TANZANIA MEDICAL JOURNAL
Mosha et al. TMJ V 36 No. 1. May 2025

Original Research Open Access

Compliance with Infection Prevention and Control Standard Precautions among Physiotherapists in Regional Referral Hospitals in Dar es Salaam, Tanzania

Idda H. Mosha[1]*, Twalib R. Mussa[2,] Hussein H. Mwanga[3]

[1]Department of Behavioural Sciences, School of Public Health and Social Sciences, Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania
[2]Rehabilitative Medicine Department, Muhimbili National Hospital, Dar es Salaam, Tanzania
[3]Department of Environmental and Occupational Health, School of Public Health and Social Sciences, Muhimbili University of Health & Allied Sciences, Dar es Salaam, Tanzania

***Corresponding author:**

Dr. Idda H. Mosha

Muhimbili University of Health and Allied Sciences

P. O. Box 65001

Dar es Salaam, Tanzania

Email: ihmosha@yahoo.co.uk

Original Research Open Access

Abstract

Background

The practice of physiotherapy entails physical contact with clients, thus posing a risk for the practitioner and client to transmit infectious diseases to other clients and health workers. Infection prevention and control (IPC) is generally recognized as a vital component of comprehensive methods for patient and health provider safety, quality improvement and improved health outcomes.

Objective

This study aimed to assess compliance to IPC standard precautions and associated factors among physiotherapists at selected District and Regional Referral Hospitals in Dar es Salaam, Tanzania.

Methods

A cross-sectional study using a qualitative approach was conducted. Participatory observation and in-depth interviews were used to collect data from three Regional Referral Hospitals and three District Hospitals in Dar es Salaam. Purposive sampling was used to select study participants. The in-depth interviews were digitally-recorded, transcribed verbatim, analyzed and subjected to a thematic analysis approach.

Results

Compliance to IPC standard precautions was assessed based on the 3 major categories, namely, regular environmental cleanliness; hand hygiene and decontamination of reusable equipment. Regular environmental cleanliness and decontamination of reusable equipment compliance was poor in district hospitals while hand hygiene compliance was moderate in both district and regional hospitals.

Individual factors that influenced IPC standards precaution compliance were perceived benefits for preventing infections which have positive impacts on IPC. Behaviour factors related to IPC standard precaution practices were attitude and fear of contracting infection, which increased compliance with IPC. The study findings further revealed that work-related factors which were lack of training, lack of motivation, and poor working environments contributed to poor IPC compliance among physiotherapists. The study findings also revealed that a higher number of patients and shortage of staff led to an increase in workload, thus contributing to non-compliance with standard precautions; while supportive supervision increased compliance among physiotherapists.

Conclusion

Physiotherapy clinic infrastructures should be improved to meet the standard requirements of the treatment room. Furthermore, in-service education on the importance of adhering to IPC among physiotherapists should be offered continuously.

Keywords: *Compliance, Infection, Prevention, Control Standard Precautions, Physiotherapists, Dar es Salaam, Tanzania.*

Background

The practice of physiotherapy requires physical contact with clients, hence posing a risk of infection transmission between health workers and their patients. Measures to prevent the transmission of infectious diseases are important components of physiotherapy care and can be achieved through the compliance to infection prevention and control (IPC) standard precautions (1). Infection Control Standard Precautions (ICSP) are designed to prevent cross transmission from recognized and unrecognized sources of infection. These sources of infection include blood and other body fluid secretions or excretions and any equipment or items in the care environment which are likely to become contaminated (2). Standard precautions consist of hand hygiene, personal protective equipment such as gloves, gowns, face masks, face shields and respiratory hygiene and cough etiquette (3). Preventing and controlling cross-infections in healthcare settings involve two strategies, namely, standard precautions and transmission-based precautions (4,5). Therefore, adherence to basic infection prevention and control practices is critical, in any setting with limited infection prevention infrastructure

Standard precautions are the essential component of providing minimal infection prevention practices which are applicable to all patients' care, regardless of suspected or confirmed infection status of the patient, and is designed to prevent the spread of infection amongst patients and health workers. Standard precautions in Tanzania include hand hygiene, use of personal protective equipment, safe injection practices (4, 6), safe handling of potentially contaminated equipment surfaces in the hospital environment, respiratory hygiene and cough etiquette (6, 7).

Health facilities are required to have a strong health system which includes the infrastructure of IPC to prevent the spread of infectious diseases including healthcare-associated infections (HAI) (5). The impact of HAI includes prolonged hospital stay, antimicrobial resistance, massive additional financial burden, long-term disability and mortality, and emotional stress to patients and their families (8).

In Europe, the prevalence rate of patients affected by HAI ranges from 4.6% to 9.3% while in developing countries HAI prevalence rate ranges from 5 to 15% of hospitalized patients (8). Low and middle-income countries (LMICs) are excessively affected with HAI compared to the developed countries due to scarce resources and insufficient application of IPC measures (9). For example a study conducted in Ethiopia, revealed that the overall compliance to IPC standards was reported to be 12%, and some components of standard precautions were reported to be inadequate including eye protection, avoidance of needle recapping, glove use when required, washing hands before and after patient contact and use of facemask (7).

Major reported factors that affect compliance to IPC include lack of understanding and knowledge among healthcare workers on standard precautions, shortage of time to implement the precautions, limited resources, lack of proper training, uncomfortable equipment, skin irritations, forgetfulness, distance from the health facilities and insufficient support from management in creating a facilitating work environment (1,7, 9, 10).

Similarly, some qualitative studies which explored the attitudes and beliefs of individuals in a paediatric hospital revealed that the failure to rigorously adhere to hand hygiene procedures was viewed as acceptable in medical emergencies, for example, when an acute intervention was needed for a sick patient. In addition to situational competing clinical activities, certain organizational factors, particularly the institutional culture, performance 32 targets, high rates of bed occupancy, understaffing and excessive workload intensity are identified in the literature as having a bearing on Health Care Workers (HCWs) adherence to IPC policies and procedures (11, 12).

Likewise, other factors that contribute to healthcare workers' non-compliance in applying Standard Precaution in developing countries include the following; most healthcare institutions in developing countries experience a shortage of basic supplies, such as appropriate gloves and masks (13). Furthermore, some countries experience high temperatures with poorly ventilated hospitals, making it unconformable to wear protective clothing like gowns (14). Moreover, many developing countries experience staff shortages with commensurate high workloads where applying Standard Precautions is seen by healthcare personnel as time-consuming (15). Further to this, incidents linked to poor IPC practices frequently occur in busy departments of hospitals such as emergency care environments (16). Additionally, lack of proper training about Standard Precautions and the principles of infection prevention and control, in general, has been reported, highlighting the lack of organizational support for safe practice (17). Besides, Malliarou et al., reported that most health workers did not comply with the IPC policy due to reasons such as non-availability of IPC resources, inadequate knowledge of IPC, allergic reaction to some IPC resources, inadequate staffing, among others (18).

Also, availability of infrastructure like availability of piped water and unavailability of alcohol-based hand rub to support IPC practices has been mentioned as barriers to IPC. It was noted that availability of Infection Preventions supplies at the hospitals lead to good compliance among HCWs than HCWs who had no those supplies (19,7). Additionally, it was revealed that unavailability of up-to-date IPC guideline hinders the compliance of HCWs to standard precaution practices (19).

In Tanzania, since 2004, activities to improve adherence to IPC guidelines and standard precautions have been implemented by the Ministry of Health to facilitate prevention of blood borne, air borne and other pathogen through training health workers on IPC, and procurement of personal protective equipment (20, 21). A t study conducted in primary health care facilities in Tanzania revealed an increased adherence to IPC guidelines from 31% to 57% following the Star Rating Assessment (22). At the same time, another study conducted in Tanzania on compliance with IPC in outpatient settings showed that the compliance was inadequate particularly on hand hygiene (6.9%) and disinfection (4.8%) (23). Despite the implementation of different intervention strategies, such as hand hygiene, use of personal protective equipment (PPE), disinfection and sterilization, injection safety, and proper waste disposal, adherence to standard precautions among health workers is low. Previous studies were conducted using a cross-sectional study design with limited qualitative methods and were unable to explore the experience of the physiotherapists' compliance with the IPC practices. Therefore, this study evaluated the compliance to IPC practices among physiotherapists in Dar es Salaam, Tanzania. The result of this study will be used by healthcare providers, especially physiotherapists, to know the level and factors associated with IPC compliance in their setting and make a plan for improvement in weak areas. Also the result highlights areas on physiotherapy which need more improvement so that individuals and departments can have a platform for extensive research and inform the Ministry of Health on infection prevention and control measures required to be taken. Last but not least, the findings of this study will be used for program planning to improve compliance with standard precaution infection prevention practices among the physiotherapists in general.

Material and methods

Study design and setting

A cross-sectional study using a qualitative approach was conducted. This study was conducted at the district and regional referral hospitals in Dar es Salaam city. Dar es Salaam city was selected for this study due to its higher population density, with 4,364,541 inhabitants and also availability of physiotherapy clinics in every district with high numbers of clients (24). Dar es Salaam City has four municipalities, which are Temeke, Kinondoni, Ubungo and Kigamboni; and one City Council which is Ilala. Further, Dar es Salaam has three regional referral hospitals which are Temeke, Amana, and Mwananyamala, and three designated district hospitals which are Vijibweni (Kigamboni), Kivule Amana (Ilala), and Zakhem Mbagala (Temeke) with full functioning physiotherapy departments. All of these regional referral and district hospitals were selected to participate in this study. These hospitals were selected to

participate in this study because of the availability of the physiotherapy departments, which receive clients from lower levels of health facilities (dispensary and health centers) within the district and self-referred clients who come to these health facilities directly from their homes. Generally, in Dar es Salaam, each Physiotherapy Out Patient Department (OPD) attends an average of 30 patients per day (25).

Study population

The study population was all full-time physiotherapists with a minimum of 3 years' experience of working as physiotherapists within the same district and regional referral hospital. This group of physiotherapists was chosen because of the working nature of their professional practices whereby they come into contact frequently with clients and caretakers or relatives when operating in physiotherapy clinics. A few numbers of physiotherapists in Tanzania (500 physiotherapists) make attend a larger number of clients per day who need rehabilitative and curative services and predispose them to cross infections (26).

Sampling technique

Purposive sampling was used to recruit participants for this study from physiotherapy clinics in the selected districts and referral regional hospitals in Dar es Salaam. Purposeful sampling involves the selection of participants according to the need of the study in question and the researcher chooses the right participant who gives rich details that can answer the research questions (27).

All participants who consented were recruited and interviewed. In this study a total of ten physiotherapists were recruited and interviewed. Among these, two physiotherapists were from Amana Regional Referral Hospital (RRH), two from Mwananyamala RRH, two from Temeke RRH, two from Mbagala Zakhem Hospital, one physiotherapist from Vijibweni Hospital and one physiotherapist from Kivule Hospital. Data was collected in June to July 2022.

Data collection methods

Participatory observation

Participatory observation method was used to collect the data. During this time, the second author (TM) who is a physiotherapist by profession participated in some of the activities conducted by the study participants like history taking, physical assessment and treatment of the clients in the selected hospitals while observing and recording activities conducted by the study participants in the selected hospitals regarding the three infection prevention

standard precautions, namely, hand hygiene, use of persons preventive equipment (PPE) and disinfecting reusable equipment. Further, the second author used a clinical observation tool adapted from a study which was conducted in Kenya (28). The tool is based on WHO guidelines to measure IPC compliance among healthcare workers (28). The tool was modified to fit into this study. Participatory observation was carried out one day before the interview in order for the researcher to develop trust and rapport with the study participants and also to get a direct sense of what study participants practice when in the field and what they report.

During participatory observation, study participants were observed when they were washing hands with soap or using an alcohol-based hand rub before and after touching the client, before a clean or aseptic procedure, after touching an object that has touched the patient or after taking vital signs.

Also, study participants were observed if they were using new gloves for each patient; washed hands with soap or used an alcohol-based hand rub for each client seen; discarded the glove into a waste bin after using gloves on a client; or discarded gloves after handling equipment used by the client. Further, the study participants were observed if they were wearing surgical masks when performing procedures and if they disinfected the equipment (stethoscope, Transcutaneous Electrical Nerve Stimulation (TENS) pad or exercise equipment) using alcohol before or after the `client's contact.

In-depth interview

An in-depth interview (IDI) guide was used to gather information from the participants. The IDI guide consisted of open-ended questions based on the research objectives and concepts from the literature. The questions and probing questions in the guide focused on the individual, behavioral and work-related factors that influenced IPC standards precaution compliance. The guide was prepared in English then translated into Kiswahili. Kiswahili interview guide was used during data collection because Kiswahili is Tanzania's national language and is universally spoken.

Two IDIs were conducted each day. This facilitated reflection on and consolidation of emerging issues for further questioning. On average, one interview took about sixty minutes. The second author interviewed the study participants while a research assistant took short notes and recorded the interviews after seeking consent from the study participants. All interviews were conducted in physiotherapy clinic private rooms and were audio-recorded by digital voice recorder after seeking permission from the study participants. A total number of 10 interviews were conducted in this study; 6 from RRHs and 4 from the District Hospitals.

Data analysis

The tape-recorded discussions and interviews were transcribed and translated into English and thereafter back translated into Kiswahili. The second author supervised transcriptions from tapes and translations into English. Further, the second author analyzed the data by using NVivo12.0 version software by initiating the coding and category assignments. Then the first and third authors went through the data identifying discrepancies. The discrepancies were discussed and the consensus was reached after referring back to the tapes. Codes and categories that emerged from data were later sorted out to form the main themes that emerged as presented in the findings section.

Table1: Illustration of the process of data analysis

Quotes	Code	Sub-theme	Theme
"We make sure first in the morning assistant nurse they do cleaning all over area and change used bed sheet and also they mop with disinfectant morning and evening or when the area get dirty (IDI, P07, 2022).	Changing sheets	Regular environmental cleanliness	Compliance to standard precautions
Usually before doing any treatment to patient I must clean my hands for example after attending the child with cerebral palsy or any case I wash my hands."(IDI, P02, 2022) *You see sometimes you do two or three procedures at a time then you don't have time for washing hands with water then I use sanitizer before I touch again the patient.*(IDI, P09, 2022)	Hand washing	Hand hygiene	
We normally use TENS for pain relief but we don't have enough pads for each patient here so what we do is we disinfect the pads then we apply to the patient (IDI, P06, 2022)	Disinfection of equipment	Decontamination of equipment	

Ethical considerations

Ethical clearance was requested from Muhimbili University of Health and Allied Sciences (MUHAS) Institution Review Board (IRB) (Ref No. DA.282/298/01.C/) and approved IRB number (MUHAS-REC-05-2022-1156). Further permission to conduct the study was sought from Amana, Temeke, and Mwananyamala Regional Referral Hospitals (RRH), Executive Directors of the respective hospitals, and District Medical Officers of Ilala, Temeke and Kigamboni. Individual written consent was sought and obtained from the study participants prior to their participation in the study. All information was kept confidential, with names excluded from the recorded materials.

Results

Socio demographic characteristics of the study participants

A total number of 10 participants were interviewed and six participatory observations were conducted in all six physiotherapy clinics. A total of three district health facilities and three Regional Referral Hospitals were included in this study. Eight participants were males while two were females; their mean age was 39 years. Six participants had a Diploma in Physiotherapy while four participants had a Bachelor Degree in Physiotherapy. Three participants were Heads of Departments while seven were clinical physiotherapists. Working experience among the participants ranged from 7 to 15 years; where by three participants seven had years, three participants had eight years, two participants had 12 years while two had 15 years of working experience.

The main themes that emerged are presented below according to the objectives of the study which were: Compliance to standard precautions (regular environmental cleanliness, hand hygiene and decontamination of equipment), individual factors (perceive benefit of preventing infections, increased workload and negligence), Behavioral factors (attitude and fear of contracting infection) and Work-related factors (availability of personal protective gears, availability of guidelines, training on IPC, motivation and conducive environment).

Compliance to Infection prevention and control

This study explored the compliance of the study participants to IPC standard precautions, specifically compliance to regular environmental cleanliness, hand hygiene and decontamination of equipment. The findings are presented in below sub themes.

Regular environmental cleanliness

During the in-depth interviews, the study participants reported that they were concerned with the general cleanliness of the clinics. They further affirmed that the first thing they do at work

is to protect themselves and patients from infections. They narrated that what they do is to make sure that the clinic environment is kept clean by regular mopping with disinfectants like bleach and frequently changing bed sheets. They recounted that they do all of these initiatives to prevent clients and themselves from contracting infectious diseases. For example, one had this to share:

> *"We make sure first in the morning when we are at clinics is cleaning, the assistant nurses clean all over the area and change all used bed sheets. Furthermore, they mop the floor with disinfectant in the morning and evening. Similarly, when it happens that the working area gets dirty like when the patient vomits during the therapy, then the area is mopped with disinfectant"* (IDI, P07, 2022).

Another study participant from Regional Hospital explained who is responsible for dusting the environment and equipment surfaces used by patients. He had this to share:

> *"Nurses are responsible for the dusting the table and windows using disinfectant and exercise equipment used during treatment, yes they clean with disinfectants every morning and evening,"* (IDI, P10, 2022).

However, some study participants from the district hospitals reported different findings from what was reported from the Regional Hospital. They explained that due to few staff at their hospitals, the cleaning is done by assistant nurse in the morning only before starting attending patients. They lamented that if it occurs that the workplace gets dirty when working, then they have to clean it themselves. One study participant had this to say:

> *"Here we don't have cleaning assistance all the time. For example, you might find that even cleaning our rooms and equipment is not done often; it is only done in the morning; and if the area gets dirty when working, then I am supposed to mop the floor myself because I have no nurse assistant to help" (*IDI, P04, 2022).

This finding was also supported by the findings from observation; it was observed that in most of the district hospitals, the level of compliance with the environmental cleanliness was low since they do not have attached assistant nurse responsible for cleaning when the environment gets dirty. Additionally, during observation it was observed that most of the equipment used by clients were not cleaned in the morning and dusts were present even on the floor and treatment tables were observed to be dirty.

Hand hygiene

Many study participants reported washing their hands before and after each procedure they conduct. They further recounted that most of the time their job involves touching clients' bodies

and sometimes they have body to body contact with the client which could pose risk of contracting infections and transmit to other clients. However, they further reported that they wash hands by using water or sanitizer to minimize the risk of infection. For example, one of the study participants had this to share:

> *"Usually before doing any treatment to any client, I must clean my hands thoroughly, for example, after attending a child with cerebral palsy or any other case I wash my hands scrupulously before attending next client*." (IDI, P02, 2022).

Another participant explained the time when they use sanitizer;

> *"You see sometimes you do two or three procedures at a time, then you don't have time for washing hands with water, in that case I use sanitizer before I touch another client"* (IDI, P09, 2022).

Additionally, during observation, it was noted that the level of compliance to hand washing was infrequently practiced in both district and regional hospitals. It was further noticed that hand washing depended on the type of procedure the study participants carried out. For example, before tissue mobilization procedure of the joint, the study participants washed hands while when removing Plaster of Paris (POP) most of them did not wash hands before this procedure. Likewise, it was observed that sanitizers were available at the nearby treatment tables and were used more frequently in regional hospitals compared to district hospitals.

Decontamination of equipment

Decontamination of equipment is another necessary practice for compliance to IPC in the prevention of cross infection in physiotherapist clinics. Most of the study participants reported using spirit to disinfect the reusable Transcutaneous Electrical Nerve Stimulation (TENS) pad for nerve stimulation, pain relief and muscles spams as one way of preventing cross infections. One of the participants had this to share:

> *"We normally use TENS for pain relief, but we don't have enough pads for each patient, so what we do all the time is that we disinfect the pads then we apply to the patient"* (IDI, P06, 2022).

Contrary to participant reporting the use of spirit to disinfect equipment, participatory observation revealed poor compliance to IPC practices. For instance, it was observed that stethoscopes were not disinfected before being used. Likewise, TENS pads were observed to be decontaminated only after several applications to clients.

Individual factors

The findings from IDIs identified the following themes under individual factors: perceived benefits of infections prevention, increased workload and negligence.

Perceived benefits of preventing infections

The study findings revealed that many study participants reported that they know the benefits of IPC in the workplace as one of measure that they could consider and pay attention while providing care to clients. They further affirmed that it is dangerous to add more problems of infections to clients when performing procedures without considering ways of preventing infection. For instance, one participant shared this:

> *"For example, the first thing you are supposed to do when you perform tissue manipulation to a client is thinking about preventing cross infections, you can transmit infection easily from you to client, so instead of treating the condition which has brought clients here, you can add more problems to the client, so we must be very carefully with our procedures not to transmit infections to the clients, nor getting infections from them"* (IDI, P10, 2022).

Likewise, some of the study participants pointed out why they are taking IPC practice seriously during care provision to clients.

> *"I know IPC is about safe practices, and we must make sure that we do not cause harm to ourselves or clients, and if you don't comply to IPC and the client contracts infectious diseases, then you might increase more suffering to the client, that is why I adhere to IPC practices"* (IDI, P03, 2022).

Increased workload

Study participants were also concerned with increasing number of clients in their clinics. For example, some of the study participants working at district hospitals reported to serve more that fifteen clients per day which is inconsistent with available number of staff. They further narrated that the issue of serving more than fifteen clients per day is increased by clients who do not adhere to their clinic schedule. They lamented that in such situations of serving large number of clients, it is difficult to adhere to IPC. For instance, one participant had this to share:

> *"I am alone here at this clinic; I can treat twelve to fifteen clients per day. This number is big for any physiotherapist. Some of the clients just come in even if you have given them appointment cards, they don't adhere to that, really, I need an assistance of someone to help me make a follow up on orders which are ordered, collecting and*

storing gloves and cleaning, as you can see it is problematic to comply with IPC in this situation while serving a large number of clients in a day" (IDI, P04, 2022).

Behavioural factors

The findings from IDIs identified the following themes under behavioural factors: attitudes and fear of contracting infections.

Attitudes

All study participants mentioned that individual attitude on not to comply with IPC affect work performance on standard precautions practices. They further explained that doing routine works and not paying attention to IPC makes an individual assuming that every client they meet is safe and thus ignoring IPC practices. They recounted that even if there are indicators of the risk of infectious diseases, some of them do not adhere to IPC practices thus making them to deliver poor quality of care to clients hence risk of cross infection. One participant had this to say:

"Sometimes you treat a client and you believe that the client is safe because is not the first time you attend and treat him; so you ignore IPC procedures and make it a business as usual! In such situations there is a risk of infection transmission from clients to the health care workers or vice versa" (IDI, P10, 2022).

Fear of contracting infection

Study participants revealed that one could comply with IPC if is afraid of contracting infectious diseases from clients. They further recounted that the fear of getting an infection arises when someone has a custom of believing that the clients treated can have some infectious diseases. Moreover, all study participants reported that most common infections contracted during provision of care are skin infectious due to the fact that they have hand contact frequently with clients' skins. For instance, one participant had this to share:

"You know many physiotherapists get skin infections from their clients. Our practices involve a lot of touching of clients' skin with our hands, sometimes if you treat a client suffering from a stroke; you use your body as a standing frame when you assist him to stand. If you do not comply with IPC then you can be easily infected if the client has some infectious disease; as for me, I am very careful on assessment and adhering to IPC procedures, because I don't want to contract diseases again" (IDI, P05, 2022).

Work-related factors

Additionally, the study findings identified six work-related themes: availability of PPE, availability of guidelines, training on IPC, motivation, conducive working environment and supportive supervision. The identified themes are presented below.

Availability of personal protective equipment

Availability of PPE was reported as a key factor regarding compliance to IPC practices by most study participants. They further complained having fewer supplies while performing their duties. The study participants did not complain about shortage of gloves or masks; however, they complained about the shortage of bed sheets, disinfectants in both districts and regional hospitals. One participant from District Hospital had shared this:

> *"Speaking the truth, I thank the doctor in-charge of this hospital; we have a lot of masks and gloves here! See they are here! The only problem we face here is that we don't have enough bed sheets for every client. For example, we serve more than ten clients a day. But you can get five or six bed sheets a day and once they are all used it becomes difficult to get another one"* (IDI, P03, 2022).

Similarly, some study participants acknowledged the importance of protective equipment in their work. They explained that they would effectively fulfil their responsibilities on preventing infections transmission if they have enough gloves and masks which enable them to protect themselves and clients.

> *"Protective equipment are very important in our work! We have everything here - gloves, masks, we have soaps, we have running water, dusters, bleach, actually we have everything here! Now our task is to use them to prevent infections"* (IDI, P05, 2022).

Availability of guidelines

Guidelines have been used by most participants as documents for referencing during compliance of IPC practices. Majority of study participants reported that availability of guidelines in their workplace improve drastically the way of practicing standard precautions. They further recounted that availability of IPC guideline in softcopy makes it easy for them to refer to the practices of IPC once they have forgotten; for example, one of the participants had this to share:

> *"When I am doing my work I have somewhere to refer in case I have forgotten something, we are human beings sometimes you need to be updated with your practice like treatment guideline helps me to make a quick reference to some of the*

conditions, so if the IPC guideline is present, it helps a lot and what you need is just to go through it; … here we have softcopies of the IPC guideline in computer and we have hard copies as well" (IDI, P01, 2022).

Another participant added the importance of having guideline in place of work: He said:

"Yes, I can say the guideline is an important pillar on IPC implementation, but when it is missing it affects all process of monitoring and IPC practices in general. I should say that the updated guidelines must be available to all relevant sections for everyone and on time." (IDI, P09, 2022).

Training on IPC

Training on IPC was another factor related to compliance to standard precautions mentioned by most of the study participants working at district and regional hospitals. Furthermore, study participants narrated that Quality Improvement Team could make enough training on IPC and provide in-service training to physiotherapists. During IDIs, most of study participants in district hospitals remarked that IPC in-service trainings have been offered to nurses and doctors thus forgot to include physiotherapists as well. One of participant had this to share;

"Here at this hospital when on job trainings come it is only the nurse in-charge and health officer who attend IPC trainings most of the time. It seems as if this training is special to nurses and doctors only, but we physiotherapists have not attended any IPC training. For us, we are just being visited by those quality team members; they only give us directions on what to do on IPC something which is different from what are covered in the trainings" (IDI, P05, 2022).

This is contrary to regional hospitals whereby many study participants explained that their compliance to IPC was largely associated with regularly training every 3 or 4 months on IPC and that training involves all healthcare providers including physiotherapists. They further explained that also quality team conduct sensitization seminars to respective focal person in each department, also after supervision they have short trainings on how to improve the deficit they have observed during supervision. One had this to say:

"Here we don't have problem with on job training. We receive IPC training even now this week there is a five-day training on IPC, and one of our staff is attending the training, so I think our compliance to IPC automatically will be higher" (IDI, P09, 2022).

Motivation

Motivation was another factor that affected practice of standard precautions in physiotherapy clinics. Motivation was described by many study participants as recognition of their works by others during practicing of the IPC measures. Some of the study participants reported lack of

motivation during IPC implementation and recounted that this has contributed significantly to carelessness and not paying attention to the IPC procedures among physiotherapists at workplaces. For example, one participant from a district hospital had this to say;

> *"Sometime you feel as if they have forgotten about your presence, we physiotherapists don't get that attention like other carders in IPC as if we don't deal with clients and we are immune from getting infections, sometimes you just hear people saying there is a workshop on IPC, but no one from our department attends that, really this demotivates us to adhere on IPC procedures"* (IDI, P07, 2022).

Conducive working environment

Many study participants explained that compliance to IPC also depends on the working environment. They further narrated that conducive working environment affects compliance to IPC procedures positively while poor working condition affects compliance to standard precautions negatively. Furthermore, during the interviews it was reported that most of physiotherapy clinics at district hospitals have small treatment rooms, hand washing facilities located far away from the point of care and they have to use buckets for hand washing instead of running water as recommended. One participant shared this:

> *"Yeah, it is really hard to practice IPC procedures here! You see we have a small room, and you do everything in this room, it is a small room, you see even me, I use a bucket of water outside this room for washing hands instead of having running water, I use it with clients and this is not a proper practice*" (IDI, P04, 2022).

The following excerpt from study participant describes the environment which makes them not to comply with standard precautions:

> *"We have a lot of physiotherapy equipment here, but where can we put them? The room is too small to accommodate the equipment. For example, we need to put exercise bicycles here, but look at the space we have, here you clerk the client, apply POP on the same table, and you see under this table there is our cabinet where we put masks, gloves, balls. Bad enough, during the day it is worse, it is very hot, even if you put a fan on, it will not help"* (IDI, P05, 2022).

Supportive supervision

This study also identified supportive supervision as another necessary factor for compliance to standard precautions and was facilitated by the hospital management. Participants explained that management has a special program for IPC within the hospital and conducts supportive supervision to every department and clinic. They further described how supervision

was conducted in their clinics to assist them to comply with standard precautions. Also, they reported that there is a planned program to monitor IPC at the hospitals. They further described that the program brings all training activities on IPC and provide guidelines and Standard Operating Procedures (SOP) to every unit and supervise every department. This helps improving compliance to IPC procedures at workplace. One study participant commented:

> *"Yes, there is a planned program to monitor IPC practices in the hospital. You see, it is this program which brings those training activities concerning control of infection and prevention and provide guidelines and SOP to every unit, also there is a specific time for supervision on IPC on every department. Likewise, people from quality improvement team pass through every department while asking some questions on IPC. This helps us improve and adhere to IPC when offering services to clients"* (IDI, P02, 2022).

Discussion

Compliance to standard precautions

Regular environmental cleanliness

The study finding shows that there is a significant level of compliance with the cleaning up of the working environment in regional hospital. The study findings further reveal that cleaning was conducted regularly, especially in the morning and in the evening with the use of disinfectants. Additionally, it was revealed that the frequency of cleaning was higher in regional hospitals than in the district hospitals. However, there was lower performance in general cleaning of physiotherapy clinics especially in district hospitals which have inadequate staff. This finding concur with findings from the study conducted by Hokororo et al.(20) in six health facilities in Tanzania which reported poor compliance, moderate compliance and low environment cleaning. Also, our study findings corroborate another study by Kassa et al. (19) in Ethiopia which revealed that compliance with standard preventive practice was low.

Proper hand hygiene

In this study, hand washing was the most performed activity in the clinics to prevent cross infection between physiotherapists and clients. Further, the study findings showed that the physiotherapists performed hand washing regularly with each procedure they performed. These results are consistent with the results of a study conducted in Ethiopia which reported regular hand hygiene before and after performing any procedure, before and after examining

a patient, before putting on gloves and after removing gloves, and on handling contaminated objects (21) . In addition to that, our study findings also revealed that there is more use of soap and running water than sanitizer for hand hygiene due to the easy access to water taps. During observation, it was observed that compliance of physiotherapists on hand hygiene was moderate in all hospitals. This findings is congruent with a study conducted to physiotherapists in Nigeria which revealed higher level of self- reported compliance in hand hygiene (1). Also, this findings is contrary to the study conducted in Tanzania during the outbreak of COVID-19, which showed hand washing was relatively low among health providers (23). The increase in frequency of hand washing can be explained by the increase in the emphasis to health providers by quality improvement team of the hospitals to follow standard prevention carefully after the outbreak of pandemic diseases such as COVID-19.

Decontamination of equipment

In this study, decontamination of reusable equipment was inadequately performed especially the TENS pads and the stethoscopes. Decontamination was reported to be low in both district and regional hospitals and this could lead to exposing clients to skin infections and other infectious diseases when using medical devices which are not decontaminated. Our study findings are similar to the results of a study conducted by Powell et al.(23) which revealed low use of disinfectants to reusable equipment by 4.8%. However, our study findings were contrary to the those from a study conducted by Hokororo et al.(20) that revealed high use of disinfectants (73.7%) in decontaminating reusable equipment before being used by another client. This indicates the need to emphasis on compliance to standard precaution by physiotherapists when using reusable equipment to clients to prevent cross infections.

Individual factors

Perceived benefits of preventing infections

Our study findings revealed that physiotherapists who knew the benefits of preventing infection had a greater ability to protect themselves and their patients. Further, our study findings revealed that self-awareness leads to self-defence and results into physiotherapists providing better and safe care for themselves and to clients as well. In addition, our study findings revealed that knowing the benefits of complying with IPC cause the physiotherapist to be enthusiastic thus following IPC guidelines and can learn new techniques that can help in preventing infection through various training. This finding concurs with study findings

conducted by Darawad et al.(30), which revealed that health workers are more likely to comply with hand washing when they believe they will get more benefits and cause few risks.

Increased workload

Increases in the number of patients in the department with fewer staffing can lead to a failure to comply with IPC procedures. When the number of clients is high, it can lead to poor quality of care that does not follow standard medical procedures and may cause physiotherapists to fail to observe the standard precautions. Our study finding is in line with a study conducted at Bugando Referral Hospital in Tanzania, which found that workload as one of the reasons for healthcare workers not to comply with standard precaution (31). Likewise, our study finding is similar to a study by Brooks (32) and Kassa et al. (19) which reported heavy workload as a barrier to comply with standard infection prevention control practices.

Behavioural factors

Attitude

Our study findings revealed that the attitudes of physiotherapists can have a greater effect on the implementation of IPC practices. Negative attitude toward IPC endangers the clients' health. Our study findings revealed that a positive attitude toward IPC may cause physiotherapists to be more sensitive to IPC practices while a negative attitude increases the risk of contracting infection and affect IPC compliance. Our study findings corroborate with findings from Nofal et al. (33) and Mukwato et al. (34) which revealed that attitude is one predictor of compliance and it has an effect on IPC standard precautions practices. This result is also in line with the findings of studies done in the Hadiya zone and Gondar comprehensive and specialized hospital, which revealed that healthcare workers who have a good attitude toward standard precaution had good compliance than those who had negative attitudes toward standard precaution (35). This similarity could be due to the fact that all professionals acknowledge the importance of IPCs when providing care and its significance in applying IPC in their work to prevent any harm to clients.

Fear of contracting infection

Our study findings revealed that fear of contracting infection is one of the behaviours that makes physiotherapists to carefully monitor IPC practices. The use of gloves, masks and apron increase when a person knows the risks involved and is afraid of being infected. Providing effective preventive care against diseases is also facilitated by fear of contracting

infections among the physiotherapists. Our study finding has revealed that many physiotherapists complied with IPC due to the fear of being infected. This finding is consistent with the finding from a study conducted by Desta et al. (36) which revealed that health workers complied to the IPC because they fear they have been exposed to infectious disease, something which improves their compliance and practices. This similarity could be caused by the similar study context and the working experience of the physiotherapists in both hospitals which could influence the compliance of IPC practice.

Work-related factors

Availability of personal protective equipment

In achieving IPC implementation in physiotherapy clinic, the study findings revealed that availability of PPE contributes significantly to preventing cross infections and enable the physiotherapist to comply with IPC standard precautions. Further, the study findings revealed that availability of enough PPE in the physiotherapy clinics can facilitate proper use of face masks, gloves, boots and aprons. Additionally, the study findings showed that lack of bed sheets and disinfectants could affect the entire IPC practices in the physiotherapy clinics. Our study findings are in line with other studies which revealed that availability of protective gears as important factor in compliance to standard precaution by heath care providers (29, 19, 37, 38).

Availability of IPC guidelines

This study finding revealed that availability of IPC guidelines contributes to improved compliance to IPC practices among physiotherapists. Furthermore, availability of IPC guideline in physiotherapy clinics was reported to be beneficial even if on-job training is not provided regularly to physiotherapists. Furthermore, the use of updated guidelines was revealed to be an important method of improving the IPC practices, especially, for new innovative techniques. This study findings are in line with other studies conducted by Kassa et al. (19) in Ethiopia, Bouchoucha et al. (37) in Australia, and Markos et al. in Ethiopia (39) revealed that the availability of guidelines in health facilities facilitated compliance to IPC. Furthermore, our study findings corroborate findings are consistent with studies conducted in Ethiopia revealed that healthcare workers who had guidelines were reported to have good compliance than those without guidelines. This may be explained by the fact that the presence of guidelines will encourage health care providers to practice and adhere with standard precautions (40).

Training on IPC

The study findings revealed that most of the health facilities managements are trying to provide on-job training for their staff, especially nurses and doctors in the area of IPC. However, unlike other health workers, physiotherapists working in district hospitals have not been receiving regular IPC training. This study finding concurs with a study by Mukwato et al. (34) which revealed that compliance with IPC standard precautions were associated with on-job training to health workers, and also the study by Okello et al. (38) which reported that lack of training in PPE had a negative impact on IPC compliance. Also, our study findings concur with another study findings conducted by Tariku et al. (7) in Ethiopia, which showed that lack of on-job training was one of the factor for not complying to IPC. In addition to that our study findings corroborate findings by Geberemariyam (41) in a study which was conducted in Ethiopia revealed that healthcare workers who get training on standard precaution had good compliance to IPC. Furthermore, our study findings are in the same line with a study conducted by Kassa et al (19) in Ethiopia which revealed that inadequate training on IPC act as a barrier for healthcare workers to adhere with IPC. This phenomenon could be due to the fact that training will equip healthcare providers with good knowledge and skill to practice standard precautions accordingly.

Motivation

Our study findings showed that in order to implements IPC in the physiotherapy clinics, factors like motivating physiotherapists should be observed. Our study findings concur with findings from a study by Markos et al.(39) revealed that up-to date on job training increased the motivation to comply with the standard precaution practices among health care workers.

Conducive working environment

The environment significantly affects IPC practices in most of the health facilities. The study findings found that some physiotherapy clinics in district hospitals had poor working conditions thus making it difficult to implement IPC practices. Poor working environment as evident in our study including shortage of water sinks, small treatment rooms and lack of storage rooms contributed to poor compliance to IPC practices in the physiotherapy clinics especially in the district hospitals. Poor working environment has become a major obstacle for physiotherapists to be able to provide quality care to clients based on high standard of IPC practices. A systematic review conducted by Houngton et al. (10) concurs with our study findings, as it revealed that space availability is necessary in enabling health workers to control cross infection by comply with IPC practices.

Supportive supervision

The study findings revealed that there is good IPC supportive supervision in most hospitals, and that this practice contributes to improving IPC practices among physiotherapists despite the lack of equipment and poor working environment. These findings concur with another study which was conducted in Tanzania by Wibonela et al. (42) which revealed that supportive supervision facilitated compliance to IPC measures. Likewise, our study findings corroborates another study which was conducted in Ethiopia that revealed supportive supervision increased the likelihood of healthcare workers' compliance to standard precaution practices (39).

Study limitations

This study relied on self-reports from physiotherapists working at some hospitals in Dar es Salaam clinics, therefore there are possibilities of social desirability bias, especially from study respondents who might provide information that they believed was what the interviewers wanted to hear rather than revealing what actually happens in terms of reasons for non-adherence to IPC. But this was triangulated through the observation method where some study participants were observed while working. Apart from that, the interviewer took excessive care in selecting the timing and places of interviews to guarantee that the study participants were comfortable sharing their experiences. Besides, the study objectives were clearly explained to the study participants before participating in the study and the interviewer established rapport with them before beginning the interviews.

Another limitation of this study is the fact that it didn't include hospital administrator and IPC committee to see how much they support and supervise physiotherapists. Notwithstanding the limitations, this study shed some light on compliance to IPC standard precautions and associated factors among physiotherapists at referral hospitals in Dar es Salaam, Tanzania.

Conclusion

The study found that compliance to regular environmental cleanliness and decontamination of reusable equipment was low in district hospitals, while hand hygiene compliance was moderate in both district and regional hospitals. Some study participants cited lack of motivation, lack of training and poor working environment as contributing factors to poor compliance to IPC standard precautions. In addition, the study revealed that inadequate number of cleaning staff, poor supply of items such as bed sheets and disinfectants and insufficient on-job training contributed to the poor compliance to IPC standard precautions. Therefore, physiotherapy clinic infrastructure should be improved to meet standard requirement of the treatment room. Furthermore, in-service education on the importance of

adhering to IPC among physiotherapists should be offered continuously. We propose another study to be conducted among hospital administrators and IPC committee on how they ensure that IPC procedures are followed by health care providers.

Abbreviations

CDC	Centre for Disease Control and Prevention
DMO	District Medical Officer
HAI	Hospital Acquired Infections
IPC	Infection Prevention and Control
ISP	Infection Standards Precautions
PPE	Personal Protective Equipment
RMO	Regional Medical Officer

Declarations

Competing interest

The authors declare that they have no competing interests.

Funding

No funding was received for this study.

Authors' contributions

TRM designed the study, collected data and analysed and interpreted data. IHM and HHM critically reviewed the study design, data analysis and the manuscript. All authors reviewed the manuscript and approved the final version of this manuscript.

Acknowledgments

The authors would like to express their deep gratitude to all people who facilitated the logistics of this study and made this study possible. We also extend our sincere thanks to all participants for their support and involvement in our study.

References

1. Ibeneme S, Maduako V, Ibeneme GC, Ezuma a., Ettu TU, Onyemelukwe NF, et al. Hand Hygiene Practices and Microbial Investigation of Hand Contact Swab among Physiotherapists in an Ebola Endemic Region: Implications for Public Health. Biomed Res Int. 2017.

2. National Health Services professionals. Standard Infection Control Precautions scope of guidance. Available at : http://www.nhsprofessionals.nhs.uk/download/comms/cg1_nhsp_standard_infection_control_precautions_v3.pdf, 2010.Accessed on 3rd Jan 2022
3. Centers for Disease Control and Prevention. Health Care Associated Infections (HAIs).Available at: http://www.cdc.gov/HAI/settings/outpatient/basic-infection-control-prevention-plan-2011/transmission-based-precautions.html, 2011. Accessed 22th Sep 2022
4. CDC. Guide to Infection Prevention for Outpatient Settings: Minimum Expectations for Safe Care. Centers Dis Control Prev. 2013; (September):1–17. Available from: https://www.cdc.gov/healthcare-associated-infections/hcp/prevention-healthcare/outpatient-expectations.html
5. MoH. National Infection Prevention and Control Policy. Minist Heal Sanit (Internet). 2015;1–182. Available from: https://www.idealclinic.org.za/docs/National-Priority-Health-Conditions/Nationl IPC Guideline 2015.pdf. Available from: https://www.afro.who.int/sites/default/files/2017-05/ipcguide.pdf
6. MoHCDGEC. The United Republic of Tanzania National Infection Prevention and Control Guidelines for Health care Services in Tanzania. 2018 ;(June). Available from: https://www.uwcea.org/wp-content/docs/cv/Guidelines_clinical_management.pdf
7. Haile TG, Engeda EH, Abdo AA. Compliance with Standard Precautions and Associated Factors among Healthcare Workers in Gondar University Comprehensive Specialized Hospital, Northwest Ethiopia. J Enviromental Public Heal. 2017. 2050635.
8. WHO. WHO Guidelines on Hand Hygiene in Health Care : a Summary First Global Patient Safety Challenge Clean Care is Safer Care. WHO Patient Saf. 2009; Available from: https://www.who.int/publications/i/item/9789241597906
9. Bardossy AC, Zervos J. Preventing Hospital- acquired Infections in Low-income and Middle-income countries; Impact, Gaps and Opportunities. Infect Dis Clin NA (Internet). 2016; 30(3):805–18. Available from: http://dx.doi.org/10.1016/j.idc.2016.04.006
10. Houghton C, Meskell P, Delaney H, Smalle M, Glenton C, Booth A, Chan XHS, Devane D, Biesty LM. Barriers and facilitators to healthcare workers' adherence with infection prevention and control (IPC) guidelines for respiratory infectious diseases: a rapid qualitative evidence synthesis. Cochrane Database Syst Rev. 2020 Apr 21; 4(4):CD013582.

11. Dixit D, Hagtvedt R, Reay T, Ballermann M and Forgie S (2012) 'Attitudes and Beliefs About Hand Hygiene Among Paediatric Residents: A Qualitative Study' Online at: BMJ Open 2012;2:6 e002188 doi:10.1136/bmjopen-2012-002188 (accessed 20/06/22)
12. Bekele T, Ashenaf T, Ermias A, Sadore AA. Compliance with standard safety precautions and associated factors among health care workers in Hawassa University comprehensive, specialized hospital, Southern Ethiopia. PLoS One. 2020:15(10):e0239744.
13. Efstathiou, G., Papastavrou, E., Raftopoulos, V. & Merkouris, A. Factors influencing nurses' compliance with Standard Precautions in order to avoid occupational exposure to microorganisms. BioMed Central Ltd. 2011.
14. Ratnayake, A.S. & Ratnayake, N.P. Seasonal and tidal influence for water quality changes in coastal Bolgoda Lake system, Sri Lanka. Journal of Coastal Conservation, 2018. https://doi.org/10.1007/s11852-018-0628-7.
15. Tebeje, B. & Hailu, C. Assessment of HIV post-exposure prophylaxis use among health workers of governmental health institutions in Jimma zone, Oromiya region, Southwest Ethiopia. Ethiopian Journal of Health Sciences. 2010: 20(1):55–64.
16. Stephen, Y., Liang, D.L., Theodoro, J.D. & Schuur, J.M. Infection prevention in the emergency department. 2014. (Online) Available: https//www.ncbi.nlm.nih.gov/pmc/articles/pmc4143473/
17. Yenesew, M.A. & Fekadu, G.A. Occupational exposure to blood and body fluids among health care professionals in Bahir Dar town, Northwest Ethiopia. Safety Health Work. 2014: 5:17–22.
18. Malliarou, M., Sarafis, P., Zyga, S. & Constantinidis, T., The importance of nurse hand hygiene. International Journal of Caring Sciences, 2013: 6(3), 327-331.
19. Kassa A, Tadesse SE, Walelign F, Kebede N. Compliance with standard precaution of infection prevention practice and associated factors among health care workers in Ethiopia: Mixed method study. Health Science Reports. 2022 Sep;5(5)
20. Hokororo J. Mohamed H., Ngowi R., German C., Behengwa R., Msigwa Y, Nassoro O., Marandu L., Kiremeji M, Lutkam D., Habtu M., Lusaya EE. Evaluation of Infection Prevention and Control Compliance in Six Referral Hospitals in Tanzania using National and World Health Organization Standard Checklists. Prev Med Epidemiol Public Heal. 2021;2(3).
21. Keleb A, Ademas A, Lingerew M, Sisay T, Berihun G, Adane M. Prevention Practice of COVID-19 Using Personal Protective Equipment and Hand Hygiene Among Healthcare Workers in Public Hospitals of South Wollo Zone, Ethiopia. Front Public Heal. 2021;9 (December):1–8.

22. MoHSW. The Tanzania Quality Improvement Framework in Health Care. 2011. Ministry of Health and Social Welfare. Available from: https://www.jica.go.jp/Resource/project/tanzania/006/materials/ku57pq00001x6jyl-att/framework_in_health.pdf
23. Powell-Jackson T, King JJC, Makungu C, Spieker N, Woodd S, Risha P, et al. Infection prevention and control compliance in Tanzanian outpatient facilities: a cross-sectional study with implications for the control of COVID-19. Lancet Glob Heal (Internet). 2020:8(6):e780–9. Available from: http://dx.doi.org/10.1016/S2214-109X(20)30222-9
24. Kinyenje E, Hokororo J, Eliakimu E, Yahya T, Mbwele B, Mohamed M, Kwesigabo G. Status of Infection Prevention and Control in Tanzanian Primary Health Care Facilities: Learning from Star Rating Assessment. Infect Prev Pract. 2020 Sep;2(3):100071.
25. National Bureau of Statistics. Tanzania in Figures. United Republic of Tanzania. 2020. 2021;(June). Available from: https://www.nbs.go.tz/nbs/takwimu/references/2020_Tanzania_in_Figure_English.pdf
26. MoHSW. Staffing level for the Ministry of Health and Social Welfare Department, Health service facilities, Health Training Institution and Agencies. 2019;
27. WCPT. Annual Physiotherapist Membership Census in Tanzania. World Physiother. 2022; Available from: https://www.physio-deutschland.de/fileadmin/data/bund/user_upload/WorldPhysiotherapy_AnnualReview2022_FINAL.pdf
28. Burke JR., Christensen L. Educational Research Quantitative, Qualitative and Mixed Approaches. 5th Edition. SAGE Publisher, Inc.; 2014.
29. Bedoya G, Dolinger A, Rogo K, Mwaura N, Wafula F, Coarasa J, Goicoechea A, Das J. Observations of infection prevention and control practices in primary health care, Kenya. Bull World Health Organ. 2017: Jul 1;95 (7):503-516.
30. Darawad MW, Al-Hussami M, Almhairat II, Al-Sutari M. Investigating Jordanian nurses' handwashing beliefs, attitudes, and compliance. Am J Infect Control (Internet). 2012; 40(7):643–7. Available from: http://dx.doi.org/10.1016/j.ajic.2011.08.018
31. Chalya, G., Chalya, P. L., & Mbunda, F. Knowledge, practice and factors associated with poor compliance with universal precautions among healthcare workers at Bugando Medical Centre, Mwanza, Tanzania. Tanzania Journal of Health Research, 2016. 18 (3).
32. Brooks SK, Greenberg N, Wessely S, et al. Factors affecting healthcare workers compliance with social and behavioural infection control measures during emerging infectious disease outbreaks: rapid evidence review BMJ Open 2021;11:e049857

33. Nofal M, Subih M, Al-kalaldeh M. Factors influencing compliance to the infection control precautions among nurses and physicians in Jordan: A cross-sectional study. 2017; 18(4):182-188.
34. Mukwato KP, Ngoma CM, Maimbolwa M. Compliance with Infection Prevention Guidelines by Health Care Workers at Ronald Ross General Hospital Mufulira District. Med J Zambia. 2007; 35(3).
35. Yohannes T, Kassa G, Laelago T, Guracha E. Health-care workers' compliance with infection prevention guidelines and associated factors in Hadiya Zone, Southern Ethiopia: hospital-based cross-sectional study. Int J Epidemiol. 2019; 3(1):1-13.
36. Desta M, Ayenew T, Sitotaw N, Tegegne N, Dires M, Getie M. Knowledge, practice and associated factors of infection prevention among healthcare workers in Debre Markos referral hospital, Northwest Ethiopia. 2018; 18, 465:1–10.
37. Bouchoucha SL, Philips NM, Lucas J, Kilpatrick M, Hutchinson A. An investigation into nursing students' application of infection prevention and control precautions. Nurse Educ Today. 2021; Vol:104.
38. Okello TR, Kansime K, Odora J, Apio JA., Pecorella I. Barriers and factors affecting personal protective equipment usage in St. Mary's Hospital Lacor in Northern Uganda. East Cent African J Surg. 2017; 22(1):59.
39. Markos T, Sinkie SO, Garedew. MG. Compliance with Infection Prevention Practices and Associated Factors among Health Professionals in the Public Hospitals of Kembata Tembaro Zone, south Ethiopia. Heal Sci J. 2021; vol. 15 No:1–9.
40. Bekele T, Ashenaf T, Ermias A, Sadore AA. Compliance with standard safety precautions and associated factors among health care workers in Hawassa University comprehensive, specialized hospital, Southern Ethiopia. PLoS One. 2020 Oct 15:15(10):e0239744.
41. Geberemariyam BS, Donka GM, Wordofa B. Assessment of knowledge and practices of healthcare workers towards infection prevention and associated factors in healthcare facilities of West Arsi District, Southeast Ethiopia: a facility-based cross-sectional study. Arch Public Health. 2018 Nov 12:76:69.
42. Wibonela SA, Mwanga A, Palangyo P. Adherence to Universal Precautions and Associated Factors among Nurses Caring for Critically ill Patients in Dar es Salaam Tanzania Adherence to Universal Precautions and Associated Factors among Nurses Caring For Critically Ill Patients in Dar es Salaam. Saudi J Nurs Health Care, March, 2020; 3(3): 106-113.