 aims at reducing child mortality by two thirds by the year 2015. About seven million children under five die every year. Almost 75% of all child deaths are attributable to just six conditions: neonatal causes, pneumonia, diarrhea, malaria, measles, and HIV/AIDS.

Understaffing and low levels of staff preparedness and knowledge are key factors leading to poor infection control in developing countries[9]. Several factors also make the implementation of minimum standards of infection control very difficult, including poor hygiene and sanitation; lack of or shortage of basic equipment, such as gloves; inadequate structures and overcrowding; and limited availability of surveillance data[9].

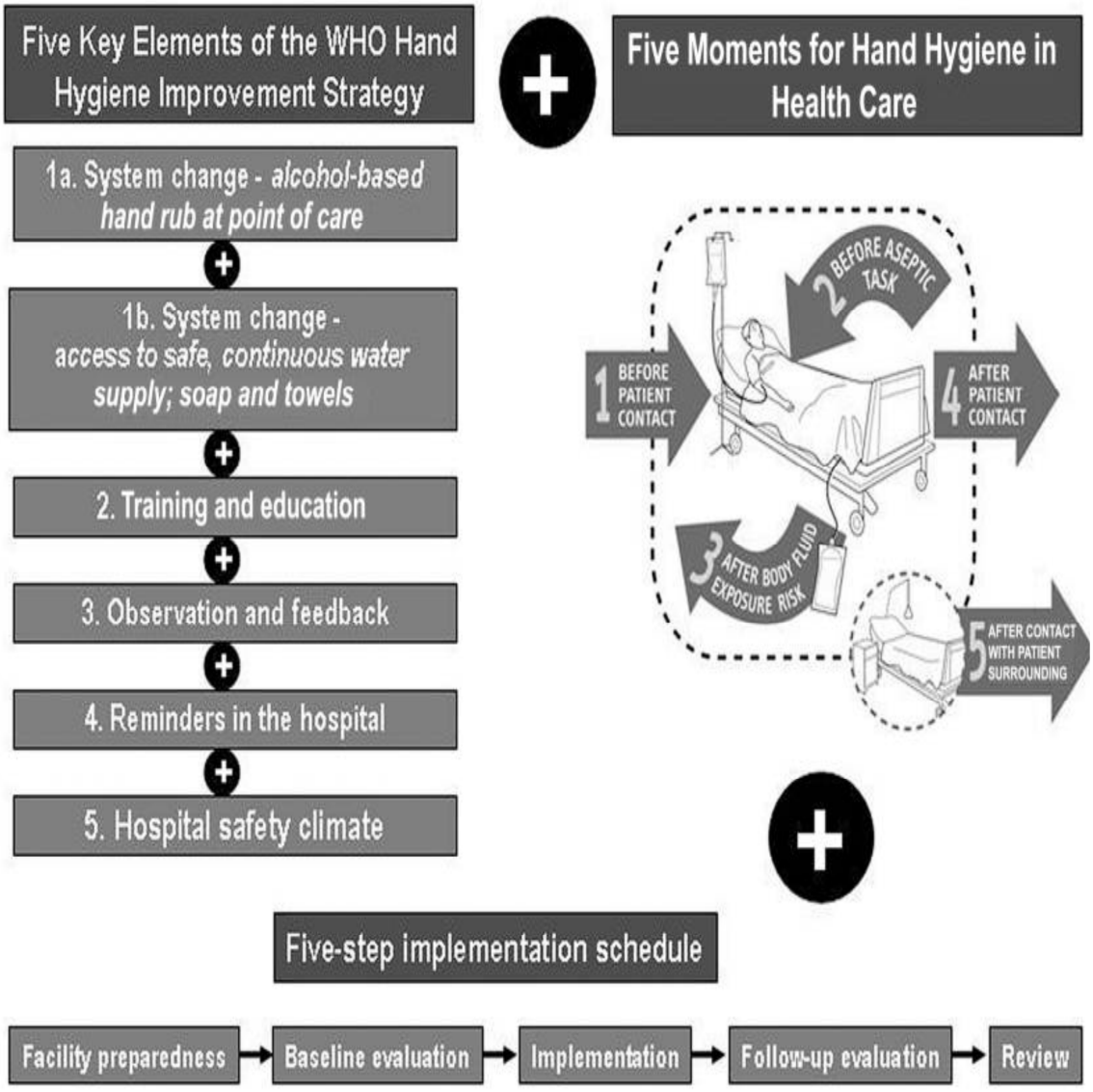
Despite this discouraging picture, simple and applicable preventive measures and tools do exist. Their effectiveness has mostly been demonstrated in settings with adequate resources but remarkable examples of implementation of interventions to reduce HCAI are also available from studies conducted in developing countries[10-15].The impact of HCAI is substantial and implies more serious infection, prolonged hospital stay, increased resistance of microorganisms to antimicrobials, long term disability, high mortality, massive additional financial burdens, high costs for the health systems and emotional stress for patients and their families[16].

It's against this background that the WHO World Alliance for Patient Safety was launched in October 2005 to tackle the problem of HCAIs worldwide. Given the critical nature of this problem, the project was launched as the First Global Patient Safety Challenge "Clean Care is Safer Care"[2, 17]. It aims at reducing HCAI worldwide and the cornerstone of the entire initiative focuses on the promotion of hand hygiene in Health Care. In May 2009, WHO issued a new global guideline on hand hygiene in health care, "WHO Guideline on Hand Hygiene in Health Care".

The WHO also developed a multimodal implementation strategy (figure A) to turn the scientific evidence included in the guidelines into practice and to suggest feasible ways to induce changes that will ultimately result in improved hand hygiene compliance and reduce morbidity and mortality due to HCAIs. In the proposed implementation schedule, baseline evaluation of the current hand hygiene practices, knowledge and perceptions of the HCWs and infrastructure availability is essential prior to introduction of the improvement activities.

Hand hygiene has been singled out as the most effective measure for preventing infections related to health care. However, no study has been done in the NDH maternal and newborn units to assess the HCWs' hand hygiene practices or their knowledge and attitudes regarding hand hygiene. This study aims at providing this baseline information which is essential in order to develop appropriate and targeted interventions aimed at improving hand hygiene practices and ultimately reducing the high rates of neonatal sepsis.

FIGURE A: MY FIVE MOMENTS OF HAND HYGIENE



2.2. Normal Bacterial Flora on hands

Normal human skin is colonized with bacteria with different areas of the body having varied total aerobic bacterial counts. Total bacterial counts on the hands of medical personnel have ranged from 3.9×10^4 to 4.6×10^6[19, 20-22]. Bacteria recovered from the hands can be divided into two categories namely, transient or resident [19].

2.2.1. Transient flora (transient microbiota)

These micro-organisms colonize the superficial layers of the skin and are more amenable to removal by routine hand hygiene. They are often acquired by HCWs during direct contact with patients or contaminated environmental surfaces adjacent to the patient and are the organisms most frequently associated with HCAI.

Some types of contact during routine neonatal care are more frequently associated with higher levels of bacterial contamination of HCWs' hands: respiratory secretions, nappy/diaper change, and direct skin contact[23, 24]. The transmissibility of transient flora depends on the species present, the number of microorganisms on the surface, and the skin moisture[25].

2.2.2. Resident flora (resident microbiota)

These micro-organisms are attached to deeper layers of the skin and are therefore more resistant to removal[26]. In general, resident flora is less likely to be associated with infections, but may cause infections in sterile body cavities, the eyes, or on non-intact skin[27].

2.3. Transmission of HCAIs through hands

The transmission of health care-associated pathogens takes place through direct and indirect contact, droplets, air and a common vehicle. Transmission through contaminated HCWs' hands is the most common pattern in most settings and requires five sequential steps: organisms are present on the patient's skin, or have been shed onto inanimate objects immediately surrounding the patient; organisms must be transferred to the hands of HCWs; Organisms must be capable of surviving for at least several minutes on HCWs' hands.

Hand washing or hand antisepsis by the HCWs must be inadequate or omitted entirely, or the agent used for hand hygiene inappropriate; and the contaminated hand or hands of the caregiver must come into direct contact with another patient or with an inanimate object that will come into direct contact with the patient[28].

2.3.1. Organisms present on patient skin or inanimate environment

Many studies have shown that healthcare-associated pathogens can be recovered not only from infected or draining wounds, but also from frequently colonized areas of normal, intact patient skin[29-36]. Because nearly 10^6 skin squames containing viable microorganisms are shed daily from normal skin, it is not surprising that patient gowns, bed linen, bedside furniture and other objects in the immediate environment of the patient become contaminated with patient flora[34-41].

Such contamination is most likely to be due to staphylococci, enterococci or *Clostridium difficile* which are more resistant to desiccation. Contamination of the inanimate environment has also been detected on ward hand wash station surfaces and many of the organisms isolated were staphylococci[42].Tap/faucet handles were more likely to be contaminated and to be in excess of benchmark values than other parts of the station.

2.3.2. Organisms transfer to HCWS hands

Several studies have documented that HCWs can contaminate their hands or gloves with Gram-negative bacilli, *S. Aureus*, enterococci or *C. difficile* when performing "clean procedures" or touching intact areas of skin of hospitalized patients[43-45]. A recent study that involved culturing HCWs hands after various activities showed that hands were contaminated following patient contact and after contact with body fluids or waste[46].

Pittet et al in another study assessed contamination of HCWs' hands before and after direct patient contact, wound care, intravascular catheter care, respiratory tract care or handling patient secretions. Using agar fingertip impression plates, they found that the number of bacteria recovered from fingertips ranged from 0 to 300 CFU. Direct patient contact and respiratory tract care were most likely to contaminate the fingers of caregivers. Gram-negative bacilli accounted for 15% of isolates and *S. aureus* for 11%.

Importantly, the duration of patient-care activity was strongly associated with the intensity of bacterial contamination of HCWs' hands in this study[23]. The use of gloves did not fully protect HCWs' hands from bacterial contamination, and glove contamination was almost as high as ungloved hand contamination following patient contact. In contrast, the use of gloves during procedures such as nappy/diaper change and respiratory care almost halved the average increase of bacteria ^{CFU}/min on HCWs' hands[24].

In another study involving HCWs caring for patients with vancomycin-resistant enterococci (VRE),70% of HCWs contaminated their hands or gloves by touching the patient and the patient's environment[41].Furthermore, HCWs caring for infants with respiratory syncytial virus (RSV) infections have acquired infection by performing activities such as feeding infants, nappy/diaper change, and playing with the infant[47].The HCWs contaminated their hands with RSV and inoculated their oral or conjunctival mucosa with the organisms.

2.4. Results of defective hand cleansing

Studies showing the adequacy or inadequacy of hand cleansing by microbiological proof are few. In a laboratory-based study, Larson et al found that using only 1 ml of liquid soap or alcohol-based handrub yielded lower log reductions i.e. greater number of bacteria remaining on hands than using 3 ml of any of these products to clean hands[52].

The findings have clinical relevance since some HCWs use as little as 0.4 ml of soap to clean their hands. Kac et al[53]conducted a comparative, crossover study of microbiological efficacy of hand rubbing with an alcohol-based solution and handwashing with an un-medicated soap. The study results were: 15% of HCWs hands were contaminated with transient pathogens beforehand hygiene; no transient pathogens were recovered after hand rubbing, while two cases were found after hand washing.

Failure to perform appropriate hand hygiene is considered to be the leading cause of HCAI and the spread of multi-resistant organisms, and has been recognized as a significant contributor to outbreaks. There is convincing evidence that improved hand hygiene through multimodal implementation strategies can reduce HCAI rates[31]. In addition, although not reporting infection rates, several studies showed a sustained decrease of the incidence of multidrug-resistant bacterial isolates and patient colonization following the implementation of hand hygiene improvement[64, 66-68].

2.5. Hand hygiene compliance among HCWS

Despite the fact that hand hygiene is a simple, highly effective measure for reducing the rate of healthcare-associated infection and the spread of antimicrobial resistance lack of compliance remains problematic in most health care settings[58, 59].The average compliance with hand hygiene recommendations varies between hospital wards, among professional categories of health-care workers, and according to working conditions, as well as according to the definitions used in different studies[60]. In most studies conducted in the neonatal setting,

compliance with hand hygiene has not exceeded 50%[61]. A study done by Sera Ngugi at KNH newborn unit showed a compliance rate of 15%[70].

3. STUDY RATIONALE

Hand hygiene, a relatively simple cost effective measure has been instituted in several facilities to prevent HCAI. Studies have shown that contaminated HCWS hands are vehicles for spread of micro-organisms. The risk of transmitting infections is higher if basic infection prevention and control practices are not observed especially in high risk patients like the neonates. In order to develop appropriate and targeted interventions for improving hand hygiene it is crucial to have a baseline evaluation of the current hand hygiene practices .This study aims to evaluate how well the health care workers follow the recommended guidelines.

4. STUDY QUESTIONS

1. What are the hand hygiene practices among health care workers at Naivasha district hospital maternal and neonatal units?
2. What are their knowledge and attitudes towards hand hygiene?
3. What are the barriers to effective hand hygiene practices?

5. STUDY OBJECTIVES

5.1. Primary Objective

1. To determine hand hygiene practices among HCWS at Naivasha District Hospital maternal and neonatal units.

5.2. Secondary Objectives

1. To assess the knowledge and attitudes of HCWS at the Naivasha district hospital maternal and neonatal units regarding hand hygiene.
2. To determine the barriers to effective hand hygiene practices.

6. METHODOLOGY

6.1. Study design

This was a descriptive cross-sectional study carried out over three months from September to November 2012.

6.2. Study population

The study population included all health care workers at Naivasha District maternal and neonatal units in direct contact with the patients: Doctors, clinical officers, nurses, nursing students, physiotherapists, nutritionists and medical students.

6.3. Study area

This study was carried out in the Labor ward and delivery units, the ante-natal and post natal wards, new born unit (NBU) and the child welfare clinic (CHW).

Naivasha District hospital is a level IV hospital and is the main ref erral facility in Naivasha District and its environs. Monthly data summaries indicate that there are 10-15 vaginal deliveries per day (approximately 3 - 6 thousand per year) and 200 daily attendances to the MCH. There are 5 - 10 admissions to the newborn unit daily. The hospital has a staff capacity of 250 and a bed capacity of 167.The units visited had approximately 90 HCWS: 30 nurses, 15 doctors, 20 Clinical officers(CO), 2 physiotherapists, 2 nutritionists and a variable number of nursing and medical students.

6.4. Sample size calculation for observations

$$n = \frac{Z^2 (1-\alpha / 2) P (1-P)}{d^2}$$

Where;

n = sample size

p = estimated hand hygiene compliance rate in neonatal unit; 15.4% from a study in Ghana[65].

d = precision (5%)

$Z^2 (1-\alpha/2)$ = the square of the standard normal deviation corresponding to a confidence interval of 95% i.e. 1.96^2

$$n = \frac{200}{}$$

Design Effect

$$DEFF\ (u\hat{}) = \frac{Var\ u\hat{}}{SRS\ Var\ (u\hat{})}$$

Where;

DEFF is the design effect

Var (u) is the actual variance under the sampling method actually used.

SRS Var (u) is the variance that would have resulted under simple random sampling assumptions.

The aim is to improve power by observing each HCW more than once.

Based on past survey experience

Mean Design Effect= 1.6[69]

Thus incorporating the design effect, the corrected sample size will be:

200 x 1. = 320 Observations of hand hygiene opportunities.

The number of HCWs in the Maternal and Newborn unit was approximately 80; therefore approximately 4 hand hygiene observations were to be done per HCW.

6.5. Sampling Procedure

HCWs in the maternal and newborn units were invited to participate in the study.

Consent was sought from the hospital administration prior to carrying out the observational study and not directly from the health care workers.

Observations were carried out without the knowledge of the HCWS on the specifics of the study to minimize bias.The principal investigator and the assistants kept a record of the number of times each HCW had been observed so as to avoid over/under-observations.

After the observational study, all the HCWS in the maternal and neonatal were given questionnaires to fill after obtaining verbal consent from them. This was done with the aim of reducing bias. Those HCWS on temporary assignment were excluded from the study so as to obtain unbiased data.

Out of 120 health workers working within the paediatric department at Naivasha District hospital (15 outpatient, 105 inpatient, 85 were eligible for inclusion). 35 health workers were ineligible for the following reasons:

Some health care workers were on temporary assignments resulting on them being available on few hours during the working hours making it impossible to carry out the required number of observations per HCW.None of the HCWS approached refused to consent to the study as it was explained earlier to them that it was a quality assessment study.

320 observations of hand hygiene practice were conducted among HCWs with 4 observations per worker. After obtaining verbal consent, 79 HCW responded to the 12 question questionnaire.

6.6. Inclusion criteria

All health care workers in the maternal and new-born units at the hospital in direct contact with the patients who consented to the study.

6.7. Exclusion criteria

The health workers who were on temporary assignment i.e. those working for less than one week at a given period in the units.

6.8. Study Materials

1**. A structured WHO hand hygiene observation form**.

A tool that uses the 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. (Appendix 1/2)

2. **A self-administered questionnaire** to assess the knowledge and attitude of HCWs regarding the importance of hand hygiene and perceived obstacles to the recommended hand hygiene practices.

The questionnaire is adopted from the WHO perception and knowledge questionnaires for HCWs. (Appendix 3)

6.9. Variables

For the observational survey, the outcome variable was be compliance with hand hygiene, defined as hand washing or hand rubbing with alcohol-based hand rub for every opportunity for hand hygiene. That is; the ratio of the number of performed actions to the number of opportunities as expressed by the following:

$$\text{Compliance (\%)} = \frac{\text{Performed actions}}{\text{Opportunities}} \times 100$$

Note: The definitions of these terms are attached to the WHO observational card (appendix 3-short description of terms)

7. DATA COLLECTION

Data was collected in two phases:

Observations of hand hygiene

HCWs in direct contact with patients or were observed randomly for 10-20 minutes at pre-specified times on week-days until four hand hygiene opportunities occurred or the HCW 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; i.e. 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 HCW 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 were 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 HCW. During each session availability of soap, free flowing water and ABHR was noted Data collection took approximately two months and a record of those observed was kept strictly confidential.

Questionnaires

The self- administered questionnaires were given to theHCWs observed earlier to assess their knowledge and perceptions regarding HCAIs and importance of hygiene as well as the barriers to the recommended hand hygiene practices. They were counterchecked on collection for completion.

8. DATA MANAGEMENT AND ANALYSIS

Data entries from both the observation forms and questionnaires were entered into a Microsoft Access Database. Data cleaning was done by counterchecking entered data against the hard copy questionnaires. Data analysis was done using Statistical Package for Social Sciences(SPSSV19). To determine hand hygiene practices among HCWS compliance to hand hygiene was used and this was calculated as:

$$\text{Compliance (\%)} = \frac{\text{Performed actions}}{\text{Opportunities}} \times 100$$

This was broken down in terms of professional category and indication.

To assess HCWS knowledge and attitudes to hand hygiene participant's responses were summarized by counts and percentages. All nominal variables were summarized using counts and proportions while continuous variables using measures of central tendency. Chi –square test was used to measure the strength of association between variables.

Results were then presented in the form of bar graphs and figures.

9. ETHICAL CONSIDERATIONS

Permission to undertake this study was sought from Kenyatta National Hospital scientific and Ethics Committee (KNH/UON-ERC) as well as the Naivasha District Hospital administration. A written consent was obtained from the hospital administration prior to the observational study.

Verbal Consent was sought from the HCWS prior to administration of questionnaires. The subjects' confidentiality was held in trust by the investigator. The study protocol, documentation, data and all the information generated was held in strict confidence. No information concerning the study or the data has been released to any unauthorized third party.

All reports and other records that left the site were identified only by the subject identification number (SIN) to maintain subject confidentiality. The benefits to the participants included health education during the delivery of feedback to the hospital and specifically the HCWS in the maternal and newborn units.

The subjects were informed on the importance of appropriate hand hygiene and WHO hand washing charts provided as a reminder to them. No monetary gain was obtained for those who had participated the study and no form of monetary coercion was done.

10. STUDY LIMITATIONS

Observation bias also referred to as the Hawthorne effect is probably the most important bias in hand hygiene observation. It refers to the tendency of people who know they are being observed in a research context to behave differently from the way they would otherwise behave. To attenuate this, a number of measures were taken: after consenting to participate in

the study, the timing of observation of the HCWs was unannounced; the principal investigator and the research assistant were working in the unit and not obvious “stranger” to those being observed and the observations were done unobtrusively during the routine care activities.

The second limitation in this study was inter-observer variability. To minimize this, the observers were only two including the principal investigator and that remained constant throughout the study period; the research assistant underwent training and cross validation with the principal investigator performed prior to carrying out the study.

The third limitation was that some background information was lacking as to the previous hand hygiene practices but this will be minimized by doing a preliminary tour to the study area prior to data collection and ascertaining availability of hand hygiene resources e.g running water , soap, hand driers and alcohol based hand rub.

11. RESULTS

HAND HYGIENE PRACTICES AT NAIVASHA DISTRICT HOSPITAL.

320 observations of hand hygiene practice were conducted among health care workers during five sessions with 4 observations per HCW. The sessions were allocated based on different working hours particularly during ward rounds and ward works.

Table 1: Professional qualification of health workers observed during hand hygiene sessions at Naivasha DH

Professional qualification	Frequency	Percent	**Observation sessions**	**frequency**	**Percent**
Doctors	13	16.25	First session	16	20
Nurses	30	37.5	Second session	28	35
Clinical officers	4	5	Third session	16	20
Student nurses	31	38.75	Fourth session	12	15
Other(nutritionist, Physiotherapists and Medical students.)	2	2.5	Fifth session	8	10
Total	**80**	**100**	Total	80	100

As shown in table 1 the most observations were contributed by either nursing students (38.75%) or qualified nurses (37.5%) and the least number of observations was among physiotherapists, nutritionist and medical students at 2.5%.The number of observations per session ranged from 8 to 28.

Hand Hygiene compliance

Compliance with hand hygiene practices was calculated according to professional classification in table 2 below followed by a total compliance rate for all sessions and all health workers. Compliance was calculated as hand hygiene action (HH) which was either hand washing or use of ABHR divided by the number opportunities for hand hygiene (Opp) multiplied by 100

Table 2: Basic compliance with hand hygiene in relation to HCWs categories

	Doctors		Nurses		Cos		Student Nurses		Others(nutritionists, physiotherapists and med students)		Total per session	
Session No.	Opp (n)	HH action (n)	Opp (n)	HH action (n)	Opp (n)	HH action (n)	Opp (n)	HH action (n)	Opp (n)	HH action (n)	Opp (n)	HH action (n)
1	0	-	3	2	0	-	13	2	0	-	16	10
2	7	-	10	2	2	-	9	3	0	-	28	23
3	5	3	5	2	1	1	3	3	2	-	16	12
4	1	1	7	-	0	-	4	3	0	-	12	9
5	0	-	5	-	1	-	2	2	0	-	8	7
HH Action (n)	**5**		**7**		**1**		**13**		**0**		**26**	
Opp (n)	**13**		**30**		**4**		**31**		**2**		**80**	
Compliance	**38%**		**23%**		**25%**		**41%**		**0%**		**32.5%**	

The overall compliance rate was at 32.5%. The highest was among student nurses at 41%(13/31)and the lowest among nurses at 23%9(7/30).None of the others i.e. nutritionist or physiotherapist observed performed the expected hand hygiene hence the 0% compliance. Compliance was calculated using the hand hygiene action which was either hand washing or use of alcohol hand rub divided by the number of opportunities.

Figure 1: Hand hygiene compliance by indication

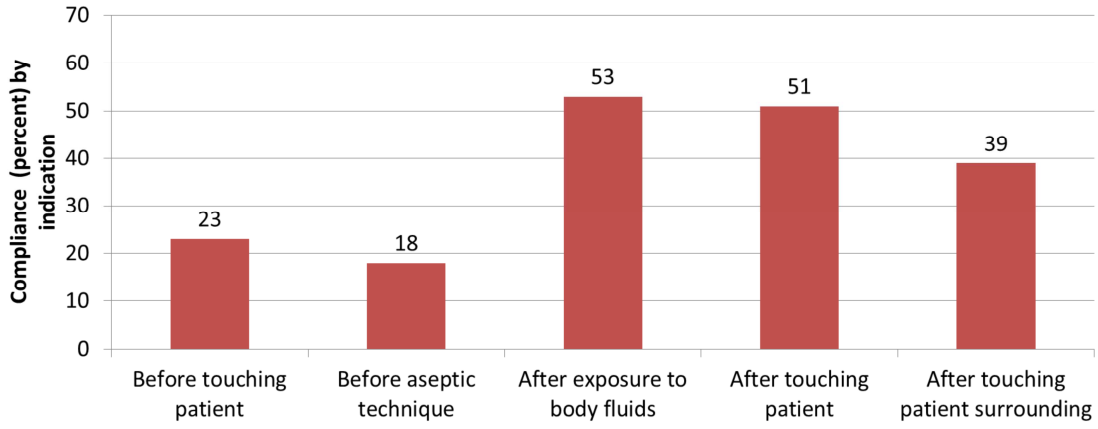


Figure 1 summarizes hand hygiene compliance by specific HH indications. The HH indication for which compliance was highest was after exposure to body fluids at 53%, 51% after touching patient, 39% after touching patient surrounding, 23% before touching patient and the lowest was at 18% before aseptic technique.

KNOWLEDGE AND ATTITUDES ON HAND HYGIENE

Table 3 summarizes the characteristics of health workers at Naivasha District Hospital participating in the hand hygiene practice survey based on a 12 question questionnaire administered. The majority (61.3%) of the participants were females. Based on health worker cadre, clinical officers (30.8%) and nurse students (23.1%) accounted for most of the respondents.

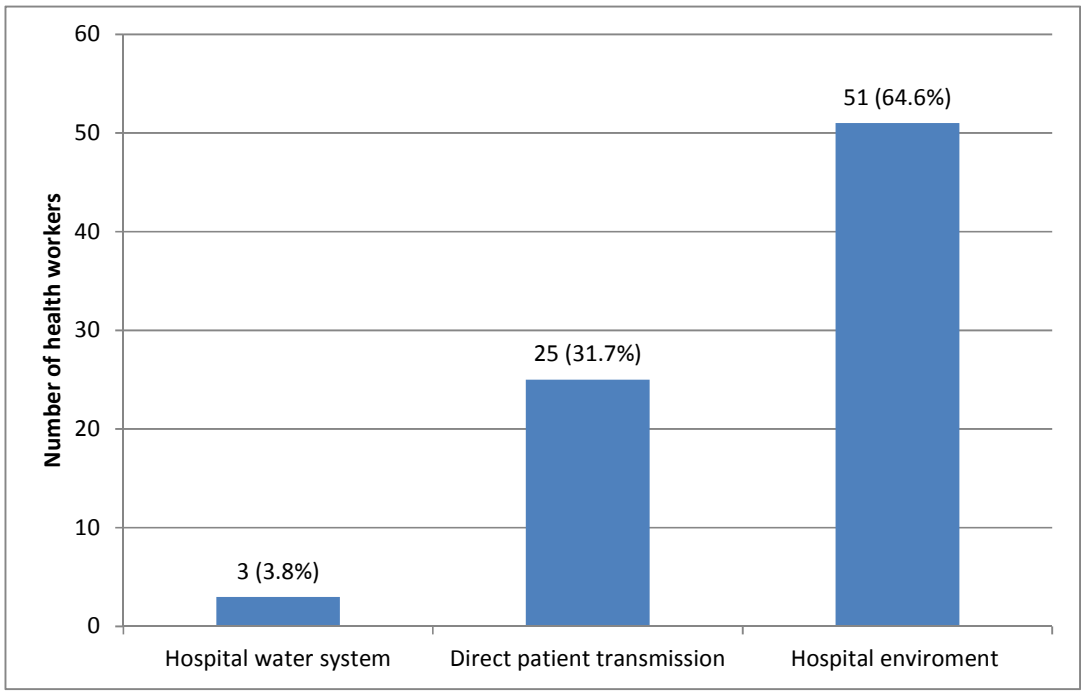
Table 3: Characteristics of health workers recruited at Naivasha District Hospital who filled the 12 answer questionnaire.

	Frequency (%)
Sex	
Male	29(38.7%)
Female	46(61.3%)
Profession	
Nursing students	24(30.8%)
Nurses	18(23.1%)
Clinical officers	11(14.1%)
Medical doctor	10(12.8%)
Others(medical students, physiotherapists, nutritionists)	15(19.2%)

Health worker knowledge and attitudes on hand hygiene

Knowledge was assessed using a set of twelve objective response items evaluating health worker understanding of sources of contamination, hand hygiene opportunities, techniques applied in practicing hand hygiene and knowledge on health-care associated infection as well as barriers to effective practices. The analysis for each of these items and overall knowledge across the different areas are presented below.

Figure 2: Health workers knowledge on sources of contamination



The majority of the HCWS 51(64.6) thought the hospital environment was the most common source of hospital infections,25(31.7%) due to germs on the patient and 3(3.8%) thought it was due to the hospital water system. None of the HCWS thought it could be due to the hospital air.

Table 4: Hand hygiene opportunities-hand washing or hand rub for different indications

Procedure	**Opportunity for hand hygiene**	
	Yes	**No**
Before touching a patient	68(86.1%)	11(13.9%)
Immediately after a risk of body fluid exposure	71(89.9%)	8(10.1%)
After exposure to the immediate surroundings of a patient	59(74.7%)	20(25.3%)
Immediately before a clean/aseptic procedure	68(86.1%)	11(13.9%)

The majority of the health care workers identified the above as opportunities for hand hygiene either by hand washing or use of alcohol based hand rub with 71(89.9%) reporting the need for hand hygiene after a risk of body fluid exposure. Before touching a patient and immediately before a clean/ aseptic procedure was at 86.1% and after exposure to the immediate surroundings was at 74%.

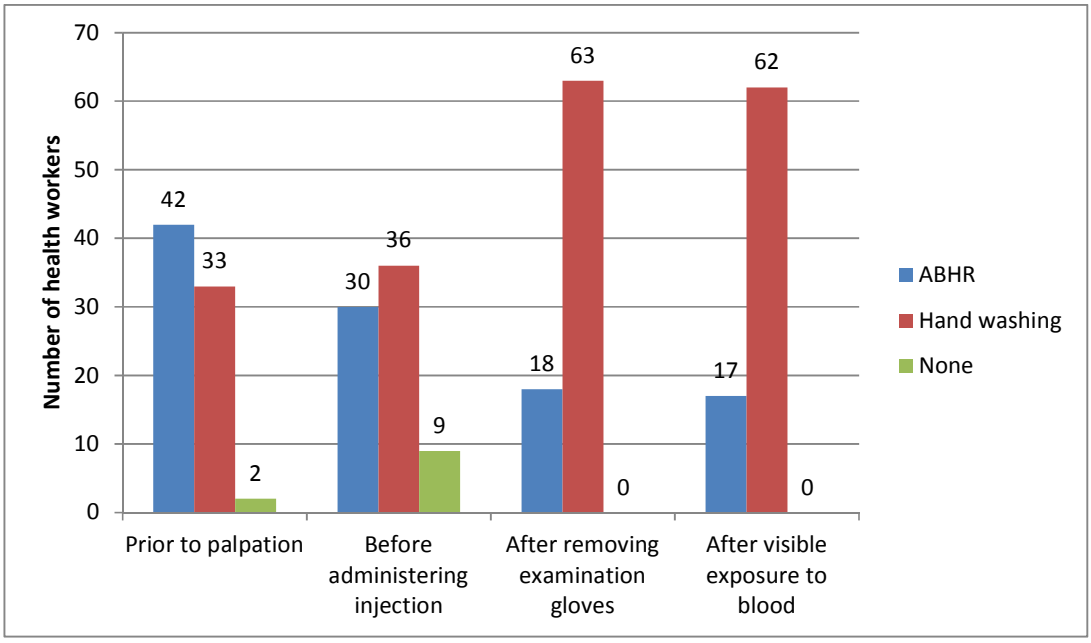
Table 5:Knowledge on 'My Five Moments on hand hygiene' based on professional category

Professional category	**NO n(%)**	**YES n(%)**
Clinical officer	1(9.1%)	10(90.9%)
Medical doctor	0(0%)	10(100%)
Nurse	9(50%)	9(50%)
Nursing student	13(54.2%)	11(45.8%)
Others(physiotherapists, nutritionist And medical students)	3(20%)	12(80%)
Total	**26(36%)**	**52(64%)**

Table 5 summarizes the knowledge of HCWs on the five moments of hand hygiene concept as proposed by the WHO. The overall knowledge was good at 64 %(n=52/78) .The majority of the HCW were able to correctly state the indications for hand hygiene for different opportunities, and the need for hand hygiene despite the use of gloves. Doctors scored the

highest at 100% and nursing students the lowest at 45.8%. Most respondents n=56/79(70.8%) believed that HCAI had high/very high on clinical outcomes of patients and a vast majority n=70/79 (88%) considered hand hygiene to be highly/ very highly effective in preventing HCAI.

Figure 3: Health workers reporting hand hygiene practices before and after patient procedures.



Health workers were more likely to report hand washing after visible exposure to blood (n = 62), after removing examination gloves (n = 63) and before administering injections (n = 36). Conversely, health workers reported using alcohol based hand rub more frequently before performing palpitation (n = 42) compared to hand washing (n = 33). Nine health workers did not think it was necessary to use either hand rub or gloves before administering injections.

Table 6: Median knowledge on hand hygiene practices based on the 12 answer questionnaire

	median(max = 12)	Minimum	Maximum	Mann-U Whitney p value
Profession				
Medical doctor	10.5	7	12	-
Nurse	10	5	11	0.48
Nurse student	8.0	5	12	**0.03**
Clinical officer	8.0	4	11	**0.01**
Others(physiotherapist, Nutritionist and med students)	8.0	5	12	**0.03**
Overall median	**9.0**	**4**	**12**	

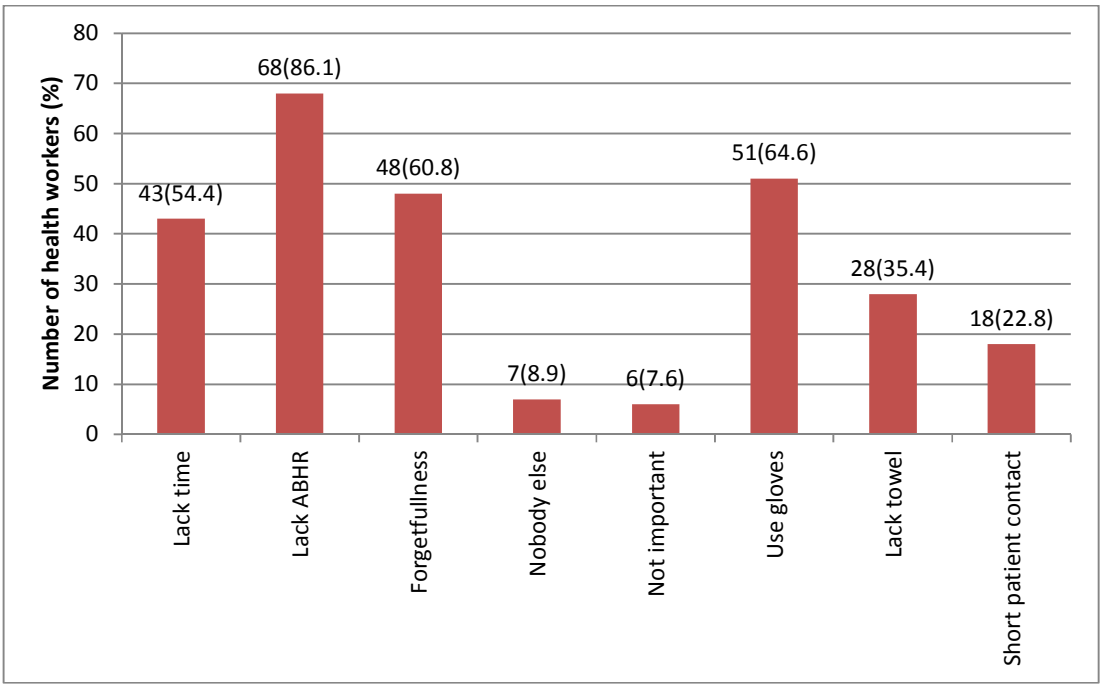
The median knowledge of medical doctors was high at 10.5 out of the possible total score of 12. Nurses was at 10 (p-0.48), nurse student, clinical officer and others at 8(p- 0.03,0.01 and 0.03 respectively).The overall median knowledge on hand hygiene in comparison to the doctors was good at 9. There was a statistical significant difference seen among nursing students, clinical officers and others.

Table 7: HCWs attitudes regarding effectiveness of the measures for improving hand hygiene

Hand hygiene measure	**Not effective**	**Less effective**	**Highly effective**
Each health worker receives education on hand hygiene	4(5.1%)	25(31.6%)	50(63.3%)
Health-care workers regularly receive feedback on their hand hygiene performance	8(10.4%)	24(31.2%)	45(58.4%)
Clear and simple instructions for hand hygiene are made visible for every health care worker	3(3.8%)	26(32.9%)	50(63.3%)
Hand hygiene posters are displayed at point of care as reminders	7(9.1%)	25(32.5%)	45(58.4%)
Leaders and senior managers at your institution support and openly promote hand hygiene	4(5.2%)	23(29.9%)	50(64.9%)
The health-care facility makes alcohol-based hand rub always available at each point of care	13(16.5%)	17(21.5%)	49(62.0%)

All 79 (100%) participating health workers felt that they could improve individual compliance with hand hygiene practices. Table 7 shows health worker attitude towards effectiveness of different approaches targeted at improving hand hygiene at Naivasha DH. At least one-half of health workers felt that each of the proposed strategies presented in table 7 could effectively improve hand hygiene. Institutional and senior management support and promotion of hand hygiene practice was the most frequently mentioned strategy for achieving effective hand hygiene, 50 (64.9%).

Figure 4:Barriers to effective hand hygiene practices



The majority of the HCWS cited lack of resources as factors which prevented their performance of hand hygiene with 86.1%% citing lack of alcohol hand rub as the major contributor. 64% opted to use gloves, 60% was due to forgetfulness, 54.4% due to lack of time, 35.4% due to lack of towels to wipe hands. Only 7.6 % thought that hand hygiene was not important.

12. DISCUSSION

Hand hygiene is a relatively simple and cost effective measure that has been instituted in several facilities to prevent HCAI. Previous studies conducted at Kenyatta National Hospital (KNH) Newborn Unit(NBU) reported high prevalence rates of neonatal infections with case fatality rates >40%[67,68,70] .Morbidity and mortality resulting from these infections can be reduced greatly with adherence to the recommended hand hygiene practices.

A pre evaluation survey was carried out prior to this study to ascertain the availability of hand hygiene facilities and confirmed the availability of clean running water and soap in all the units with erratic distribution of ABHR and paper towels. Out of the 120 health workers working within the pediatric department at Naivasha District hospital (15 outpatient, 105 inpatient, 85 were eligible for inclusion. Thirty five HCWs were ineligible since some were on temporary assignments and none of the HCWS approached declined to consent to the study.

The primary objective of this study was to have a baseline evaluation of the current hand hygiene practices at Naivasha District Hospital maternal and neonatal units in order to develop appropriate and targeted interventions for improving their practices. The overall compliance rate with hand hygiene was at 32.5% with a range of 23% to 41% depending on the professional category. This is lower than the global rate of 39% [17]but higher than that of a similar study conducted in KNH which showed a compliance rate of 15%[70] .

Although this study was carried out in both the maternal and neonatal units the compliance rate among HCWS in the different units i.e. NBU, pediatric ward, maternity ward and child welfare clinics ranged between 30%-35%. The previous studies have shown high adherence to hand hygiene among doctors compared to nurses[70] as was seen with this study i.e. 38% among doctors and 23% among nurses. Surprisingly the highest compliance rate was seen among nursing students at 41% and this could be attributed to the fact that they were in training and were well aware that adherence to infection control was part of their assessment.

The WHO recommends use of alcohol based hand rubs as the gold standard for hand hygiene [17] but despite this fact it was not availed in the different units although the pharmacy had sufficient stock which was not distributed to the different units. None of the study subject was

also noted to have personal pocket ABHR which would make the process of hand hygiene faster and more convenient.

It was also noted that compliance to hand hygiene was highest after patient procedures i.e. 53% after exposure to body fluids, 51 % after touching the patient and 39 % after touching the patient surrounding. The lowest compliance rate was seen before patient procedures and this behavior was suggestive of self-protection rather than patient safety thus predisposing the patients to HCAI as previous studies have shown that transmission of infections is highest through contaminated HCWs hands[25].

The overall knowledge on hand hygiene and its importance on preventing HCAI was good with an overall median of 9 on a scale of 4 to 12. This was found to be highest among doctors with a median of 10.5 which surprisingly did not correlate with their relatively low compliance rate to hand hygiene. Conversely the nursing students who had the highest compliance rate of 41%, were among the ones who had the least knowledge concerning hand hygiene with a median of 8(p-0.03 CI=5-12). These findings could be attributed to the fact that the students were on training hence on continuous assessment and thus complied with hand hygiene to achieve good grades.

The majority of HCWS 51(64.6) thought the hospital environment was the most common source of hospital infections as has been shown by previous studies [43-46].In regards to the attitudes towards hand hygiene it was clear that all HCWs in this study felt they could improve hand hygiene with simple measures such as regular feedback on hand hygiene performance, simple and clear instructions on hand hygiene, and support from the senior management team of the hospital as has been proposed through the WHO global guideline on hand hygiene [2, 17.]

The majority of the health workers cited lack of resources as factors which prevented their performance of hand hygiene with 86.1% citing lack of alcohol hand rub as the major contributor. Sixty four percent opted to use gloves, 60% was due to forgetfulness, 54.4% due to lack of time, 35.4% due to lack of towels to wipe their hands. These factors correlate with the ones done in the previous studies specifically in resource limited settings[10] but despite this discouraging picture there are remarkable implementation strategies which can be used to promote hand hygiene in our setting [10-15].

13. CONCLUSION

The overall compliance on hand hygiene among the HCWs was at 32.5 % a figure lower than the global one of 39% with a range of 23% to 41% depending on the professional category. The highest compliance rates were commonly seen after patient procedures.

Institutional and senior management support , use of clear and simple instructions visible for all HCWs and training of the HCWs on hand hygiene were the most frequently mentioned strategies for achieving effective hand hygiene at 50/79 (63.3%).

The overall knowledge on hand hygiene was good at 75%, the highest being among doctors at 87.5 % and the least being among nursing students.

The common barriers to effective hand hygiene noted were lack of alcohol based hand rub, forgetfulness and some HCWS opted to use gloves.

14. RECOMMENDATIONS

The hospital’s senior management team should support and openly promote hand hygiene. There should be clear and simple instructions on hand hygiene made visible for every health worker at their work stations.

Health care workers should receive regular training on correct hand hygiene practices. Alcohol based hand rubs and towels should be made available in the units.

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16. APPENDICES

APPENDIX 1: HAND HYGIENE OBSERVATION FORM

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 ○missed ○gloves	1	☐bef-pat. ☐bef-asept. ☐aft-b.f. ☐aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○missed ○gloves	1	☐bef-pat. ☐bef-asept. ☐aft-b.f. ☐aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○missed ○gloves	1	☐bef-pat. ☐bef-asept. ☐aft-b.f. ☐aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○missed ○gloves
2	☐bef-pat. ☐bef-asept. ☐aft-b.f. ☐aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○missed ○gloves	2	☐bef-pat. ☐bef-asept. ☐aft-b.f. ☐aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○missed ○gloves	2	☐bef-pat. ☐bef-asept. ☐aft-b.f. ☐aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○missed ○gloves	2	☐bef-pat. ☐bef-asept. ☐aft-b.f. ☐aft-pat. ☐aft.p.surr.	☐ HR ☐ HW ○missed ○gloves
3	☐bef-pat. ☐bef-asept. ☐aft-b.f. ☐aft-pat. ☐aft.p.surr.	☐ HR ☐ HW ○missed ○gloves	3	☐bef-pat. ☐bef-asept. ☐aft-b.f. ☐aft-pat. ☐ aft.p.surr.	☐ HR ☐HW ○missed ○gloves	3	☐bef-pat. ☐bef-asept. ☐aft-b.f. ☐aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○missed ○gloves	3	☐bef-pat. ☐bef-asept. ☐aft-b.f. ☐aft-pat. ☐aft.p.surr.	☐ HR ☐HW ○missed ○gloves
4	☐bef-pat. ☐bef-asept. ☐aft-b.f. ☐aft-pat. ☐ aft.p.surr.	☐ HR ☐HW ○missed ○gloves	4	☐bef-pat. ☐bef-asept. ☐aft-b.f. ☐aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○missed ○gloves	4	☐bef-pat. ☐bef-asept. ☐aft-b.f. ☐aft-pat. ☐ aft.p.surr.	☐ HR ☐ HW ○missed ○gloves	4	☐bef-pat. ☐bef-asept. ☐aft-b.f. ☐aft-pat. ☐aft.p.surr.	☐ HR ☐ HW ○missed ○gloves

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 : STUDY QUESTIONNAIRE

SERIAL NO.____

Gender: Male ☐ Female ☐

Age: _____years

Profession: Nurse ☐ Médical doctor ☐ Nurse Student ☐ Médical student ☐

1. Do you routinely use an alcohol-based hand rub for hand hygiene? Yes ☐ No ☐

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

a) The hospitals water system

b) The hospital air

c) Germs already present on or within the patient

d)The hospital environment (surfaces)

3. Which of the following hand hygiene opportunities require one to practice hand hygiene?

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

4. Which of the following hand hygiene actions prevents transmission of germs *to the health-care worker*?

a) Use of gloves Yes ☐ No ☐

b) Use of Alcohol hand rubs Yes ☐ No ☐

c)After exposure to the immediate surroundings of a patient yes ☐ No ☐

5. Which type of hand hygiene method is required in the following situations?

Before palpation of the abdomen: Rubbing with alcohol based hand rubs (ABHR) ☐
Hand Washing ☐
None ☐

Before giving an injection: Rubbing with ABHR ☐
Hand washing ☐
None ☐

After removing examination gloves: Rubbing with ABHR ☐

Hand Washing ☐

None ☐

After visible exposure to blood: Rubbing with ABHR ☐

Hand Washing ☐

None ☐

6. Which of the following statements are true?

a)Wearing jewellery increases likelihood of colonisation of hands with harmful germs:

True ☐ False ☐

b)Hand rubbing is more rapid for hand cleansing than hand washing: True ☐ False ☐

7. In general, what is the impact of a health care-associated infection on a patient's clinical outcome?

Very low ☐ Low ☐ High ☐ Very high ☐

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

Very low ☐ Low ☐ High ☐ Very high ☐

9. On average, in what percentage of situations requiring hand hygiene do <u>health-care workers</u> in your hospital/ward actually perform hand hygiene, either by hand rubbing or hand washing (between 0 and 100%)?

_____% ☐ I don't know

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

Lack of time/ too busy:	True	☐	False	☐
Lack of alcohol-based hand rub:	True	☐	False	☐
Forgetfulness	True	☐	False	☐
Nobody else does	True	☐	False	☐
It's **not** important	True	☐	False	☐
Use gloves instead	True	☐	False	☐
Lack of towels	True	☐	False	☐
Short patient contact	True	☐	False	☐

11. In your opinion, how effective would the following actions be to improve hand hygiene permanently in your institution/ ward?

Please tick one ☐ on the scale according to your opinion.

a. Leaders and senior managers at your institution support and openly promote hand hygiene.

Not effective ☐---☐---☐---☐---☐---☐---☐Very effective

b. The health-care facility makes alcohol-based handrub always available at each point of care.

Not effective ☐---☐---☐---☐---☐--☐--☐Very effective

c. Hand hygiene posters are displayed at point of care as reminders.

Not effective ☐---☐---☐---☐--☐---☐---☐Very effective

d. Each health-care worker receives education on hand hygiene.

Not effective ☐-----☐---☐--☐---☐---☐---☐Very effective

e. Clear and simple instructions for hand hygiene are made visible for every health-care worker.

Not effective ☐---☐---☐---☐---☐---☐---☐Very effective

f. Health-care workers regularly receive feedback on their hand hygiene performance.

Not effective ☐---☐---☐---☐---☐--☐---☐Very effective

g. Do you feel that you can improve your compliance with hand hygiene?

Yes ☐ No ☐