

**HAND HYGIENE COMPLIANCE AMONG HEALTHCARE WORKERS
AT MUHIMBILI ORTHOPAEDIC INSTITUTE, DAR ES SALAAM
TANZANIA.**

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**MSc Nursing (Critical Care and Trauma) Dissertation
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Department of Clinical Nursing**



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**Dissertation Submitted in (Partial) Fulfilment of the Requirement for
Degree of Master of Science in Nursing (Critical Care and Trauma) of**

**Muhimbili University of Health and Allied Sciences
October, 2021**

CERTIFICATION

The undersigned certify that he has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled “**Hand hygiene compliance among healthcare workers at Muhimbili Orthopaedics Institute, Dar es Salaam Tanzania.**” in partial fulfilment of the requirements for the degree of Master of Science in Nursing (Critical Care and Trauma) of Muhimbili University of Health and Allied Sciences.

Dr. Beatrice Mwilike (Ph.D)

(Supervisor)

Date

DECLARATION AND COPYRIGHT.

I, **Grace A. Lukamirwa**, declare that this dissertation/thesis entitled is my own original work and it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature..... Date.....

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DEDICATION

I dedicate this dissertation first and foremost to Almighty God who granted me the strength to complete this project. Secondly I wish to extend much gratitude to my family and partner for accepting and respecting the times when I could not avail myself because of my academic responsibility.

ABSTRACT

Background of the study: In Tanzania hand hygiene was rarely practiced when gloves were used, compliance to hand hygiene varies by health worker characteristics whereby female health workers were better at hand hygiene, and there is a variation in compliance across facilities level, ownership, and location. Therefore, the study will assess the compliance and knowledge of healthcare workers regarding hand hygiene at Muhimbili Orthopaedic Institute

Objective: To assess hand hygiene compliance among healthcare workers at Muhimbili orthopedic institute, Dar es Salaam Tanzania.

Materials and methods: This is a cross-sectional study involving observational method employed to 251 of healthcare worker selected by multistage random sampling. Self-administered questionnaire and observation checklist was used as data collection tools. Data was analyzed by SPSS version 23 to obtain descriptive statistics and p-value of less than 0.05 was considered significant.

Results: The overall prevalence of knowledge regarding hand hygiene was found to be 58.7%. Almost (213, 84.9%) of participants were knowledgeable with the wearing of hand jewelry increases germs. Inadequate knowledge was most reported (193, 76.9%) as the barrier to comply with the hand hygiene. Most of healthcare workers prefers to use alcohol (43.03%) since it is more effective against germs. But, 42.63% of health care worker spent a minimum of 20 seconds for hand rub. Compliance of hand hygiene by healthcare worker was 55.4% among healthcare works.

Conclusion and recommendation: In this study despite of moderate knowledge by health workers they also showed slightly higher compliance with hand hygiene. Then, there should be conscious efforts to improve knowledge and hand hygiene compliance in healthcare workers especially among medical and nursing professionals.

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OPERATIONAL DEFINITIONS

Hand hygiene Compliance: defined as by WHO is the (2009) as an action of hand hygiene performed at any of the following moments': Moment 1: Before touching a patient Moment 2: Before a procedure Moment 3: After a procedure or body fluid exposure risk Moment 4: After touching a patient Moment 5: After touching a patient's surroundings (Hilt *et al.*, 2020).

Hand hygiene practice: this is defined as the responses to hand hygiene indication; it can either be a positive action by performing a hand wash or hand rub or it could be a negative action by missing hand wash or hand rub

Hand transmission: Healthcare workers hand to touch a sequence of surface, with each hand to surface exposure, microorganisms can be transmitted from the donor surface to the receptor surface

Healthcare workers: Any person who provides health care services (preventive, curative, promotional, rehabilitative). These includes a variety of professionals who are involved in providing health care for patients

Hand washing process of mechanically removing dirt and debris from the skin with plain soap and water

Healthcare-associated infections (HAIs): refers to any infections acquired during the process of delivery of health care while receiving treatment from or visiting the health facility. This infection can affect Health Care workers, patients, and visitors.

CHAPTER ONE

INTRODUCTION

1.1. Background of the study

Worldwide, there had been different continuously efforts and commitment of both public and private sectors to promote and support the installation of handwashing facilities in areas with high disease outbreaks (WHO, 2018). Hand washing is the rubbing together of all surfaces and crevices of the hands using soap or chemical and water. Hand washing should be performed after arriving at work, before leaving work, between client contacts, after removing gloves, when hands are visibly soiled, before eating, after excretion of body wastes (urination and defecation), after contact with body fluids, before and after performing invasive procedures, and after handling contaminated equipment. The exact duration of time required for handwashing depends on the circumstances. A washing time of 10 to 15 seconds is recommended to remove transient flora from the hands. High-risk areas, such as nurseries, usually require about a 2-minute hand wash. Soiled hands usually require more time (Jemal, 2018).

In the delivery of day-to-day patients' care and treatment, safe and effective performance is an essential element for both patient outcomes and healthcare worker health and safety. In line with that accepted guideline on the core component of infection prevention and control program by World Health Organization proposed that patient care activities should be undertaken in a clean and/or hygienic environment that facilitates practices related to the prevention and control of Hospital Acquired Infections (World Health Organization (WHO), 2016). Also bacterial can contaminate the most frequently touched objects when there is direct contact with infected and/or colonized patients, as well as objects, may lead to the transmission through hand and resulting in morbidity and mortality (Bhatta *et al.*, 2018). However, Healthcare-Associated infections (HAI) are infections that are a stubborn global problem that poses a serious threat to the lives of millions of people worldwide. Then maintaining Hand hygiene among healthcare workers is a core element of patient safety for the prevention of Health Care-Associated infections (HAIs) and the spread of anti-microbial resistance because hand hygiene prevents cross-infection in hospitals (Gesser-Edelsburg *et al.*, 2020).

Optimal hand hygiene requires running water in large washbasins which require little maintenance, with ant splash devices and hands-free controls, a product which includes soap or antiseptic depending on the procedure, facilities for drying without contamination (disposable towels if possible) for the hand washing while the hand disinfection requires specific hand disinfectants such as alcoholic rubs with antiseptic and emollient gels which can be applied to

physically clean hand for the prevention of Hospital-acquired infection (Dellinger, 2016). A previous study on the efficacy of waterless hand hygiene compared with hand washing with soap revealed that alcohol-based hand sanitizers are waterless hand hygiene agents that have received little attention for their use in the developing world like Tanzania as compared to the developed countries like the United States and Europe that have been accepted widely for use in hospitals and health care facilities (Pickering *et al.*, 2010). Although the adherence to hand hygiene by most Health Care Workers (HCWs) has been challenging. A study conducted in Karachi shows the compliance of hand hygiene among healthcare workers, has been mediocre whereby only 31% of the healthcare providers were well informed about proper hand hygiene practices (Ahmed, Malik, Memon, Bin Arif, *et al.*, 2020). A study carried out in Embu referral hospital in Kenya (a level higher than Ruiru) showed that time spent washing hands by health care workers was 12.36% of the 40-60 seconds which is lower than the WHO recommendation (20-30 seconds if using an alcohol-based hand rub) (Ministry Of Public Health And Sanitation Ministry and Ministry Of Medical Services, 2010).

1.2. Statement of the Problem

Compliance with infection prevention and control practices is essential for minimizing transmission of infection in the hospital setting. The overall compliance to infection prevention was found to be 6.9% for most of outpatient facilities in Tanzania (Powell-Jackson *et al.*, 2020). Moreover, low rate of hand hygiene compliance among HCWs was mentioned to be the leading factor to an increased nosocomial infection in a healthcare setting (Abdel & Shahin, 2019 ; Pickering *et al.*, 2010; Malebo, 2016). WHO recommend a range of 5% to 89% as a mean baseline and 38.9% as an overall average for the adherence of hand hygiene procedure among Healthcare worker (World Health Organization, 2018). Therefore, in Tanzania, a suboptimal hand hygiene was reported from various health facilities and among healthcare workers (Malebo, 2016).

Compliance generally in Tanzania and at Muhimbili Orthopaedic Institute (MOI) is low despite various measures had been put in place (Muhimibil Orthopaedic Institute (MOI), 2020). It has been stated that non-compliance to hand hygiene guidelines leads to increased nosocomial infections which have been reported to be high in middle income countries. The evidence from study documented, HAIs affect 5.7% to 19.1% of hospitalized patients in low and middle- income countries including Tanzania (Saga *et al.*, 2018). Therefore, there is a need to assess hand hygiene compliance among healthcare workers at Muhimbili Orthopaedic Institute, Dar es Salaam Tanzania.

1.3. The rationale of the study

The results of the study may inform healthcare workers and their leaders and improvement strategies put in place to improve compliance to hand hygiene guidelines. Moreover, finding may facilitate the development of appropriate and targeted interventions for improving hand hygiene practices. The finding of the study will add knowledge regarding compliance of hand hygiene among healthcare workers at Muhimbili Orthopaedics Institute. The information obtained expected to provide awareness through the provision of in-service training to update healthcare knowledge regarding the importance of effective hand hygiene and the use of a disinfectant. Moreover, the finding from the study provide an evidence-based practice regarding the barrier affecting the effective hand hygiene. Therefore, the finding will enlighten the hospital authority and other stakeholder for employing appropriate intervention to address barrier that hinder effective hand hygiene among health care workers.

1.4. Overall question

What was the compliance to hand hygiene among healthcare workers at Muhimbili Orthopaedics Institute, Dar es Salaam, Tanzania?

1.5. Research questions

- i. What are the levels of knowledge regarding hand hygiene compliance among healthcare workers at Muhimbili Orthopaedics Institute?
- ii. What are the practices to hand hygiene compliance among healthcare workers at Muhimbili Orthopaedic Institute?
- iii. What are the barriers and enhancer to hand hygiene compliance among healthcare workers at Muhimbili Orthopaedic Institute?

1.6. Broad objective

To assess compliance to hand hygiene among healthcare workers at Muhimbili Orthopaedics Institute, Dar es Salaam, Tanzania.

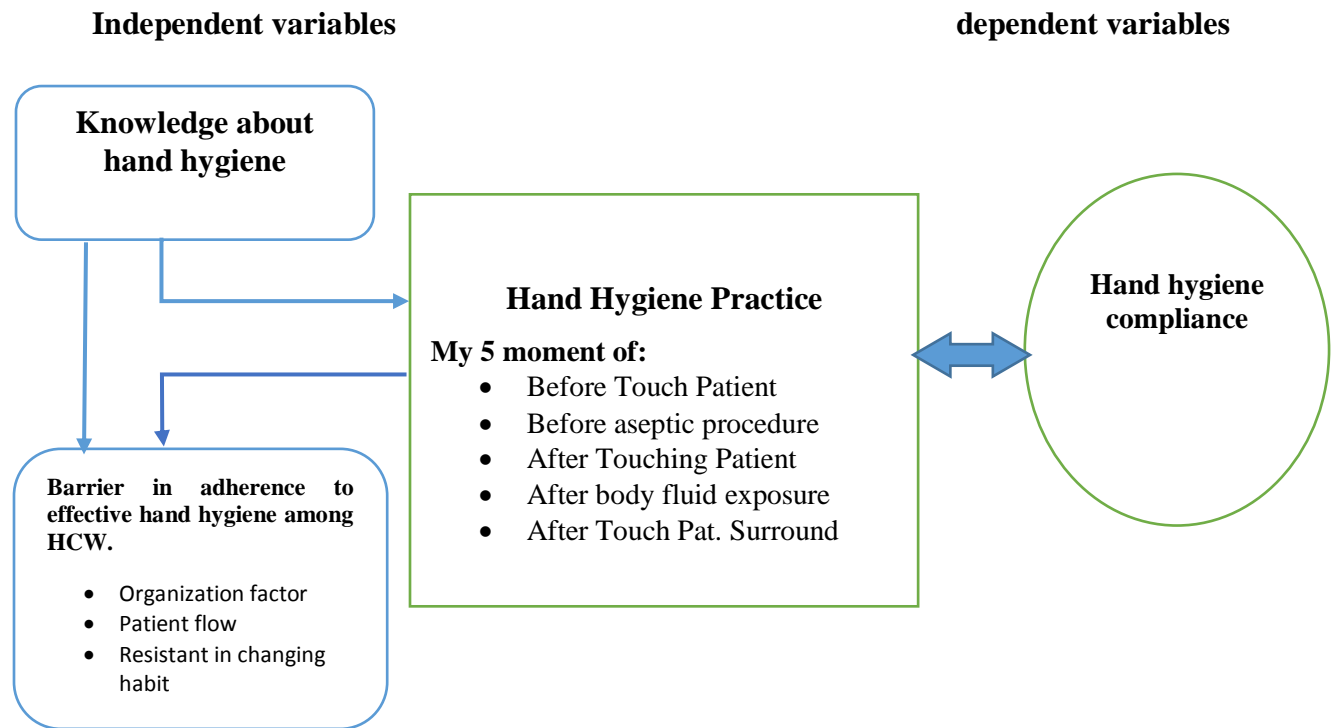
1.7. Specific objectives

- i. To identify levels of knowledge regarding hand hygiene compliance among healthcare workers at Muhimbili Orthopaedic Institute.
- ii. To assess the practices to hand hygiene compliance among healthcare workers at Muhimbili Orthopaedic Institute.

- iii. To determine the barrier and enhancer to hand hygiene compliance among healthcare workers at Muhimbili Orthopaedic Institute.

1.8. Conceptual framework

A conceptual framework is a diagrammatic representation of the variables in research and how these variables are related to each other to explain the natural progression of the phenomenon to be studied (Adom and Hussein., 2018). Based on the nature of this study the conceptual framework assessed the compliance and knowledge of healthcare workers regarding hand hygiene and use of disinfectants at Muhimbili Orthopaedic Institute Muhimbili. The following conceptual framework illustrates how the study independent and dependent variables relate to each other to assess the effectiveness of hand hygiene and the uses of disinfectant among healthcare workers.



Source: adapted from World Health Organization, (2010a) and modified by the researcher

Figure 1: Conceptual Framework of compliance and knowledge of healthcare workers regarding hand hygiene and uses of disinfectants.

Operationalization of conceptual framework in this study

The independent variables in this study, were the knowledge and barrier to comply with effective hand hygiene among healthcare workers while the dependent variable was the hand hygiene compliance and use of disinfectants among healthcare workers that affected by independent variables.

The conceptual framework illustrates how would comply to hand hygiene and the use of disinfectant if health care workers have adequate knowledge about hand hygiene, especially those occurring in the healthcare setting with the crucial moment of when health care workers should perform hand hygiene. According to World Health Organization, (2021) recommended approaches that a healthcare worker should clean their hands which include before touching a patient, before cleaning or aseptic procedures, after body fluid exposure or risk, after touching a patient, and after touching patient surroundings. On the other hand, there were various barrier that affects the hand hygiene compliance among healthcare worker including the institutional factors that consisted of in-service training, presence of policy strategies and budget, patient flow

in the hospital that interface the hand washing, resistant in changing habit, ignorance and negative attitude, shortage of time, lack of surveillance and feedback assessment, (Negewo, 2017; Saga et al., 2018). Therefore, this framework assisted the researcher in explaining and constructing the worldview on hand hygiene and the use of disinfectants among healthcare workers.

CHAPTER TWO

LITERATURE REVIEW

2.1 Level of Knowledge regarding hand hygiene compliance among healthcare workers

Hand hygiene is cost-effective and has been recognized as an effective measure in the control of communicable diseases. An institution-based assessment shows a hand washing knowledge was greatly associated with hand washing behaviour among nursing and medical students (Mbouthieu Teumta *et al.*, 2019). Besides, recent study from Nigeria show healthcare worker have a good knowledge of hand hygiene this was due to training conducted in the school and public campaign on hand hygiene in the country (Agbana, Ogundeji and Owoseni, 2020). However a study from Indonesia shows a training with a multi-model strategy play a greater role on impacting knowledge regarding hand hygiene and HAIs among Healthcare workers in a limited-resource hospital (Santosaningsih *et al.*, 2017). Therefore studies suggested the need for training to enhance the hand washing knowledge among healthcare workers.

Hand washing knowledge creates awareness on the importance of hand washing that will enhance the practice and skills for effective hand washing. A study in Ethiopia revealed the majority of the study participants were knowledgeable on hand washing. However, they had the poor practice of hand washing (Jemal, 2018). The study recommends the uses of soap, water, dry and clean towel follow the hand washing procedure at all the time. Moreover, according to a study conducted in Nigeria, healthcare providers have good hand hygiene knowledge but poor hand-drying habits, which affect hand washing after contact with patients. (Ekwere and Okafor, 2013). In another study from the University of Sri Jayewardenepura, moderate knowledge was reported among nursing students with a good use of aseptic technique including hand washing compared medical students (Ariyaratne *et al.*, 2013). Therefore, an evidence from a previous study shows the low level of knowledge regarding hand hygiene was influenced by the supervisor's lack of information and poor educational background among healthcare works. (Nabavi *et al.*, 2015).

Despite, findings of the study illustrate the immediate need to incorporate measures to increase understanding, which will play an important role in raising compliance with hand hygiene among staff and reducing infection cross-transmission among patients. (Shinde and Mohite, 2014). Then in the Tanzania context, the accepted guideline for improving hand hygiene knowledge was recommended to creating awareness of all health professionals on the importance of improving

hand hygiene practices. (Tanzania Ministry of Health, 2015). Then little is known on level of knowledge regarding the compliance of hand hygiene among healthcare **workers in Tanzania**.

2.2 The barrier and enhancer to hand hygiene compliance among healthcare workers

The barrier to for hand hygiene compliance is multifactorial and occurred at different groups/level such as whether to an individual or institutional levels (Pittet, 2001 and Gesser-Edelsburg et al., 2020). Therefore the following were the factors that affect compliance with hand hygiene.

A previous study illustrated the main barriers compliance to hand hygiene were related to being overworked, lack of resources, and lack of or inadequate training among healthcare workers (Gebel *et al.*, 2013). Moreover, poor infrastructure from the hospital facility affect the compliance of hand hygiene from healthcare worker. An evidence from Southwestern Nigeria observed inadequate supply of hand washing kits; soap, running tap water, alcohol rub, and a towel or hand dryers limited healthcare worker to comply with hand hygiene despite of having a good knowledge (Agbana, Ogundeji and Owoseni, 2020).

Another institutional factors was a cloth towels for hand drying have been reported limit and effective hand hygiene by health care providers Nigeria Tertiary Hospital, (Ekwere and Okafor, 2013). However, there are many infections acquired from both patients and HCPs under these conditions through poor hand hygiene. Then a study from Jordan revealed the most important barriers toward hand hygiene were insufficient time, skin irritation, wearing gloves, lack of knowledge, and ignorance of guidelines (Ghafari and Aburuz, 2019).

Moreover, an institution-based study on the assessment of students' handwashing behavior finds that male 9(3.1%) had use alcohol hand sanitizer compared to female 16 (5.5%) in Cameroon (Mbouthieu Teumta *et al.*, 2019). This indicates that female participant were more compliance to hand hygiene compared to male participants. In the Tanzania context, the barriers to handwashing among auxiliary workers and medical students from the National Institute of Medical Research as well as at Kampala International University respectively were reported to be lack of water was mentioned by 40% of respondents, limited water availability, lack of soap, lack of time (Malebo, 2016 and Wairimu, 2016). Furthermore perceived barrier to appropriate hand hygiene by World Health Organization mention to be lack of active participation in hand hygiene promotion at an individual or institutional level, Lack of institutional priority for hand hygiene, Lack of administrative sanction of non-compliers or rewarding of compliers, Lack of institutional safety climate or culture of personal accountability of HCWs to perform hand hygiene (World Health Organization, 2018).

2.3 The use of disinfectants for hand hygiene among healthcare workers

WHO guideline reported that HCWs can contaminate their hands or gloves with pathogens such as Gram-negative bacilli, *S. aureus*, enterococci or *C. difficile* by performing clean procedures or touching intact areas of the skin of hospitalized patients (World Health Organization, 2018). Then through a disinfection process will eliminate many or all pathogenic microorganisms, except bacterial spores, on inanimate objects. Since antiseptic and disinfectants are chemical agents that inhibit or destroy microorganisms on living tissue (antiseptics) and inanimate surfaces and objects (disinfectants) (Tiwari and Hospital, 2017). Alternatively, Hand Disinfection is the term used to refers to hand wash, antiseptic hand rubbing, hand antiseptis or decontamination or degerming, handwashing with an antimicrobial soap and water, hygienic hand antiseptis, or hygienic hand rub (World Health Organization, 2018). Moreover, the guideline highlighted that following contact with patients and/or a contaminated environment, microorganisms can survive on their hands for differing lengths of time (2-60 minutes). Therefore, the HCWs hands become progressively colonized with commensal flora as well as with potential pathogens during patient care.

To control and prevent infection, a guideline in Tanzania direct the provision of adequate water supply, soap, disinfectants, and antiseptics including the provision of facilities for running water shall create a conducive and enabling environment that should be maintained to improve health workers' hand hygiene practices (Tanzania Ministry of Health, 2015). Although there are numerous disinfectants designed to decontaminate healthcare environments and reusable, non-invasive care equipment (NICE). The selection of appropriate disinfectant depend on the numerous factors including efficacy; range and speed of activity; stability of the ingredients; compatibility of the disinfectant with surfaces; inactivation of the disinfectant by organic matter; method of application; convenience; health and safety concerns; and cost (Curran, Wilkinson and Bradley, 2019).

Provision of reliable information on whether toxic residues are left behind; the precautions necessary for use; any cost-comparisons; and the safety data are necessary information when selecting disinfectant. A survey conducted in Karachi shows that usage of disinfectant was approximately twice among males. Moreover, a doctor who was found to be more in contact with the patient was more likely to uses disinfectant compared with another healthcare worker in the medicine department, technicians, and nurses (Ahmed, Malik, Memon, Bin Arif, *et al.*, 2020). This study highlights the need for conducting training on infection control and prevention in a healthcare setting, which would stress maintaining adequate hand hygiene through

disinfectants with strict supervision. The previous study on the impact of education on hand disinfectant practice shows that the consumption of hand disinfectant increased and the application of hand disinfectant became more thorough after one single hygiene lecture (Sjöberg and Eriksson, 2010). This suggests that the hygiene lecture is the simple and cost-effective method to increase the use of hand disinfectant, thereby reduce the number of nosocomial infections

2.4 The practices to hand hygiene compliance among healthcare workers

The practice of hand hygiene is considered a modest measure in improving the quality of patient care. To allow the healthcare worker to practice the appropriate hand hygiene there must be a necessary infrastructure for easy access to a safe, continuous water supply including soap and towels for hand hygiene in a timely fashion and the readily-accessible alcohol-based hand rub at the point of care (World Health Organization, 2010; Pittet, 2001). Moreover, in an area with high-stress working conditions and at times of overcrowding or understaffing, hand-rub practice is facilitated with the uses of disinfectant such as alcohol-based solution for compliance to hand hygiene.

A recent study on compliance and knowledge of healthcare workers regarding hand hygiene and the use of disinfectants shows that healthcare workers had adequate knowledge about nosocomial infections and their relationship with hand hygiene compliance. But there was a significant gap between knowledge and practice. The gap was documented by a lack of adherence to guidelines was noticed among nurses, ward assistants, and technicians as well as in the surgical department; Male healthcare providers used disinfectant more frequently than women (Ahmed, Malik, Memon, Arif, *et al.*, 2020). The study highlights the need for conducting training on infection control and prevention in a healthcare setting, which would stress maintaining adequate hand hygiene through disinfectants with strict supervision. On the other hand, another study revealed that educational programs improve hand hygiene compliance and knowledge among healthcare workers. Moreover, the study shows that the role model training had the most impact in the pediatrics (24.1% to 43.7%; $P < 0.001$), internal medicine (5.2% to 18.5%; $P < 0.001$), and obstetrics-gynecology (10.1% to 20.5%; $P < 0.001$) at the limited-resource hospital in Indonesia (Santosaningih *et al.*, 2017). Therefore WHO guidelines recommended the provision of regular training or education based on the My five moments for hand hygiene approach and the correct procedures for hand rubbing and handwashing is important to all HCWs for hand hygiene (World Health Organization, 2010b).

However, the accepted guideline by WHO recommended an HCWs are requested to clean their hands, before touching a patient, before clean or aseptic procedures, after body fluid exposure/risk, after touching a patient, and after touching patient surroundings (World Health Organization, 2010a, 2010b, 2018). Then, in Tanzania, a study conducted in Mwanza by Chalya, Mbunda, and Chalya, (2016) documented that lack of personal protection equipment (69.5%), lack of knowledge (65.0%), emergencies (63.0%), the presumption that patient is not infected with HIV or HBV (59.0%), time constraints (53.0%), heavy workload (48.0%) and absence of penalties (34.0%) were the factors associated with poor compliance (practice) with universal precautions.

A comparative study conducted in Dodoma, Tanzania using WHO methodology on the impact of hand hygiene intervention in health care facilities revealed that hand hygiene practice was significantly higher in-hospital facilities associated with the interventional project compared with health centers and dispensaries (Wiedenmayer *et al.*, 2020). The comparative study was limited to a low compliance rate as recommended by the WHO compliance rate of $\geq 81\%$ which is based on self-report of subjectivity elements from both units of intervention and non-intervention units as well as most of the healthcare facilities had a continuous supply of water. Then this necessitates the observational study on hand hygiene compliance and the use of disinfectants among healthcare workers.

2.5 Research gap

HAIs represent a significant threat to patient safety, affecting hundreds of millions of individuals worldwide. HAIs result in increased mortality and morbidity, greater length of stay, and higher healthcare costs. Effective hand hygiene remains one of the most important measures for preventing the spread of pathogens in hospitals. Compliance with hand hygiene and the use of disinfectant has been discussed by several studies worldwide. However, studies discussed in this literature review provide wider information, and research gap has been identified in each specific objectives such as the level of knowledge, practice, barrier in adherence to effective hand hygiene (Hlabano, 2015; Abdel and Shahin, 2019; Arbogast *et al.*, 2019; Chen *et al.*, 2020; Hilt *et al.*, 2020). Therefore, there was a knowledge gap exist compliance to hand hygiene and uses of disinfected Tanzania despite the available protocol and knowledge about the importance of hand Hygiene, Therefore, this necessitate the observational study on compliance and use of disinfectant among healthcare worker.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The chapter presents the study design and how it had been conducted. Research methodology contains the research paradigm, research design, study area, study population, source of data, and how data had been collected. Also, it describes the sampling frame, sample size, the sampling procedure, and the data collection procedures. The research methodology describes the methods which had been used to analyze both qualitative and quantitative data under the study together with the consideration for data reliability and validity presented.

3.2 Study design

The observational cross-sectional study design was adopted in this study whereby a quantitative approach was employed (Zangirolami-Raimundo, Echeimberg and Leone, 2018). The design was selected due to the nature of the study that intends to characterize the prevalence of hand hygiene compliance and use of disinfectants among healthcare workers at Muhimbili Orthopaedic Institute, Dar es Salaam Tanzania (Wang and Cheng, 2020).

3.3 Study area and study setting.

The study was conducted at Muhimbili Orthopaedic Institute located at Ilala Municipal in the Dar es Salaam region of Tanzania. Dar es Salaam is located in the eastern part of Tanzania between these coordinates 6° 48' 8.4708" S and 39° 16' 46.4016" E that covers an area of 1590km² on a natural harbor on the coast of East Africa. There are five Municipalities in the Dar es Salaam region, namely Kinondoni, Temeke, Ilala, Ubungo, and Kigamboni. The region has a 4,360,000 million population account for 10% of the total Tanzania mainland population(National Bureau of Statistics, 2012).

Muhimbili Orthopaedic Institute is an autonomous institute established under ACT. No 7 of 1996 for providing primary, secondary, and tertiary care of preventive and curative health service in Tanzania. Also, MOI, has a bed capacity of 340 beds of which is the leading institution that provides equitable, affordable, accessible quality of services such as Orthopaedics, Neurosurgery and Trauma management, training, and research in East and Central Africa by using efficient and effective hospital management systems and modern technologies supported by trained staffs (The United Republic of Tanzania, 2020). Therefore, this necessitate the researcher to conduct the study because they are the most common bacteria causing health-care associated infection (HAI) among MOI healthcare workers.

3.4 Study populations.

The study included all healthcare workers who provide direct care to the patient at Muhimbili Orthopaedic Institute in Dar es Salaam Tanzania. Generally, the institute has 800 all healthcare workers. In this study, a Healthcare worker encompasses every individual whose primary goal was to protecting and improving the health of the patient. This included all doctors, nurses, health attendants, physiotherapist, physicians, and medical students. Then research targeted all healthcare workers who are working at MOI from the Orthopaedics surgery department, Neurosurgery department, Physiotherapy and Rehabilitation department, Emergency departments, Outpatient departments, Pharmacy, laboratory, Radiology, and Nursing blocks with operating block, High dependent Unit (HDU), private general wards and Intensive Care Unit (ICU). The department and unit were the mostly selected due to the fact that health-associated infections (HAI) were thought to be transmitted by the hands of health care workers (HCWs) through direct contact. Hand transmission mainly happens when microorganisms are transferred by the hands between individuals or individuals and the environmental reservoir (Hagel *et al.*, 2019).

3.5 Inclusion and exclusion criteria

3.5.1 Inclusion criteria

- i. This study included all healthcare workers (doctors, nurses, laboratory staff, physicians) who have been working in various wards of the hospital for a minimum of six months and involved in direct patient care at Muhimbili Orthopaedic Institute.
- ii. This study included all medical students involved in providing direct patient care at Muhimbili Orthopaedic Institute

3.5.2 Exclusion criteria

The following exclusion criteria was considered

- i. Healthcare workers who were involved in managerial activities at the Muhimbili Orthopedic Institute.
- ii. Healthcare workers who were sick or in an acute condition during the time of data collection.

3.6 Sample size calculations.

The sample size for the study was calculated using Yamane et al 1967 formula, which provides a simplified formula, in a 95% confidence level and precision, $P = 0.05$ (Yamane, 1967).

The Sample size formula used was:

$$n = \frac{N}{1 + N(e)^2}$$

Where n = sample size

N = the population size (Total healthcare worker from at Muhimbili Orthopedic Institute at a given time of developing this proposal is= 677.)

e =Level of precision ($P =0.05$)

$$n = \frac{677}{1 + 677(0.05)^2}$$

The sample size obtained from the formula was **251**

The 251 was sample size based on a 95% confidence level and a 5% margin of error. The 10% (25) was added to cater to non-respondents or dropouts. Hence sample size was **276** during data collection from Muhimbili Orthopedic Institute.

The sample size in each stratum would be determined using Morgan and Krejcie's (1970) table for health care workers from different cadres who qualified for inclusion criteria (Krejcie and Morgan, 2011).

Table 1: Healthcare worker sample stratification

Profession	Population	Sample size
Doctors	105	40
Nurses	274	101
Health attendants	181	67
Physiotherapy	57	31
Interns Medical students	30	16
Intern nurses	30	16
Total	677	276

3.7 Sampling technique

A multistage random sampling technique was used to select eligible participants in this study (Sedgwick, 2015). The researcher select this technique because the hand hygiene compliance and use of disinfectants have an impact across every healthcare workers working in each departments at MOI, then this technique enabled researcher to divide the population into groups for conduction research (Elfil and Negida, 2019). Initially all departments at MOI were selected by simple random sampling. At the department level, healthcare worker from each department were stratified into, doctors, nurses, physiotherapy, health attendants, and medical students (intern's nurses and medical doctors) and subsequently allocated in each stratum. Finally, the list of Healthcare worker in each stratum were obtained via the head of the departments and the questionnaire was administered to the participants using simple random selection according to their sampling fraction as indicated in table 1 above.

3.8 Variable

3.8.1 Independent variable

The Independent variable in this study was the demographic characteristics of healthcare workers, the barrier to compliance to hand hygiene of healthcare workers, and level of knowledge regarding the hand hygiene and use of disinfectants.

3.8.2 Dependent variable

The dependent variable in this study was the effective hand hygiene and use of disinfectants.

3.9 Data collection methods

The permission for data collection was presented to in charge of the particular unit/ward who is familiar with the environments. The in-charge of the unit/ward introduced researcher and research assistants to the healthcare workers; and the researcher explained the purpose of the study, benefits, and risks as well as inclusion and exclusion criteria to healthcare workers. The unit change list obtained from the hospital administration was used to proportionate the representative of the study. In the random selection of the representative, a random sample of number ONE/TWO tickets was drawn from the box by healthcare workers, those who draw tickets with number ONE was selected for the study. Then the selected representative was requested to sign a written consent form upon voluntary decision to participate in the study.

The research assistant administered a self-administer questionnaire to the study representative to collect data from respondent after obtained consent form. Data collection was conducted in a convenient time according to the duty rooster of the particular unit/wards to maximize response

rate and each respondent was given ample time of 30 to 45 minutes for filling the questionnaire. The questionnaire was collected by researcher and the researcher assistant from the respondents after they have completed to prevent the loss of the questionnaire during data collection.

Furthermore, a non-participatory observational checklist for hand hygiene activities was used as an additional method to observe the practice of healthcare workers in complying with hand hygiene and the use of disinfectant at various department from MOI. Covert non-participatory observation was employed by researcher to maximize level of participation. Then, researcher engaged herself with the study participants in a daily routine to observe hand hygiene practice from healthcare workers without being acknowledged by the participants.

3.10 Data collection tools

A self-administered questionnaire was used as a data collection tool on assessing the hand hygiene compliance and use of disinfectant among healthcare worker at Muhimbili Orthopaedic Institute. Besides, the questionnaire was divided into the following area to accomplish the study objectives. This includes demographic characteristics of the respondents comprised of age, gender, level of education, and current cadre, level of knowledge of healthcare workers about hand hygiene, comprised of main route for transmission, mode of prevention between germ to patient and/or healthcare workers, methods in a particular situation for hand hygiene, hand and items with high risk for colonizing germ and number of steps for hand washing. Moreover, it cover the barrier for healthcare workers in adherence to hand hygiene and the use of disinfectants. The barrier was consisted with the lack of knowledge, product like skin dispenser, time, skin irritation, wearing gloves. Furthermore, the use of disinfectant was covered by uses of alcohol base hand rub, time for rubbing. Meanwhile the practice of health care workers was assessed by the use of checklist to enable researcher to observe event for the practice as it is covered by my five moment as it was recommended by WHO. The checklist was developed based on the available literature for hand hygiene self-assessment (Jemal, 2018, World Health Organization, 2010b) and recent literature on practice to comply with hand hygiene (Mortell *et al.*, 2013; Abdel and Shahin, 2019).

3.11 Training of research assistants

This study recruited a researcher assistant who had an experience in data collection and research activities with good communication skills in both English and Swahili-language. The research assistants was trained for two (2) days on how to use the tools to collect data, recruit subjects, safeguard the confidentiality of the subjects, prepare reports and materials and assess the needs

of the clients. Furthermore, the researcher assistant was not obtained from the same setting to minimize conflict of interest.

3.12 Pre-testing of the tools

Pre-testing of the data collection tool was conducted at Muhimbili National Hospital consisting of 27 healthcare workers, but not included in the sample to enhance validity and reliability of the data collection tool before the actual study. Before data collection, the tools was checked and questions were rephrased to clear either misunderstanding or misconception to some of the specified questions to fit the participants' interpretations.

3.13 Validity

In this study, the validity of the tool was achieved by reviewing all questions with the help of research experts and provided an opinion on the coverage of the item of the research objectives. The comments and clarification from reviewers was taken into consideration and analyzed to assuring the validity of the tools.

3.14 Reliability

In this study, the sample of twenty-seven (27) healthcare workers which are ten (10%) from Muhimbili National Hospital was used to pretest the tool before the actual study but they were not included in a sample. This enabled the researcher to test the instrument to bring accurate and reliable results to the study. However, the findings from the pre-test was used to make necessary adjustments for the improvement of the tool. Hence, after adjustment from the pre-test conducted the same tool was administered to all participants.

3.15 Data analysis

The Statistical Package for Social Sciences (SPSS) version 23 was used for data entry and analysis. Data entered, coded, and cleaned. Descriptive statistics were used to summarize socio-demographic characteristics, mainly frequency and proportional for categorical variable and mean (standard deviation) or median (Interquartile range) for continuous variables. Level of knowledge, the barrier to compliance among healthcare workers was assessed by multiple answers questions concerning hand hygiene. To determine the strength of each independent variable on the dependent variable (Hand hygiene and use of disinfectant) whereby the p-Value of less than 0.05 was used as a cut-off point for the statistical significance variable. The correlation coefficient was used to test for association between independent and dependent variables. Moreover, the knowledge was assessed by using ten questions and the average was

obtained for the total mark scored by individual. The percentage obtain from converted average was grouped into two categories. Those scored above 70% was considered to have Good knowledge and less than 70% had Poor knowledge regarding hand hygiene.

3.16 Ethical consideration

The study was approved by the Muhimbili University of Health and Allied Sciences (MUHAS) Institutional Ethical Review Board. Before the start of data collection process, the permission to conduct this study was obtained from Muhimbili Orthopedic Institute. In addition, upon receiving a clear explanation of the study its objectives, the risks, benefits of taking part in the study as well as the right to withdraw or participate in the study to ensure transparency, respondents were provided written informed consent. Anonymity was taken into consideration by using numbers instead of names to maintain confidentiality and all data collected from the field locked in a safe cupboard and key handled by the researcher. Moreover, the computer was secured with a password from the time of data entry and analysis as well as report writing; only authorized personnel allowed to access the data.

CHAPTER FOUR

RESULTS

4.0: Demographic characteristics.

A total of 276 healthcare worker from MOI participated in this study. From the result, 57.4% were female followed by 42.6% male health workers. The mode and mean age of the participant were 38.0 and 36.5 respectively while the majority 102(40.6%) were at the age between 30-39 years. Furthermore, study result shows that 90 (35.9%) had working experiences between 6-10 years while majority 141(56.2%) were educated to bachelor degree in health profession. Moreover, almost all of the participant by 240(95.6%) had attended training on hand hygiene and use of disinfectants (table below)

Table 2: social demographic distribution of health care worker.

Variables	Frequency (N)	Percentage (%)
Gender		
Female	144	57.4
Male	107	42.6
Age (years)		
20-29	62	24.7
30-39	102	40.6
40-49	70	27.9
50-59	17	6.8
Years of working experiences		
Less than 1 years	19	7.6
1-5 years	75	29.9
6-10 years	90	35.9
More than 10 years	67	26.7
Professional qualification		
PHD	1	0.4
Master's Degree	13	5.2
Bachelor	141	56.2
Diploma	71	28.3
Certificate	25	10
Trained on Hand Hygiene and use of Disinfectant		
Yes	240	95.6
No	11	4.4
Current card among Health professional		
Medical student	24	9.6
Physicians	10	4.0
Doctor	55	21.9
Nurses	116	46.2
Health attendant	24	9.6
Physiotherapy staff	22	8.8

4.1 Knowledge about hand hygiene compliance among healthcare workers

An overall knowledge regarding hand hygiene compliance among healthcare workers was found to be 58.7%. Out of 251 participants in the present study, 213(84.9) knew that an increased germ was associated with the wearing of jewelry. Knowledge about an increases of germs were in association of with artificial finger nail was present by 211(84.1) among health workers. Moreover, almost half of the health worker, 167(66.5%) understood that rubbing and washing hand is required after removing out gloves. Besides 136(54.2%) of health worker are aware of recommendation of practicing hand hygiene before medical examination. Additionally, 122(48.6%) understood the following MRSA, VRE and clostridium were the survived environmental pathogens as well as contaminated Hand of clinical staff spread antibiotic resistant pathogens

Table 3: Knowledge about hand hygiene compliance among healthcare workers

Item	Right n (%)	Wrong n (%)
Infections transmitted from patient to clinical staff	104(41.4)	147(58.6)
Environmental survived pathogen are MRSA, VRE and clostridium	122(48.6)	129(51.4)
Rubbing and washing hand is required after removing glove	167(66.5)	84(33.5)
Hand hygiene is recommended before medical examination	136(54.2)	115(45.8)
Contaminated hand of clinical staff spread antibiotic resistant pathogens	122(48.6)	129(51.4)
Increased germs were associated with wearing jewelry	213(84.9)	38(15.1)
Increased germs were associated with artificial finger nail	211(84.1)	40(15.9)
Increased germs were associated with damaged skin	172(68.5)	79(31.5)
Increased germs were associated with regular use of hand cream	78(31.1)	173(68.9)
Average score	58.7%	41.3%

4.2: Main barrier and Enhancer to hand hygiene compliance among healthcare workers

The study findings shows majority 220(84.9%) of the study participants reported a lack of knowledge about hand hygiene was the main barrier to compliance of hand hygiene. Other main barriers were irregular water supply for hand hygiene 201(77.6%), inconvenient location of sink for hand hygiene 154(59.5%), and inconsistent location for alcohol hand rub 128(49.4%).

On the other hand, almost 198(76.4%) of study participants indicated that suitable environment that encourage hand hygiene enhance compliance to hand hygiene. Moreover, hand hygiene was enhanced by the other factors like performance feedback to hand hygiene product 163(62.9%), wearing gloves 157(60.6%); adequate time for hand hygiene 157(60.6) and remainder in workplace for hand hygiene 154(59.5%).

Table 4: Barrier and enhancer to hand hygiene compliance among healthcare workers

Variable	Barrier n (%)	Enhancer n (%)
Lack of knowledge regarding hand hygiene	220 (84.9)	30(11.6)
Reminder in workplace for hand hygiene.	97(37.5)	154(59.5)
Suitable environment that encourage hand hygiene	53(20.5)	198(76.4)
Irregular water supply for hand hygiene	201(77.6)	50(19.3)
Inconvenient location of sink for hand hygiene	154(59.5)	97(37.5)
Inconsistent location for alcohol hand rub	128(49.4)	123(47.5)
Skin irritation causes by Hand hygiene products	87(33.6)	163(62.9)
Wearing gloves	94(36.3)	157(60.6)
Lack of time to hand hygiene	94(36.3)	157(60.6)
Performance feedback Hand hygiene products	87(33.6)	163(62.9)

4.3: The use of disinfectants for hand hygiene among healthcare workers

4.3.1 The reasons for using alcohol hand rub.

The result shows that majority 43.03% of the health workers uses alcohol based hand rub since it is more effective against germs. Followed by hand washing and hand rub 30.28%, it causes skin dryness 14.74% and 11.95% hand rub is more rapid than hand washing.

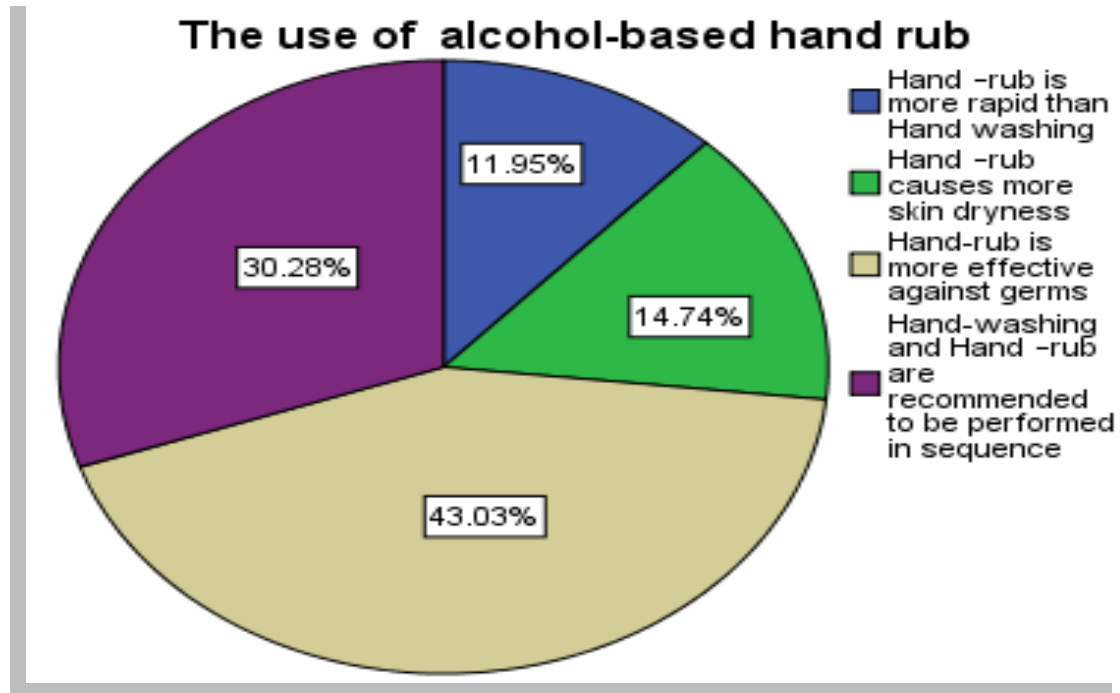


Figure 2: Reasons for using alcohol hand rub among healthcare workers.

4.3.2 Frequency distribution to the duration for alcohol or hand rub

The result indicated that 42.63% spent a minimum of 20seconds when alcohol based rub was used among health workers. Followed by 20.72% uses 10second, 20.32 uses one minutes and 16.33% uses three seconds.

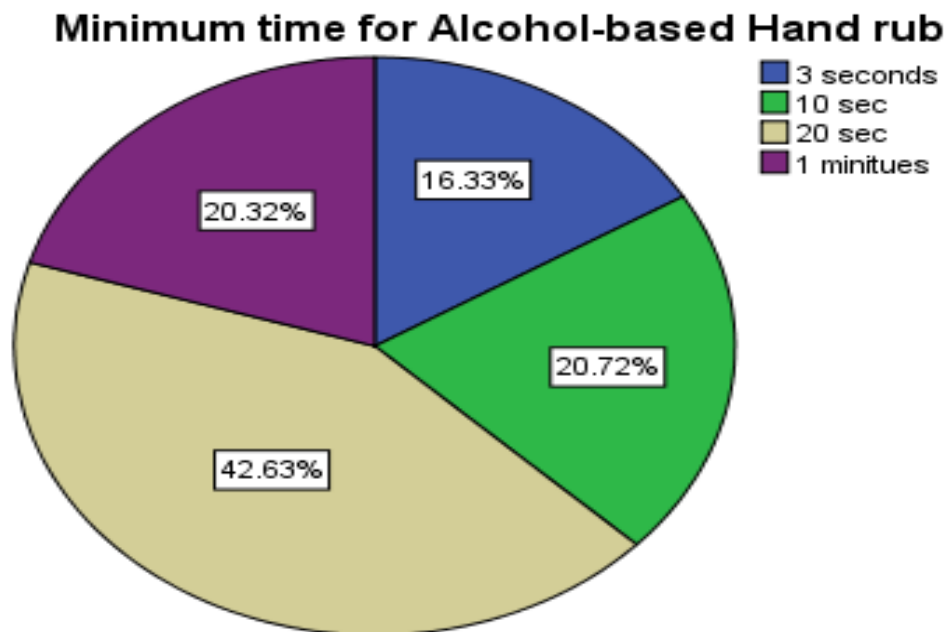


Figure 3: distribution to the duration for alcohol or hand rub

4.4 Compliance to hand hygiene among healthcare workers

4.4.1 Distribution of healthcare providers' compliance to hand hygiene

The overall compliance for the use of alcohol as the hand rub observed among health worker come out to be 60.3%. But majority of 92(36.7%) were nurses followed by doctor 61(24.3%) and 39(15.5%) from health attendant. Other were physiotherapy 24(9.6), medical students 18(7.2%), nursing student 17(6.8%)

Table 5: Distribution of healthcare provider's in compliance to hand hygiene

Variable		Frequency	Percent
Health care workers	Nurse	107	36.7
	Physiotherapy	24	9.6
	Medical student	18	7.2
	Nursing student	17	6.8
	Health attendants	39	15.5
	Doctors	71	24.3
	Total	276	100.0

4.4.2 Compliance of hand hygiene as per observed usage of soap for hand washing.

The overall compliance of hand washing with soap among healthcare worker was observed to be (154, 55.8%) out of 276 healthcare works at MOI. Almost (64, 41.6%) of study participant from six to ten year of working experience had comply with the usage of soap for hand washing more significantly than the other health care workers at ($X^2=7.92$, $df=3$, $p=0.04$). Moreover, majority (73, 47.4%) of nurses comply with hand hygiene by using soap for hand washing significantly than other cadre of health care professional at ($X^2 =13.74$, $df=5$, $p=0.02$). But there was no statistical correlation between the usage of soap for compliance with hand hygiene and age, sex, level of education, training, barrier and enhancer for hand hygiene.

Table 6: Association between hand hygiene compliance as per observed usage of soap and healthcare demographic for hand washing.

Variables	usage of soap for compliance hand hygiene		p-Value
	Non-compliance	Compliance	
Age (years)			
20-30	41(33.6%)	37(24.0%)	$X^2=3.54$, df=3, p=0.32
31-40	46(37.7%)	67(43.5%)	
41-50	30(24.6%)	40(26.0%)	
51-60	5(4.1%)	10(6.5%)	
Sex			
Female	76(62.3%)	88(57.1%)	$X^2=0.75$, df=1, p=0.38
Male	46(37.7%)	66(42.9%)	
Year of working experience			
Less than 1 year	11(9.0%)	9(5.8%)	$X^2=7.92$, df=3, p=0.04
1-5 year	39(32.0%)	45(29.2%)	
6-10 year	32(26.2%)	64(41.6%)	
More than 10 year	40(32.8%)	36(23.4%)	
Level of education			
Diploma	45(36.9%)	63(40.9%)	$X^2=0.46$, df=1, p=0.49
Degree	77(63.1%)	91(59.1%)	
Trained on hand hygiene			
No	4(3.3%)	7(4.5%)	$X^2=1.68$, df=3, p=0.64
Yes	116(95.1%)	145(94.2%)	
Cadre of health care professional			
Medical student	18(14.8%)	8(5.2%)	$X^2=13.74$, df=5, p=0.02
Physicians	4(3.3%)	6(3.9%)	
Doctors	21(17.2%)	34(22.1%)	
Nurses	73(47.4%)	62(50.8%)	
Health attendant	13(10.7%)	15(9.7%)	
Physiotherapist	4(3.3%)	18(81.8%)	
Barrier and enhancer for HH			
Barrier	42(34.4%)	70(42.5%)	$X^2=3.43$, df=1, p=0.06
Enhancer	80(65.4%)	84(30.4%)	
Knowledge regarding HH			
Poor knowledge	10(8.2%)	14(9.1%)	$X^2=0.06$, df=1, p=7.93
Good knowledge	112(91.8%)	140(90.9%)	

4.4.3 Compliance of hand hygiene as per observed alcohol-based hand rub used by healthcare worker.

The overall compliance of alcohol-based hand rub among healthcare worker was observed to be (170, 61.6%) out of 276 healthcare works at MOI. More than half (51, 48.1%) of study participant age ranged from 31-40 years more significantly to comply with alcohol-based hand rub for hand hygiene than the other health care workers at ($X^2=9.51$, $df=3$, $p=0.02$). Moreover, majority (164, 96.5%) of participant with good knowledge were more significantly to comply with alcohol-based hand rub than others with poor knowledge regarding hand hygiene at ($X^2=13.74$, $df=5$, $p=0.02$). But there was no statistical correlation between compliance of alcohol-based hand rub and sex, year of working experiences, level of education, cadre of healthcare professionals, training, barrier as well as enhancer for hand hygiene among healthcare workers.

Table 7: Association between hand hygiene compliance as per observed usage of alcohol and healthcare demographic for hand washing.

Variables	Usage of alcohol-based hand rub for compliance with hand hygiene		p-Value
	Non-compliance	Compliance	
Age (years)			
20-30	33(31.1%)	45(26.5%)	$X^2=9.51$, $df=3$, $p=0.02$
31-40	51(48.1%)	62(36.5%)	
41-50	20(18.9%)	50(29.4%)	
51-60	2(1.9%)	13(7.6%)	
Sex			
Female	67(63.2%)	97(57.1%)	$X^2=1.02$, $df=1$, $p=0.31$
Male	39(36.8%)	73(42.9%)	
Year of working experience			
Less than 1year	10(9.4%)	10(5.9%)	$X^2=1.95$, $df=3$, $p=0.58$
1-5 year	34(32.1%)	50(29.4%)	
6-10 year	33(31.1%)	63(37.1%)	
More than 10 year	29(27.4%)	47(27.6%)	
Level of education			
Diploma	45(36.9%)	63(40.9%)	$X^2=0.46$, $df=1$, $p=0.49$
Degree	77(63.1%)	91(59.1%)	
Trained on hand hygiene			
No	5(4.7%)	6(3.5%)	$X^2=2.92$, $df=3$, $p=0.40$
Yes	98(92.5%)	163(95.9%)	

Cadre of health care professional

Medical student	18(14.8%)	8(5.2%)	$X^2=9.20$, df=5, p=0.10
Physicians	4(3.3%)	6(3.9%)	
Doctors	21(17.2%)	34(22.1%)	
Nurses	62(50.8%)	73(47.4%)	
Health attendant	13(10.7%)	15(9.7%)	
Physiotherapist	4(3.3%)	18(81.8%)	

Barrier and enhancer for HH

Barrier	43(40.6%)	69(40.6%)	$X^2=0.00$, df=1, p=0.99
Enhancer	63(59.4%)	101(59.4%)	

Knowledge regarding HH

Poor knowledge	18(17.0%)	6(3.5%)	$X^2=14.88$, df=1, p=0.00
Good knowledge	88(83.0%)	164(96.5%)	

CHAPTER FIVE

DISCUSSION

6.0 Socio demographic characteristic

Compliance to hand hygiene play an important role in prevention and control of transmitting healthcare associated infections (Chavali, Menon and Shukla, 2014). However, the study recruited 251 healthcare workers in the study. Then, our study finding showed that, 90 (35.9%) had working experiences between 6-10 years while almost all of the participant by 240(95.6%) had attended training on hand hygiene and use of disinfectants. The study finding, were similar with the previous study conducted in India, 92.2% of health care worker received a formal training in hand hygiene in the last three years (Saga *et al.*, 2018).

6.1 Knowledge regarding hand hygiene compliance among healthcare workers

An overall knowledge regarding hand hygiene compliance among healthcare workers was found to be 58.7%. This was in contrary lower compared to a study finding done in Nigeria, 83% had a good knowledge (Ekwere and Okafor, 2013). Also, in more than 84.7% of healthcare worker from Ethiopia were found to be knowledgeable regarding factors associated among healthcare workers. However, this differ due to sample size and different social demographic characteristic. Furthermore, our study finding shows that, majority were knowledgeable regarding wearing of jewelry which result into increasing amount of germ. This was inconsistency with the study conducted in Jordan, 48.3% knew that the most frequency source for germs responsible for HAI were the germs already pressing with the body (Chen *et al.*, 2020).

6.2 Barriers and enhancer for hand hygiene compliance among healthcare workers

Our study finding reported that 220(84.9%) of healthcare workers identifies a lack of knowledge about hand hygiene was the main barrier to compliance to hand hygiene. This was inconsistent with the study on hand hygiene compliance conducted from Dutch reported that a lack of knowledge about Hand hygiene practice were identified by 14 Healthcare worker (Hilt *et al.*, 2020). The inconsistency could be due to study area, study population and sample size as well as social demographic characteristic among health care workers.

On the other hand, the study findings show conducive environment encourage almost all of the participants to comply with the hand hygiene. This was significant with the study conducted in Iran, reveal nurses had a positive perception on the type of hand washing solution used in the

hospital; available hand washing solutions at all times; the correct sink location; continuing education and retrain for ICU nurses; caring for isolated patients; administrative support and their encouragement improve the compliance for hand hygiene among healthcare workers (Khodadadi, 2020).

6.3 Practices to hand hygiene compliance among healthcare workers at Muhimbili Orthopedic Institute

Hand hygiene compliance in our study findings was 55.4%. This was inconsistency with the study finding from India, 43.2% of health care workers comply to hand hygiene (Saga *et al.*, 2018). This could be due to study difference in study area, sample size and social demographic characteristic among health care workers.

The finding from the observation shows there is a high compliance for hand hygiene with the use of alcohol hand rub among health worker. This is consistent with the study finding conducted from India shows the higher prevalence for compliance of hand hygiene among healthcare workers (Chavali, Menon and Shukla, 2014).

The present study findings indicated, 42.63% of health care worker spent a minimum of 20seconds when alcohol based rub was used. According to WHO, 2018, recommended a total duration of health care worker an average of 60 sec for hand preparation with alcohol-based (World Health Organization, 2018). Moreover, alcohol based hand rub was more rapid for hand cleansing than hand washing at 150(72.5) of health care workers. But also the minimal time used for alcohol-based hand rub to kill most germs on your hands in 20 seconds (Hilt *et al.*, 2020).

Furthermore, the study findings show that majority of nurse were more significant associate with the usage of alcohol hand rub in complying to hand hygiene than the other healthcare workers. This was similar previous study show nurse had higher number of contact during provision of care compared to the other healthcare worker which was significantly related with the usage of alcohol hand rub for hand hygiene (Chavali, Menon and Shukla, 2014).

Furthermore, the study findings shows that majority of healthcare workers aged ranged from 31-40 years were more significantly to comply with alcohol-based hand rub for hand hygiene than the other health care workers. This was consistent with the similar study finding where majority of study participant were of the age of 28 year. Most of the study participants complies previous study showed that compliance rate with hand washing was observed to statistically significant (Engdaw, Gebrehiwot and Andualem, 2019).

CHAPTER SIX.

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The overall compliance of hand washing with soap was observed to be higher (170, 61.6%) compared to (154, 55.8%) of alcohol-based hand rub among healthcare worker. This was greatly contributed with higher knowledge regarding hand hygiene compliance, suitable environment that encourage compliance to hand hygiene. On the other hand, participant with less than six year of working experience had low compliance to soap for hand washing. Besides, healthcare workers apart from nurses had low compliance to hand hygiene than other cadre of health care professional.

6.2 Recommendations

The present demonstrated the compliance to hand hygiene and use of disinfectants among healthcare workers at MOI. However, the study identify low compliance to hand hygiene among healthcare workers such as the Doctor, physician and health attendance, then effort should be made to improve these such as.

Recommendation to ICU healthcare workers.

To improve compliance to hand hygiene among Healthcare workers, the availability of portable hand hygiene sanitizer for each healthcare workers such as Doctor, Nurses, physician and health attendance could improve the practice.

Recommendation to Muhimbili Orthopedic institution

- i. The hospital management is recommended to facilitate on job training regarding infection prevention and control through hand hygiene in accordance to WHO five moment for hand hygiene.
- ii. Moreover, to improve practice for hand hygiene among health care worker the hospital management is recommended to supply portable alcohol hand rub to health care worker to encounter an inconsistent location of alcohol hand rub.

Recommendation to Teaching Institution.

- i. The institution is recommended to facilitate interventional study on amount of microorganism found in healthcare workers before and after hand washing.

- ii. To conduct culture sensitivity and surveillance study to highly touched area to detect amount of microorganism found in the hospital environment and timely feedback should also be shared with all concerned to improve outcome.

Recommendation for further research

Factors influence compliance of hand hygiene with alcohol hand rub among young health care worker should be explored for further study.

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LIST OF APPENDICES

Appendix i: Questionnaire (English version)

Title: Assessment of Compliance and knowledge of healthcare workers regarding hand hygiene and Use of Disinfectants at Muhimbili Orthopaedics Institute, Dar es Salaam Date

ID No:

Section A: SOCIAL DEMOGRAPHIC DATA.

1. Sex
 - i. Female
 - ii. Male
2. What is your age _____
3. How many years of work experience do you have at MOI?
 - i. < 1year
 - ii. 1-5 years
 - iii. 6-10 years
 - iv. >10 years
4. What is your level of education
 - i. Certificate
 - ii. Diploma
 - iii. Degree
 - iv. Masters
5. Training received in hand hygiene and use of disinfectants
 - i. Yes
 - ii. No
6. What is your current cadre in among the healthcare profession.
 - i. Medical student
 - ii. Physicians
 - iii. Doctor
 - iv. Nurses
 - v. Laboratory staff

Section B: knowledge regarding hand hygiene among healthcare workers at Muhimbili Orthopaedics Institute. (Please Circle the most correct answer)

7. In which of the following situations should hand hygiene be performed?
- Before having direct contact with a patient .
 - Before inserting an invasive device (e.g., intravascular catheter, foley catheter)
 - When moving from a contaminated body site to a clean body site during an episode of patient care
 - After having direct contact with a patient or with items in the immediate vicinity of the patient
 - After removing gloves
8. If hands are not visibly soiled or visibly contaminated with blood or other proteinaceous material, which of the following regimens is the most effective for reducing the number of pathogenic bacteria on the hands of personnel?
- Washing hands with plain soap and water .
 - Washing hands with an antimicrobial soap and water .
 - Applying 1.5 ml to 3 ml of alcohol-based hand rub to the hands and rubbing hands together until they feel dry
9. How are antibiotic-resistant pathogens most frequently spread from one patient to another in health care settings?
- Airborne spread resulting from patients coughing or sneezing .
 - Patients coming in contact with contaminated equipment .
 - From one patient to another via the contaminated hands of clinical staff .
 - Poor environmental maintenance
10. Which type of hand hygiene method is required in following situations?
- Before Abdominal Palpation.
 - Before giving an injection
 - After emptying a bed pan
 - After removing gloves
 - After making patient's bed

11. Following are associated with increased likelihood of colonization of hands with germs?

- i. Wearing Jewellery (rings, bangles)
- ii. Using artificial Finger nails
- iii. Damaged skin
- iv. Regular use of hand cream

12. Hand Hygiene recommended

- i. Before Medical Examination
- ii. Before taking blood sample with gloved hands
- iii. After wound Dressing with gloved hands
- iv. After shaking hands
- v. After touching linen/bedding of Patient

Section C: Barrier in adherence to effective hand hygiene among healthcare worker (Please put tick to appropriate response)

Sn	Barriers to hand hygiene comply and use of disinfectant.	Very important barrier	Important barrier	Somewhat important barrier	Not important barrier	Totally not important barrier
17.	Lack of knowledge and education					
18.	Empty hand hygiene products					
19.	Sinks/dispensers are not inconvenient location					
20.	Insufficient time (high work load)					
21.	Skin irritation					
22.	Wearing gloves					
23.	Ignorance of guidelines					
24.	Lack of written guidelines					
25.	Lack of sanctions to non-compliance					
26.	Lack of climate that encourage safety					

**Section D: using disinfectants for hand hygiene among healthcare workers at Muhimbili
Orthopaedic Institute**

1. Following statements on Alcohol-based hand rub are true?
 - a) Hand –rub is more rapid than Hand washing.
 - b) Hand –rub causes more skin dryness.
 - c) Hand-rub is more effective against germs
 - d) Hand-washing and Hand –rub are recommended to be performed in sequence.
2. Minimum time needed for Alcohol-based Hand rub to kill most germs on your hand?
 - a) 3 seconds
 - b) 10 sec
 - c) 20 sec.
 - d) 1 minute
3. At what time of sterilized after using alcohol before hypodermic injection administration and when alcohol based hand rub is used in between checking the patient or using same stethoscope or sphygmomanometer for more than one patient.
 - a) 3 seconds
 - b) 10 sec
 - c) 20 sec.
 - d) 1 minute

Appendix iii: An informed consent form (English version)

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED HEALTH SCIENCES

DIRECTORATE OF RESEARCH AND PUBLICATIONS



ID No.

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Dear

Participants, Greetings! My name is **Grace A. Lukamirwa**, I am a postgraduate student nurse pursuing MSc Critical Care and Trauma conducting a study, on assessment Hand hygiene and compliance and use of disinfectant among of healthcare workers Muhimbili Orthopaedic Institute, in Dar es Salaam, Tanzania.

Purpose of study

To assess the compliance of hand hygiene and use of disinfectants among healthcare workers at Muhimbili Orthopaedics Institute, Dar es Salaam, Tanzania.

What participation involves

Your participation in the study will be your own choice and you are free to decide without any adverse reactions. Participation will require you to answer questions regarding assessment of the Knowledge and compliance of healthcare workers regarding hand hygiene practice at Muhimbili Orthopaedic Institute, in Dar es Salaam, Tanzania. It will take less than 20 minutes to fill out the questionnaire.

Confidentiality

All information collected will be confidential and this will be maintained by use of codes, no names will be asked or required. Information collected from the questionnaire will be entered into computers with only the study identification number and if the results of the current study will be published or presented in a scientific meeting, names and other information that might identify you will not be used.

Benefits

There will be no direct benefit for your participation; however, the study findings will help the healthcare worker improve practice on hand hygiene after they have been aware. It will be used

to inform our Hospital systems but at most the policymakers to reconstruct the policies as per evidence-based recommendations concerning challenges affecting the compliance of healthcare worker to hand hygiene.

Compensation:

There will be no compensation of any kind for participation.

Risk

The study will not harm you physically, psychologically, or emotionally.

Rights to Withdraw and Alternatives

Participation in this study is voluntary and you have the right to refuse to participate and at any time you may withdraw from the study even if you have already given your consent. Refusal to participate or withdraw from the study will not involve penalty or loss of any benefits to which you are otherwise entitled.

Who to Contact

If you ever have questions about this study, you should contact the principal investigator **Grace A. Lukamirwa, from Muhimbili University of Health and Allied Sciences School of Nursing P.O. Box. 65004 Dar es Salaam, through Mobile 0754648540, P.O. Box 65111, Dar es Salaam or research supervisor Dr. Beatrice Mwilike, Muhimbili University of Health and Allied Sciences School of Nursing P.O. Box. 65004 Dar es Salaam, Mobile+255 712620924.**

If you ever have questions about your rights as a participant, you may contact the Director of Research and Publications Committee DR BRUNO SUNGUYA, Muhimbili University of Health and Allied Sciences P.O. Box 65001 Dar es Salaam Tel + 255 222150302.

Signature:

Do you agree to participate?

Participant agrees Participant does NOT agree

I, _____ have read the contents in this form. My questions have been answered. I agree to participate in this study.

Signature of participant _____

Signature of the researcher _____ Date _____

Appendix iv: An informed consent form (Swahili Version)
CHUO KIKUU CHA SAYANSI ZA AFYA NA TIBA MUHIMBILI
MKURUGENZI WA UTAFITI NA MACHAPISHO



Namba ya utambulisho

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Fomu ya ridhaa

Salamu! Jina langu ni **Grace A. Lukamirwa** Mimi ni mwanafunzi muuguzi shahada ya Uzamili ya huduma mahututi na Majeruhi. Ninafanya utafiti juu ya “”.

Dhumuni la utafiti

Kutathmini uzingatiaji wa usafi wa mikono na matumizi ya viuatilifu kati ya huduma ya afya katika taasisi ya mifupa ya Muhimbili (MOI) iliyopo Dar es Salaam, Tanzania

Kwa namna gani utashiriki

Ushiriki wako kwenye utafiti huu ni wa hiari na pia uko huru kuamua bila kushinikizwa. Kushiriki kwako kunahitaji kujibu maswali yanayohusiana na.

Usiri

Taarifa zote tutakazozikusanya zitabaki kuwa ni siri na tunakuhakikishia usiri huo kwa kutumia namba na hatutatumia jina lako sehemu yeyoto ile. Taarifa tutakazokusanya kwenye dodoso letu tutaziingiza kwenye kompyuta na sisi pekee ndio tutakuwa na haki ya kuzitumia taarifa hizo na siyo vinginevyo.

Faida

.

Malipo

Hakutakuwa na malipo yeyote kwa mshiriki.

Madhara

Utafiti huu hautegemei kukuathiri wewe mshiriki kimwili, kiaakili wala kifikra.

Haki ya kujitoa

Ushiriki wako katika utafiti huu ni wa hiari. Kama utakataa kushiriki katika utafiti huu au kujitoa muda wowote ule hata kama mwanzoni uliridhi kushiriki, hakutakua na hasara na madhara

yeyote yale kwako. Kutokushiriki au kujitoa muda wowote katika utafiti huu hakutakua na hasara yeyote kwako wewe binafsi.

Mawasiliano

Kama una swali lolote kuhusiana na utafiti huu, tafadhali usisite kuuliza kupitia namba zifuatazo:Mtafiti mkuu, **Grace A. Lukamirwa, Mobile 0754648540**, P.O.Box 65111, Dar es Salaam. Kama una maswali kuhusu haki zako kama mshiriki unaweza kuwasiliana na au piga simu kwa Mkurugenzi wa utafiti na machapisho wa kamati.

Sahihi:

.....

Umekubali kushiriki katika utafiti huu?

Mshiriki amekubali..... Mshiriki amekataa.....

Mimi, _____ nimesoma na kuelewa ujumbe katika fomuhii. Maswali yangu yamejibiwa, nimekubali kushiriki katika utafiti huu.

Sahihi ya mshiriki _____

Sahihi ya mtafiti _____Tarehe_____