UNIVERSITY FOR DEVELOPMENT STUDIES

INFECTIONS PREVENTION AND CONTROL PRACTICES AMONG HEALTHCARE PROVIDERS AT THE SURGICAL DEPARTMENT OF TAMALE TEACHING HOSPITAL

BY

ABDUL RAUF ALHASSAN

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UDS/MPH/0006/17

A THESIS SUBMITTED TO THE DEPARTMENT OF COMMUNITY HEALTH AND FAMILY MEDICINE OF SCHOOL OF MEDICINE AND HEALTH SCIENCES UNIVERSITY FOR DEVELOPMENT STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER OF PUBLIC HEALTH

2020

DECLARATION

Student

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this University or elsewhere:

ABDUL RAUF ALHASSAN	…….	…….
(UDS/MPH/0006/17)	SIGNATURE	DATE

Supervisors

We hereby declare that the preparation and presentation of the thesis was supervised in accordance with the guidelines on supervision of thesis laid down by the University for Development Studies.

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ABSTRACT

Background: Efficient infection prevention and control (IPC) practices are basic requirements for all health facilities to reduce the morbidity and mortality associated with microbial agents and hence excellent patient outcome. Adherence to IPC is important to reduce the transmission of nosocomial infections.

Objectives: The main objective of this study was to assess infection prevention and control (IPC) practices among healthcare workers at the surgical department of Tamale Teaching Hospital (TTH).

Methodology: This study was conducted using descriptive cross-sectional survey of 156 participants plus observational study of forty healthcare providers and forty-five operation room cases. Stratified and simple random sampling was used in selecting the study participants. Data entry and analysis was done using Statistical Package for the Social Sciences (SPSS) version 20 and Graph Pad Prism version 6.05. The univariate analysis was done using pie chart and bar chart and arithmetic mean. Bivariate analysis such as chi-square analysis, Pearson correlation, analysis of variance (ANOVA) was used for the significance of associations and multiple logistic regressions to identify predictors of IPC compliance.

Results: Out of the 156 participants who responded, 22 (14.1%) were Doctors, with 107 (68.6%) Nurses, 12 (7.7%) Anaesthetics and 15 (9.6%) Orderlies. Approximately, 50.6% of the respondents' were knowledgeable with regards to IPC, 55.1% of the respondents' had a good attitude towards IPC and 58.3% had good compliance towards IPC. Factors associated with knowledge level were: educational level (p = 0.0001), occupation (p = 0.0001), Marital status (p = 0.0300) and age (p = 0.0300). The occupation was the only factor associated with the attitude level (p = 0.0480). The factors associated with IPC compliance level were: occupation (p < 0.0010), educational level (p = 0.0010), age (p = 0.0090), IPC materials

availability level (p = 0.0010), IPC knowledge level (p =0.0010) and attitude level towards IPC (p =0.0010). IPC materials were 78.9% always not available, 14.7% sometimes available and 6.4% were always available.

Conclusion: More than half the respondents' reported having good knowledge, good attitude and good compliance towards IPC. And majority of the respondents' reported that IPC materials were not always available. The major predictor of IPC compliance was IPC materials availability, followed by the occupation of respondents and age of the respondents'.

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- My family and all the friends who one way or the other contributed to the success of this work.

To you all, I say 'thank you' and I wish you all the best in your endeavors; may others show you as much care and help as you showed me.

DEDICATION

This work is dedicated to my late parents of blessed memory, and also my wife, children, brothers, sisters and friends for their prayers and support throughout this course.

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ABBREVIATIONS/ACRONYMS

CDC	Centers for Disease Control
GHS	Ghana Health Service
HAI	Hospital Acquired Infections
HCW	Health Care Worker
HIV	Human Immunodeficiency Virus
ICU	Intensive Care Unit
IPC	Infection Prevention and Control
KAP	Knowledge, Attitude and Practices
MOH	Ministry of Health
PPE	Personal Protective Equipment
SSI	Surgical Site Infection
VAP	Ventilator-Associated Pneumonia
WHO	World Health Organization

DEFINITION OF CONTEXTUAL TERMS

Attitude: This is one's behaviour towards something.

Compliance: Acting according to certain accepted set standard.

Healthcare workers or providers: A person who delivers care and services to the sick and ailing either directly as Doctor, Nurses, and Anesthetics' or indirectly as aides, helpers, laboratory technicians, or even medical waste handlers.

Infection Prevention and Control: Refers to measures aimed at preventing and controlling infections and transmission of infections in health care settings.

Knowledge: An idea about something.

CHAPTER ONE

INTRODUCTION

1.1 Background

Efficient infection prevention and control (IPC) practices are basic requirements for all health facilities to reduce the morbidity and mortality associated with microbial agents and hence excellent patient outcome. Healthcare facility associated infections which are also known as nosocomial infections are acquired during healthcare delivery from patient or healthcare staff or through contaminated equipment's, instruments, hands, bed linen or air droplets (Al-Khalidi, 2017). An infection is classified as nosocomial when it occurs after forty-eight hours or more on admission or within thirty days after discharge from the healthcare facility (Bello et al., 2011).

The contributory factors implicated in nosocomial infections are poor knowledge, attitude and practice of IPC among healthcare workers (Jain et al., 2012).

It has been reported by Nakamura et al., (2012) that about 5 to 10.0% of all admitted patients develop nosocomial infections and 70.0% of the identified pathogens are resistant to one or more of the antimicrobial medicine presently in use.

Nosocomial infections come with economic burden due to prolong patients stay in the ward and this increase bed occupancy rate leading to high consumption of patient and hospital scarce resources. The best prevention of healthcare-associated infection is over and done with active infection prevention control compliance; however, compliance with universal precautions and standard precautions are reported low in many studies McGraw et al., (2012).

For instance, McGraw et al., (2012) investigation on healthcare workers' attitudes to and compliance with infection control guidelines in the operating department at the University Hospital of the West Indies, Jamaica, and indicated 83.0% all participant were noncompliant with all the seven infection control policies. The study further revealed that only 17.0% of the participants had compliance with all the seven infection control policies.

A survey by WHO (2002), using 55 hospitals in 14 countries across four WHO Regions (Europe, Eastern Mediterranean, South-East Asia, and Western Pacific) reported a prevalence of nosocomial infections to be 8.7%.

The Center for Disease Control and Prevention estimated in 2017 that every year about 1.70 million Americans are affected with hospital-associated infections with all types of microorganisms with some microorganisms difficult to treat with antibiotics (Al-Khalidi, 2017). The CDCP also reported that one out of every 31 patients admitted to a health facility has at least one healthcare-associated infection (CDC, 2018).

Health policy report in England by Burke, (2003) estimated health facility-related infections to be one of the top complications for hospitalized patients.

According to Mbim et al., (2016), 3.4% to 10.9% of nosocomial infections usually results in deaths in most developed countries and this is expected to be higher in sub-Saharan Africa and other developing countries. In developing countries where the healthcare system is already overstretched, the risk of nosocomial infection is 20 folds higher than developed countries (Bello et al., 2011).

Nosocomial infection prevalence rate in developing countries is 15.5% per 100 patients and this persist due to lack of effective national infection prevention and control policies,

infections prevention control personnel and lack of compliance to hospital acquire infection guidelines (Labi et al., 2018).

Sub-Saharan African countries have a high incidence rate of hospital-acquired infections ranging from 2.0 – 49.0%; this is more so with patients admitted to the critical intensive unit where the rate is estimated to range from 21.2 - 35.6%. The prevalence of hospital-acquired infections in some African countries such as Burkina Faso, Mali, Gabon, Uganda, Cameroon varies between 1.6% to 28.7%(Mbim et al.,2016). For instance, prevalence of nosocomial infections in Ghana is reported to be 6.7% (Mbim et al.,2016).

A survey conducted in Ghana among ten hospitals including the Tamale Teaching Hospital on hospital acquires infections reported an overall prevalence rate of 8.2% and that of Tamale Teaching Hospital to be 8.0% (Labi et al., 2018). Furthermore, Labi et al., (2018) found surgical site infection to be the leading nosocomial infection nationwide (Labi et al., 2018).

1.2 Problem Statement

According to Kaneko et al., (2015) surgical site wound infection accounts for one out of five healthcare-associated infections.

The prevalence of nosocomial infections in Tamale Teaching Hospital has been reported by a previous study to be 8.0%, and this is close to the national point prevalence rate of 8.2%, with surgical site infections being the commonest (Labi et al., 2018).

Available current literature covering the period 2016 to 2018 has revealed an increase in surgical site wound infections in Tamale Teaching Hospital from 9.3% to 11.5% for overall surgical site infection with 3.4% to 6.0% for deep surgical site infection. (Bugri et al., 2016: Tabari et al.,2018).

An earlier study in 2014, by Apanga et al., recommended further institution-based research to evaluate or identify other factors accounting for the increased surgical site infection in health facilities, particularly in the TTH.

And since there is no known study that has attempted to identify some of the work practices (IPC) of healthcare providers in the surgical department that could possibly contribute to nosocomial infection, hence the need to conduct this study with the topic: infection prevention and control practices among healthcare workers at the surgical department of Tamale Teaching hospital.

1.3 Research Questions

This study seeks to answer the following research questions to achieve the aim of this research:

1. What is the knowledge level of infection prevention and control among healthcare providers at the surgical department of the Tamale Teaching Hospital?
2. What is the attitude level of healthcare providers at the surgical department of Tamale Teaching Hospital to infection prevention and control?
3. What materials are available to ensure infection prevention and control practice among healthcare providers at the surgical department of Tamale Teaching Hospital?
4. What is the compliance level with regards to infection prevention and control among healthcare providers at the surgical department of Tamale Teaching Hospital?

1.4.1 General Objective

To assess infection prevention and control (IPC) practices among healthcare workers at the surgical department of Tamale Teaching Hospital (TTH).

1.4.2 Specific Objectives

The specific objectives of the study are to:

1. To assess the knowledge level of Infection Prevention and Control among healthcare providers at the surgical department of Tamale Teaching Hospital.
2. To examine the attitude level of healthcare providers at the surgical department of Tamale Teaching Hospital towards infection prevention and control.
3. To evaluate the availability of materials for Infection Prevention and control at the surgical department of Tamale Teaching Hospital.
4. To examine the compliance level of Infection Prevention and Control by healthcare providers at the surgical department of Tamale Teaching Hospital.

1.5 Significance of the study

One of the key policies to health sector practices is infection prevention and control. So findings of this study will help improve patient care and help with maximum protection of health staff, patients and the general public against healthcare-related infections.

The results of the study will help determine if healthcare workers need training with regards to infection prevention and control.

Also the result will help healthcare educators to develop new ideas in planning and developing appropriate educational programs.

Furthermore, the findings of this study will be able to reveal some of the factors obstructing infection prevention and control practice in Tamale Teaching Hospital.

Policymakers (management of TTH, metropolitan and regional health directorate and ministry of health) will be informed by this study with regards to the level of compliance with infection prevention and control at Tamale Teaching Hospital.

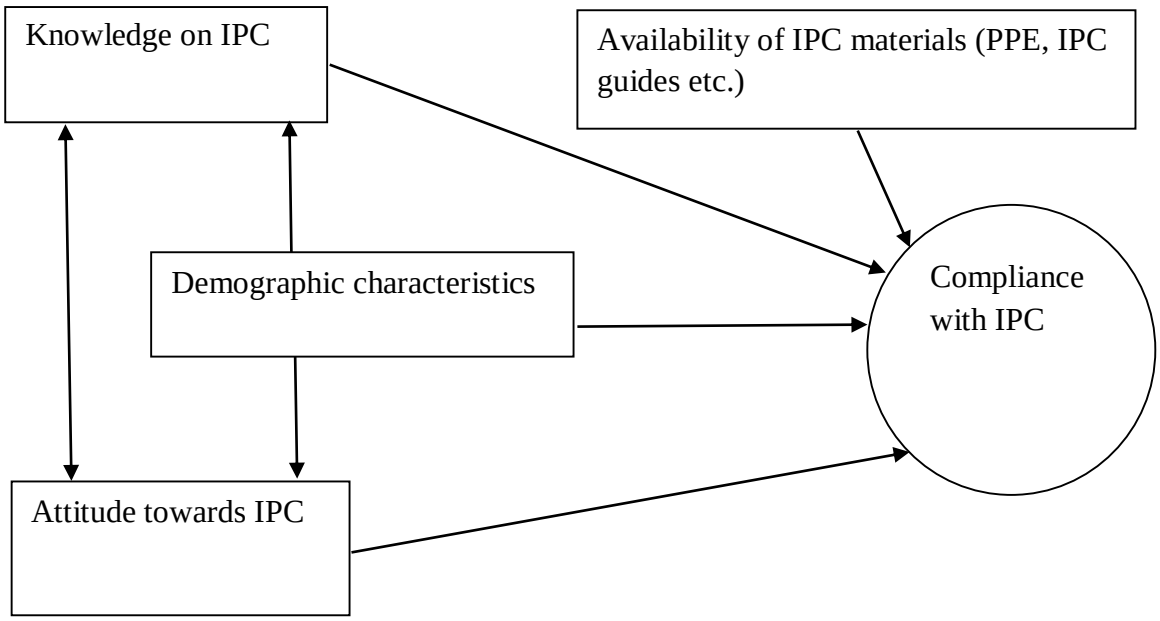
The study will also inform researcher areas for further research on IPC. The ministry of health Ghana encourages periodic research in all levels of healthcare settings to ascertain the practices, skills, and knowledge on infection prevention and control and access the potency of the monitoring and evaluation process (MOH, 2015).

1.6 Conceptual Framework: Infection Prevention and Control Practices

This conceptual framework is based on Knowledge-Attitude-Practice Model (Bano et al., 2013). KAP model is a rational model in health education. It is built on the concept that increasing personal knowledge will influence change in health behavior.

This study will try to see the relationship between respondents' IPC (knowledge, attitude, and material availability level), respondent demography and respondents' compliance / practice of IPC. The study will also try to identify the relationship between respondent IPC (knowledge, attitude and practice / compliance) and respondent demographic characteristics.

Healthcare workers practice of infection prevention and control is dependent on their knowledge (through training and guidance) and attitude with regards to the subject. And their compliance with infection prevention and control is accomplished with the availability of IPC working materials. The relationship is presented in figure 1.1.



(By Researcher)

Figure 1. 1. Conceptual Framework: Infection Prevention and Control Practices

1.7 Organization of the Study

This study is made up of six main chapters. Chapter one contains the introduction to the study, the background to the study as well as a problem statement and the research questions. The Conceptual framework, main objective and specific objectives and justification of the study are also covered in this chapter. Chapter two contains the literature review. Chapter three is methodology containing study type/design, study area, study population and study units. This chapter also outlines the sample size and sampling method, variables and data sources including study instrument, plan for data analyses and presentation of results, quality control, and ethical consideration. Study limitations and plan for dissemination of results is also covered in this chapter. In chapter four, results and analysis are presented in tables and graphs with accompanying narratives. Chapter five discusses the results in reference to

relevant literature and Chapter six, the last chapter gives the summary of the results, conclusions from the results and gives recommendations for implementation

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

Our healthcare delivery system is completely dependent on IPC practices to avoid nosocomial infections.

Healthcare workers are a group of people who deliver care and services to the sick or ailing directly (doctors, nurses, and anesthetics) or indirectly (laboratory technicians, orderlies, etc.)

There are very few studies on the work practices of orderlies in our health facilities, yet their role ranging from keeping the hospital environment clean and safe to transfer of patients between departments is highly depended on to maintain the overall hospital efficiency (Stisen et al., 2016). Therefore there is the need to include orderlies in this current study.

This section entails a review of literature on nosocomial infection and infection prevention and control practices

2.1 Nosocomial infection

According to Bhore (2015), nosocomial infection is an infection acquired by the patient during admission and was never present 48 hours before admission or infection acquired in healthcare delivery mediated environment.

For nosocomial infection to be confirmed the following must be fulfilled: it must be 48 hours after admission, must be up to 72 hours after discharge, must be up to 30 days after an operation and admission to a health facility with a condition other than the infection (Stubblefield, 2016).

2.2 Types of nosocomial infection

Base on biological and clinical criteria, Centers for Disease Control for surveillance has classified hospital acquire infections into 13 types with various infection sites of 50 (Khan et al., 2015).

A survey in Ghana by Labi et al., (2018) in ten hospitals on nosocomial infections identified the leading infection to be SSI (32.6%), followed by bloodstream infection (19.5%), the urinary tract infections (18.5%) and respiratory tract infections (16.3%).

Even though bloodstream infection (BSI) is the frequent type of hospital-acquired infection, the other types are surgical site infection (SSI), Pneumonia; e.g. ventilator-associated pneumonia (VAP), and urinary tract infection (Custodio, 2016).

According to Rogers (2016), symptoms of infection may vary according to the type of infection and some of the symptoms are: discharged from the wound, fever, cough, shortness of breath, burning with urination or difficulty urinating, headache, nausea, vomiting, and diarrhea.

Centre for disease and control (2018) classified nosocomial infections into catheter-associated urinary tract infections, central line-associated bloodstream infection, surgical site infection, and ventilator-associated pneumonia.

2.2.1 Catheter-Associated Urinary Tract Infections

This type of infection is associated with any part of the urinary tract, for example, the urethra, bladder, and kidney. This is the most common type of nosocomial infection. Urinary catheter accounts for 75.0% of all hospital-acquired urinary tract infections (CDC, 2018).

According to Labib et al., (2013), the predominant risk factor for catheter-associated urinary tract infection in Sub-Saharan Africa is the duration of cauterization. However, other relevant

risk factors are: unsterile procedure and environment for cauterization, inappropriate catheter usage for a long term, diabetes and immunocompromised (HIV).

2.2.2 Central Line-Associated Bloodstream Infection

This happens when a laboratory confirms infection occurs 48 hours after central line insertion and not related to a different site. This is usually preventable through aseptic technique compliance, central line surveillance and care or management strategy (Haddadin et al., 2019).

2.2.3 Surgical Site Infection

An infection that occurs post-surgery at the surgery site and is of two types (superficial or deep). It is superficial when the infection involves only the skin but deep when tissues below the skin are involved example; organs and implant materials (CDC, 2018). This is preventable through the appropriate use of antibiotics and IPC compliance in the operation and the ward.

2.2.4 Ventilator-Associated Pneumonia

A ventilator is a machine for assisting the patient to breathe by placing a tube in patients' mouth or nose. An infection occurs when germs pass through the tube to the lungs (CDC, 2018).

2.3 Causes of nosocomial infections

According to Rogers, (2016), nosocomial infections are caused by bacteria, fungus, and viruses and 90 percent of all hospital-acquired infections are caused by bacteria. Some of the specific agents implicated in nosocomial infection are: *Streptococcus spp.*, *Acinetobacter spp.*, *Enterococci*, *Pseudomonas aeruginosa (P. aeruginosa)*, *coagulase-negative staphylococci*, *Staphylococcus aureus (S. aureus)*, *Bacillus cereus (B. cereus)*, *Legionella* and

Enterobacteriaceae family members including *Proteus mirabilis, Klebsiella pneumonia (K. pneumonia), Escherichia coli (E. coli), Serratia marcescens* (Khan et al., 2015).

Some of the predisposing factors for nosocomial infections are endotracheal intubation, intensive care unit, antibiotics, surgery, chronic disease, old age, cauterization, and depressed immune system.

2.4. Mode of transmission

To prevention nosocomial infection, it is very important to know the mode of transmission. A lot of microorganisms require living host to survive while may not survive outside a living host. There are various modes of transmission and some of them are direct contact, indirect contact, airborne, droplets, and common vehicle.

According to Khan et al., (2015), one microbe may have more than one mode of transmission. Examples of microbes with their mode of transmission are presented below:

Staphylococcus aureus

This can be transmitted through direct contact with infected person skin or through contaminated surfaces such as door handles, towels, benches and taps.

Escherichia coli

This one is transmitted from person to person, contaminated food or water.

Vancomycin-resistant enterococci

This is transmitted from patients' with diarrhea. Surfaces and equipment around these patients usually serve as a reservoir for this microbe since it has the capacity to survive on

these surfaces for days or weeks. They become a source of nosocomial infection for healthcare staff or other patients or patients' relatives.

Klebsiella pneumonia

This can be transmitted through person to person contact more particularly when health staff fails to clean or wash hands after attending to an infected patient respiratory machine, catheters or exposes wounds or stool.

Pseudomonas aeruginosa

Breast pumps, incubators, sinks, hand soap, and health staff hands are the common reservoirs for this microorganism.

Clostridium difficile

Inanimate surfaces and infected intestinal patients are major reservoirs for these microbes and they can stay on these surfaces for months. Sometimes they become an issue for disinfection and cleaning.

2.5. Disease infection chain

It is very important to understand infection transmission chain for infection prevention and control practice. According to Olin (2012), infection is the entry of pathogenic agent and multiplication of this pathogenic agent in living tissue. Infection has a chain for effective transmission. This chain has six elements and all these elements are dependent on each other for effective transmission and they are:

Infectious agent or microorganism- a microbe is able to cause severe disease base on its ability to enter the human tissue (invasive) and multiple (virulence). It should also have the ability to cause disease (pathogenicity)

Reservoir - a suitable environment for microbes to live and multiple examples: human or animal tissue, inanimate materials such as door handles, water, table surface and so on.

Portal of exit – this is for the microbe to leave the reservoir such as mouth through saliva, anus through feces, nose through sneezing, etc.

Mode of transmission – the method by which microbe is carried from one place to another example hands health staff from patient to patient.

Portal of entry – this is the entry that permits the microbe to enter the host example mucous membrane, open wound, orifices, needle stick, and instrument cut.

Host – the person who the microbe has succeeded to enter and multiple. This will result in disease if the person immune system is unable to fight it.

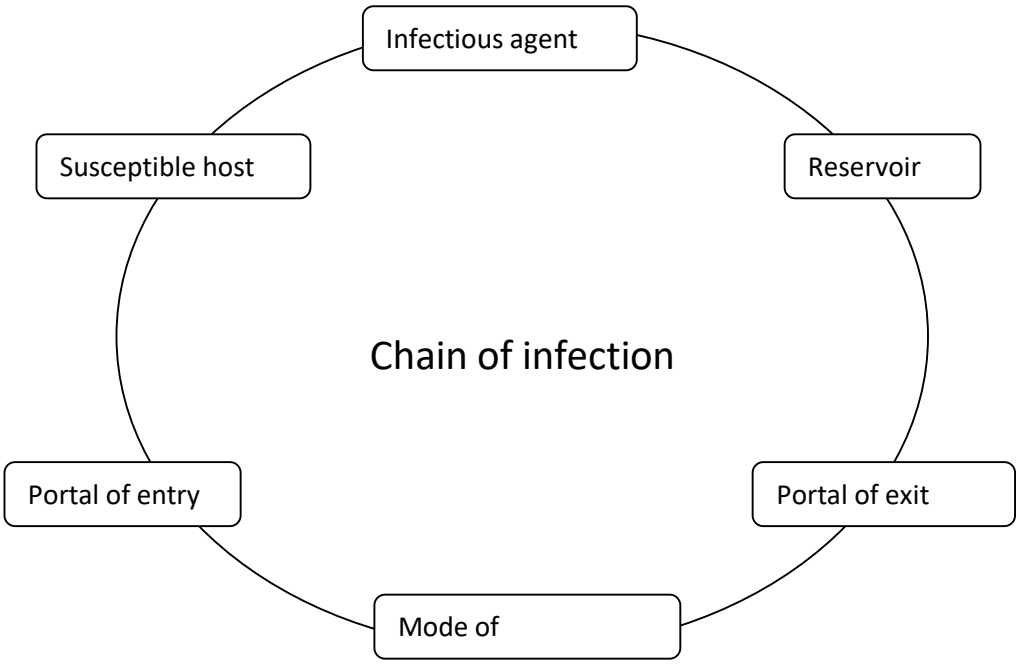


Figure 2. 1 Adapted and modified from (Olin, 2012)

Infection is only possible if the chain remains intact and infection prevention and control can only be effective if this chain is broken.

2.6. Infection Prevention and Control

Infection prevention and control refers to steps or procedure adopted to avoid or reduce infections related to the healthcare setting. It is one of the basic requirements for quality healthcare since it reduces disease burden on patients, healthcare setting and the whole nation (MOH, 2015).

Over the years, there have been so many efforts to ensure a safe environment for efficient and effective healthcare delivery through the practice of infection prevention practice in healthcare settings. Some of these efforts led to the birth of guidelines, procedure manuals

and other related training materials and programs in all aspect of our healthcare settings, but all these efforts yielded non-compliance result according to Institutional Care Division (ICD) on IPC in 2005 (MOH, 2015).

According to MOH (2015), Ghana had the first edition of national IPC policy in 2003 and IPC policy and Guidelines are built on recommendation from experts and professionals.

Ghana infection prevention policy has the following principles: safety, client-centered care, cost-effectiveness, efficiency, teamwork, standardization and sustainability (MOH, 2015).

Even though the practice of infection prevention and control is particular to healthcare facility level rather than at the society level, it is of public health importance in reducing disease and improving society productivity.

According to MOH (2015), standard precaution is the baseline for infection prevention and control and this is based on the assumption that all body fluids, blood, secretions, excretions (such as sweats), open skin and mucous membrane are sources for infection. Standard precautions are applied to all patients irrespective of the diagnosis. Standard precautions are for the protection of both the healthcare worker and the patient (Dix, 2002).

The components of standard precaution according to MOH (2015) are listed below:

- Hand hygiene;
- Personal protective equipment (PPE) gloves, gowns/plastic aprons, masks, goggles, face shields, eye protectors, etc.) proper use and removal;
- Appropriate placement of patients, worker placement, visitors, and transportation;
- Reusable equipment and other items such as rubber boots proper processing after use;

- Environmental control, cleaning, and disinfection (housekeeping, handling food and drinks, dishes and utensils);
- Sharps management (handling and disposal);
- Management of solid and liquid waste from health delivery;
- Harmless injection practices and aseptic practices;
- Work-related health and care;
- Management of textiles and laundry;
- Gathering, management, and conveying of clinical specimens;
- Respiratory or cough protocol (para.2).

Some of them are further explained below;

2.6.1 Hand hygiene

According to Mathur (2011), the most efficient, easiest and least cost method of infection prevention in a healthcare setting is hand hygiene. Even though hand hygiene is a good way to prevention of infection in a healthcare setting, studies have shown that, on average, healthcare providers do hand hygiene half the number of times they are supposed to clean and this has contributed to nosocomial infections (CDC, 2017).

According to WHO (2009) guideline on hand hygiene in health care: a summary, even though hand hygiene remains the basic measure proven to be effecient in fighting nosocomial infection, its compliance has been very low in both developed and developing countries with the average compliance 38.7%.

Hand hygiene is not limited to healthcare providers alone but patients and all hospital visitors. Hand hygiene can be done with alcohol-based formulation or with water and soap.

Hand hygiene according to a study by Randle et al., (2014) on an observational study of hand hygiene adherence following the introduction of an education intervention, indicated educational program on hand hygiene is a good predictor of hand hygiene practice among healthcare workers. There was increase adherence to hand hygiene practice from the baseline of 53.0% post educational intervention to 67.7% for point 2 observation and 70.8% for point 3 observation.

A study of hand cleaning practices among healthcare providers in four health facilities in Zambia reported barriers to hand cleaning to be: large patients load, discomfort in reaching to distance handwashing facility, broken sink and insufficient handwashing soap (Chipungu et al., 2018).

According to the CDC (2017), the various instances that require hand hygiene in the Healthcare setting are:

- After touching patient bed rails, bedside table, remote control or phone;
- After touching doorknobs;
- After using the restroom;
- After blowing your nose, coughing, or sneezing;
- Before touching your eyes, nose or mouth;
- Before eating;
- Before and after changing bandages.

Hand hygiene can is further summarised into ‘five moments of hand hygiene’ according to WHO, (2005) guidelines on hand hygiene which illustrated in **figure 2.2.**

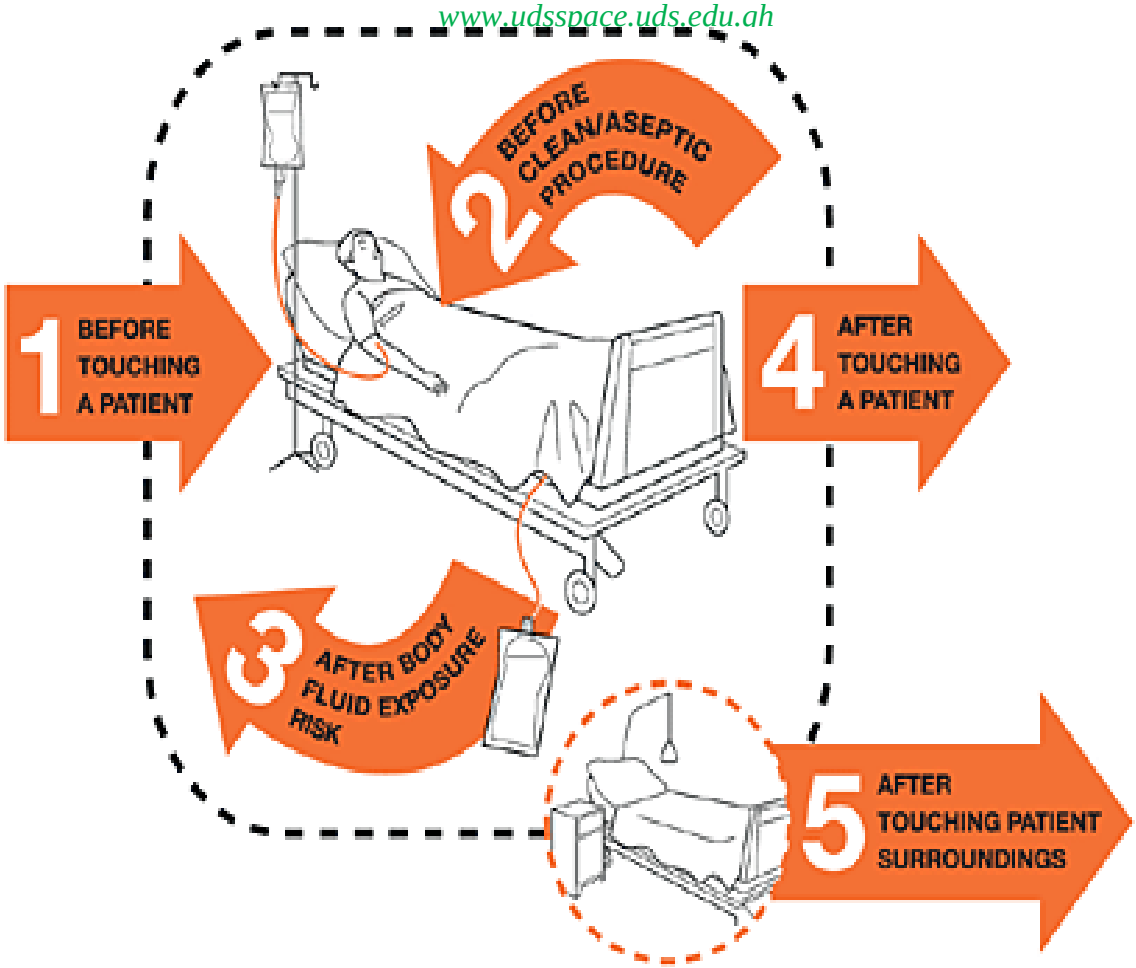


Figure 2. 2 WHO five moment of hand hygiene

Before touching a patient; hand cleaning at this moment is intended at avoiding the colonization of the patient with health care delivery associated microorganisms, resulting from the transmission of organisms from the environment to the patient through contaminated hands, and exogenous infections in some cases. A clear example would be the time period after touching the door handle and shaking the patient's hand: the door handle belongs to the health-care area outside the patient zone, and the patient's hand belongs to the patient zone. Therefore hand cleaning must take place after touching the door handle and before shaking the patient's hand (WHO, 2009).

Before clean or antiseptic procedure; hand hygiene is very critical, especially when attending to a patient with a high risk of infection, example patient with opened venous access line, giving an injection, or performing wound care. Hand hygiene is important even if the last hand contact to the surface was in the same patient environment. Under sterile procedure where sterile gloves will be used, hand hygiene is equally important since glove use alone may not be enough to prevent contamination (WHO, 2009).

After body fluid exposure risk; this moment of hand hygiene is important to reduce risk of colonization with an infectious agent or its infection of healthcare worker and secondly, to reduce the transfer of infection from one part of the patient body to the other (WHO, 2009).

After touching a patient; this is done before leaving the patient zone and before touching any other patient or surface to reduce the chance of microorganism colonization and cross-contamination.

After touching the patient surrounding; patients' surrounding is potentially contaminated so hand hygiene is needed before leaving the patient surrounding and before touching any other patient or surface to reduce the chance of microorganism colonization and cross-contamination.

To ensure compliance to hand hygiene, the healthcare administrators need to ensure constant safe water supply and appropriate detergent in all needed place for effective hand washing. Alcohol-based hand rub must be provided at patient point care (WHO, 2009).

According to WHO (2009) Multimodal Hand Hygiene Improvement Strategy, the five-element to promote hand hygiene compliance are: system change to ensure hand hygiene facilities availability especially alcohol-based hand rub formation at the point of patient care, continues training and education, continues evaluation and feedback on compliance to hand

hygiene, placement of reminders at various aspect of workplace and institution assurance of safe environment for practice.

The ministry of health Ghana guidelines on IPC recommend the following for hand hygiene compliance (MOH, 2015, p. 26):

- Administrators make water, soap, and antiseptics accessible always
- Administrators provision and model good hand cleaning practice
- Healthcare settings delivery of educational services and assistances to make sure all staff are informed about the importance of good hand cleaning behaviour
- Supervisors provision of pictures or signs demonstrating the process and times for handwashing, exposed at accessible points (restrooms, eating areas, toilets) to help staff become aware of appropriate hand cleaning behaviour.

2.6.2 Personal Protective Equipment (PPE)

Personal protective equipment is not always for protection of healthcare provider alone, but sometimes the patients; for example, the use of gloves. For compliance towards IPC, PPE is required in most clinical practice and serves as a barrier to the exchange of body fluids between healthcare provider and patient that may cause infection. Examples of some of PPE are; gloves, gowns or water proof aprons, facemasks, face shields, eye protectors or spectacles,, etc. (WHO, 2016).

The type of PPE use is dependent on the type of procedure to be performed and the anticipated exposure. The commonly used types are gloves, gowns, surgical face mask, surgical headgear or cap, rubber apron, and leg protection or rubber boots (MOH, 2015)

Gloves

The role of the gloves is to prevent the exchange of microbes such as viruses between healthcare providers and their clients by creating a barrier.

They come in with different types and sizes (MOH, 2015).

The most available types of gloves according to MOH (2015, p. 27) are:

- Surgical or sterile gloves: They are sterile and are used for invasive procedures that involve contact with blood and normally clean areas of the body. Some of them can be as long as to the elbow especially are used gynecological cases
- Disposable gloves: These are non-sterile one time use gloves and shall be used for non-invasive procedures relating to touching the intact mucous membranes (except otherwise indicated) and also for other patient care actions that do not necessitate the use of sterile gloves.
- Utility gloves: These shall be used when managing unclean items and when carrying out non-surgical undertakings such as housekeeping.

WHO (2002) practical guideline on infection control in healthcare facilities recommends that: gloves should be used when touching body fluids and mucous membrane.

Gloves should be changed between patients or between different procedures on the same patient and gloves should be disposed of immediately without reuse especially surgical and examination gloves.

Gown/apron

Gowns are used to protect clothes from soiling during patient care or surgery and this will eventually prevent cross-transmission from the clothes to the body. This is used when there is

the anticipation of splashes during the case. The gown must be large enough to cover entire clothing, it should be waterproof, and disposable gowns and must not be reused (MOH, 2015).

Surgical face mask

The purpose of using a face mask is a two-way benefit; first to prevent contamination of the patient wound and secondly to protect healthcare provider from spray or splashes of fluids from the patient. Surgical mask, when used correctly, reduces the risk of SSI (Vincent et al., 2016).

It is worn over nose and mouth; the way they are worn or removed contribute to their purpose of preventing infection. They should be worn and removed with clean hands, equally the hands should be washed after they are moved. They are made from **f**abric or other material like polypropylene and to be used once without reuse (HSA, 2009).

Headgear or surgical cap

The surgical cap decreases the threat of hair dropping into the sterile zone during a surgical operation. The hair is contaminated with lots of bacteria even if just cleaned. The most recommended are the disposable caps. If the one time use caps are not available, well-fitting cotton caps and scarves can be an alternative which should be sterilized or washed at a high temperature above 60 degrees Celsius (MOH, 2015).

Leg protection or rubber boots

Waterproof boots are worn during surgical operation as a protective measure from contamination with blood, pus, amniotic fluid, etc**.** The recommended boots are made from rubber and at least the sides of the boots must be 30 cm high (MOH, 2015).

In order to successfully use these personal protective equipment, it is important to have adequate knowledge with regards to when to use them, how to use them and how to handle them after use.

2.6.3 Proper patient placement, staff allocation, visitors, and transportation

Patients with a very infectious condition should be properly isolated and the use of proper personal protective equipment's should be assured for both health professionals and visitors. During the transportation of the patient from department to department, infection prevention and control should be adhered to through the use of personal protective equipment.

According to WHO (2014):

- Patients with suspected or confirmed infectious disease should be isolated with dedicated latrine, bathroom, and sink with running water and soap or alcohol-based hand sanitizer.
- Patients in isolation should be given staff allocation with appropriate training and supply of PPE.
- The visitor must be restricted and those allowed must be given appropriate guidance and PPE.

2.6.4 Environmental control, cleaning, and disinfection

Cleaning is one of the routine practices implemented in healthcare facilities to reduce the risk of spreading infection. Before the patient environment is cleaned, it is important for point-of-care risk assessment to identify body fluids or blood and use appropriate PPE and disinfectant (Alberta Health Services, 2017).

2.6.5 Handling and disposal of sharps

Healthcare workers exposure sharps and needle sticks injuries is about 385000 a year. These injuries are usually associated with the transmission of diseases such as hepatitis B virus, hepatitis c virus and human immunodeficiency virus among others (CDC, 2015). Needles should never be recapped and bent and should be discarded into puncture-resistant sharps containers since these activities will reduce the risk of needlestick (CDC, 2012).

Medical sharps are devices or tools that cut into the skin and they include needles and scalpels. These devices are source of infection to anybody, hence, the need to have sharp containers to contain these sharps is important. The sharps container should be replaced when two-thirds full (Martin, 2018).

Martin (2018, para 5&7), gave a guideline for handling and disposing medical sharps and they are;

- DO NOT uncover or unwrap the sharp object until it is time to use it;
- Keep the object pointed away from yourself and other people at all times;
- Never recap or bend a sharp object;
- Keep your fingers away from the tip of the object;
- If the object is reusable, put it in a secure, closed container after you use it;
- Never handle a sharp object to someone else or put it on a tray for another person to pick up;
- Tell the people you are working with when you plan to set the object down or pick it up;
- Never put your fingers into the sharps container;

- If the needle has tubing attached to it, hold the needle and the tubing when you put it in the sharps container;
- Sharps containers should be at eye level and within your reach;
- If a needle is sticking out of the container, do not push it in with your hands. Call to have the container removed. Or, a trained person may use tongs to push the needle back into the container;
- If you find an uncovered sharp object outside of a disposal container, it is safe to pick it up only if you can grasp the non-sharp end. If you cannot, use tongs to pick it up and dispose of it.

According to American Nurses Association, the Health care worker can prevent needle stick by avoiding recapping, using an appropriate sharps container, placing the sharps container at eye-level, emptying sharp contain prior to being completely full (ANA, 2002).

2.6.6 Healthcare waste management

It is important to properly manage healthcare waste to avoid imposing the risk of infection on health professionals, patients or the community. Healthcare waste can be classified into three and color coding is applied for segregation. They are a general waste (black); e.g. paper, kitchen waste, etc, infectious waste (yellow); e.g. sharps, patient waste, radioactive waste, etc and dangerous unwanted materials (brown); e.g. expired drugs, vaccine, chemical, etc (MOH, 2006).

HCWM (2016), indicated waste management as a process that begins with the point of generation of waste to the point of final disposal of waste.The eight steps of HCWM in waste management are: waste minimization plan, the process waste generation, segregation and containment of waste, intermediate healthcare facility storage, healthcare facility internal

transport of waste, health facility waste central storage, external transportation of waste and final treatment and disposal of waste.

2.6.7 Handling textiles and laundry

Used linen must be handled and transported in a way that it must not cause environmental contamination or transfer of infectious organism to patients or health staff for washing, drying and folding or packing. Also, the used linen must be sorted into dirty and soiled linen and appropriately decontaminated, washed, dried, ironed and packed (MOH, 2015).

2.6.8 Collection, handling, and transportation of clinical specimens

The aim of taking precautions when collecting, handling, and transporting of clinical specimens are to avoid or reduce healthcare-associated infections (Carr et al., 2017). The precaution does not only prevent infection but help protect the specimen result quality.

The standard precautions in the collection, handling, and transportation of clinical specimen by Carr et al., (2017) are:

- Hands must always be wash before and after taking and handling specimens
- Waterproof dressing must be used to cover cuts and lesions
- If there is a likelihood of blood and body fluids, appropriate apron or gloves must be used
- Care must be taken not to contaminate the outside of specimen container
- The specimen container must be used for its main purpose
- The container must be securely closed
- If syringe and needle are used for specimen collection, it must be used with a safety device and discarded appropriately.

2.6.9 Respiratory hygiene/cough etiquette

Infectious respiratory infections such as influenza, tuberculosis are spread through coughs or sneezes and droplets from patient to patient, patient to health staff or health staff to patient. Respiratory hygiene and cough etiquette are ways to avoid or reduce these infections (SHR Infection Prevention & Control Committee & Facility Board of Directors, 2008).

According to SHR Infection Prevention & Control Committee & Facility Board of Directors (2008), instructions for respiratory hygiene and cough etiquette include the following:

- Mouth and nose must be covered with tissue or dress sleeve when coughing or sneezing
- Used tissue must be disposed of in the nearest waste container
- Hand cleaning must be performed with water and soap or with alcohol-based hand sanitizer
- Those coughing in the common waiting area must be sorted out in terms of priority.

2.7 Knowledge About Infection Prevention and Control

Knowledge, according to Bano et al., (2013), knowledge is the ability to gain, keep in mind and use ideas; a combination of understanding, skill, judgement, and experience.

Currently, the most important problem in the health system is an infection. Most morbidities and mortalities related to clinical, diagnostic and therapeutic procedures are related to infection and the solution to this is right knowledge, positive attitude and good compliance toward IPC (Alharbi et al., 2019).

According to Wesangula et al., (2016), the major knowledge gap in IPC is attributed to an inadequate comprehensive approach to IPC training. Adequate IPC training is ensured

through regular training needs assessment and training through in-service education, on the training, time to time review of the training impact to inform the need for re-training (WHO, 2004).

A literature review of ten articles on IPC compliance by healthcare workers identified compliance was low and the major predictor was low level of knowledge (Al-Mahdali, 2015).

Many studies have identified the positive influence of knowledge of infection prevention and control on practice. A study on the topic: Knowledge and practices of infection control among healthcare workers in a Tertiary Referral Center in North-Western Nigeria, indicated overall median relationship between knowledge and IPC (70.0%) and practice of IPC (65.0%) (Iliyasu et al., 2016). Knowledge level of IPC do not always reflect the practice of IPC. For instance, a study by Sha (2015), identified knowledge of IPC to be 85.8% against practice of 55.7%. Also, all participants were aware of indication for facemask and glove use but in practice only 77.1% were practicing that.

Another study from three regional hospitals about healthcare providers' knowledge towards IPC in Trinidad and Tobago indicated very low knowledge of 20.3% against the better practice of 44.0% (Unakal et al., 2017).

Gulilat and Tiruneh (2014) assessed the knowledge, attitude and practice of health care workers on infection prevention in a health institution in Bahir Dar city administration and found high knowledge score of 84.5% translated to low practice of 54.2%.

A study on IPC in the Operating Room: Staff Compliance to Existing Policies in a Developing Country by Cawich et al., (2013), identified 81.0% of staffs with knowledge of infection control practices against 41.0% of them with compliance to IPC.

A study done on the topic: knowledge, attitude and practices regarding biomedical waste management among healthcare personnel of selected hospitals in Dhaka, Bangladesh, indicated cleaners had poor knowledge, attitude and practice as compare to other healthcare professional (doctors, nurses and medical technologists) who had excellent (knowledge and practice). Also cleaners were ignored with regards to training and vaccination, meaning occupation was a factor here for IPC compliance (Jahan et al., 2018).

Results of Mukwato et al., (2008) study suggested the need to provide healthcare workers with in-service training and infection prevention guidelines to encourage compliance with infection prevention and control.

Another study in La General Hospital in Ghana indicated knowledge on IPC among health workers to be 97.0% as against compliance which was 30.7% (Kondor, 2018).

The ministry of health Ghana encourages periodic research in all levels of healthcare settings to ascertain the behaviours, talents, and understanding on infection prevention and control and access the potency of the supervisory and appraisal process (MOH, 2015).

Infection prevention and control education and training should be directed towards all categories of healthcare staffs (MOH, 2015). All healthcare workers must have adequate knowledge with regards to the mode of infection transmission and various ways of breaking the infection circle including knowledge on hand wash methods and the use of personal protective equipment such as gloves, gowns, mask, face shield, goggles, headgear, boots, rubber aprons, etc.

IPC manuals and guiding principle must be readily available for every staff to have access.

2.8 Attitude towards Infection Prevention and Control

According to Bano et.al., (2013) "Attitude refers to inclinations to react in a certain way to a certain situation; to see and interpret events according to certain predispositions; or to organize opinions into the coherent and interrelated structure."(p.30).

One of the strongest pillars of IPC compliance is a positive attitude towards IPC (Gulilat et al., 2014).

A study by Ocran et al., (2014) in central Regional hospital of Ghana on knowledge, attitude of healthcare providers and patients on nosocomial infections identified attitudinal change as number one predictor of infection prevention and control.

A similar study in Italy by Sessa et al., (2011) on Nurses knowledge, attitude and practice towards IPC with regards to disinfection procedures in Italian hospitals identified a great positive attitude towards the use of disinfection procedures guidelines and protocols.

According to Kondor, (2018), time constraint contributed 66.4% to noncompliance towards IPC.

In a study of student Nurses and their mentors, negative attitude of students towards IPC was attributed to their perception that IPC is an additional workload as opposed to an important aspect of safety and quality healthcare (Ward, 2012).

A study by Unakal et al., (2017) in three hospitals in Trinidad and Tobago indicated attitude level of 53.3% which is translated to practice level of 56.0% of infection prevention and control; a sign that attitude has influence over knowledge.

In Gulilat et al., (2014) study on Assessment of knowledge, attitude and practice of health care workers on infection prevention in health institution Bahir Dar city administration, attitude score was 55.6% translated to almost the same practice of 54.2%.

Another study conducted at Wolaitta Sodo Teaching hospital in South East Ethiopia on knowledge, attitude and practice of infection prevention measures among health care workers identified knowledge (99.3%) and attitude (93.4%) towards IPC to be high among of the respondents but failed to translate directly into practice (60.5%) among respondents (Hussen et al., 2017).

A study by Braithwaite et al. (2012) on healthcare workers' attitude toward IPC revealed good attitude by major health professional groups toward IPC even though the attitude of Doctors was lower as compared to the other professional groups.

2.9 Availability of materials for infection prevention and control practice

Compliance to infection prevention is relative to the availability of IPC materials. The foundation of compliance is good knowledge, good attitude, and availability of IPC material.

According to WHO (2004) practical guidelines for infection control in healthcare facilities, it is the role of healthcare administrators to ensure the safety of healthcare providers and patients through training on IPC and adequate provision of materials for IPC. (WHO, 2004).

A study in La General Hospital identified very low (31.4%) availability of IPC materials (soap, water, and towel) for healthcare care workers to comply with IPC (Kondor, 2018).

According to the spokesperson for Hospital Orderlies Association of Ghana (HOAG), their job sometimes expose them to sickness due to the kind of work they do in all aspect of the

hospital and hospitals are clean and neat because of them yet they don't usually have the right tools to work (Safo, 2014).

An observational study by Bedoya et al., (2017), identified a weak association between healthcare workers demographic characteristics and IPC compliance. Their study further identified association between compliance and availability of supplies.

The problem of healthcare worker exposure to blood-borne pathogens like HIV and hepatitis B while caring of patients is on increase in both developed and developing countries due to inadequate IPC resources (Ojulong et al., 2013).

According to a study by Mukwato et al., (2008), compliance to infection practice was significantly high in wards' with sufficient infection prevention and control materials as compared to wards without adequate materials. Hence, IPC materials availability and accessibility are determinants for infection prevention and control compliance.

An observational study by Chipungu et al., (2018) on hand cleaning behaviors among healthcare providers' in four peri-urban health facilities in Zambia indicated barriers to hand hygiene to be: large patients load, discomfort in reaching to distance handwashing facility, broken sink and insufficient handwashing soap. Factors that influence hand cleaning practices among health workers such as patients load, availability of handwashing materials and proper positioning of handwashing facilities as identified by Chipungu et al., (2018) have a relative influence on the attitude of health workers to hand washing practices.

Also a qualitative study by Travers et al., (2015), revealed that language/culture, knowledge/training, per-diem/part-time staff, workload and accountability were barriers to IPC compliance by Nurses and recommended increase staffing as one of the solutions.

Healthcare facility bed occupancy exceeding the standard capacity of the health facility is associated with increased risk of nosocomial infection and this is complicated with inadequate healthcare providers (WHO, 2018).

A study by Ward (2012) revealed a negative attitude among students nurses towards IPC and the major cause of this negative attitude was their perception that IPC is additional workload as opposed to an important aspect of safety and quality healthcare (Ward, 2012). The perception could negatively influence the attitude of health workers in the practice of IPC as identified in the study of student nurses and their mentors (Ward, 2012).

Political support and commitment are important in developing national strategies, guidelines, and policies for effective infection prevention and control. The practice of infection prevention and control in low and middle income is low compared to that of developed countries due to the availability and accessibility of IPC materials. Low and middle countries governments have the challenge to provide IPC materials due to limited resource and any initiative in this direction will impact the outcome greatly (Raka, 2010).

2.10 Compliance to Infection Prevention and Control

According to Banu et.al., (2013), "by Practice we mean the application of rules and knowledge that leads to action. A good practice is an art that is linked to the progress of knowledge and technology and is executed in an ethical manner." While compliance is a reflection of knowledge and rules, it results in practice (Alharbi et al., 2019).

According to Bedoya et al., (2017), IPC compliance assessment is based on indications and corresponding actions. An indication has to do with the situation in which IPC practice is due

to avoid infection cross-transmission while the corresponding action is responding correctly to the situational due IPC practice (Bedoya et al., 2017).

Infection prevention and control involves different areas and requires compliance from all categories of health staffs at all levels. Infection prevention and control compliance is obligatory for prevention and controlling nosocomial infection (MOH, 2015).

Yakob et al., (2015), stated that standard precaution compliance is an effective means to prevent and control nosocomial infections and such means is to protect patients, healthcare workers, and environment.

Staff compliance with infection prevention and control is a factor to influence other colleague health staffs to practice infection prevention and control. The process of assessing compliance is through process surveillance (IPAC Canada, 2016).

According to Mukwato et al., (2008), high compliance towards infection prevention and control is influenced by IPC knowledge and availability and accessibility of IPC materials. Contrary to this finding is a study in La General Hospital in Ghana in which high knowledge (97.0%) is opposite to low compliance (30.7%) (Kondor, 2018).

2.10.1 Operation Room Compliance to Infection Prevention and Control

The causes of SSI is multiple and can be classified into patient-related risk factors and procedure-related factors. The factors related to the patient include malnutrition, advanced age, co-morbidity, and diabetes. The external factors or procedure-related factors includes: types of surgery, duration of surgery, the skill of the surgeon, the adequacy of skin preparation, the quality and promptness of antibiotics prophylaxis, the usage of implants and the quality of instrument sterilisation (Spagnolo et al., 2013).

According to Spagnolo et al. (2013), the state of the operation theatre has a great influence on the rate of SSI. The floor of the operating room must be clean and dry. There should be a restricted number of people and movements in the operating room as these activities influence the number of microorganisms in the room. The quality of ventilation, humidity, and temperature of the operating room are influential in controlling SSI.

Theatre operation room compliance to IPC is of greater importance due to the vulnerability of patients who are highly exposed to infection due to the invasive nature of the procedures. It is therefore very important to maintain standard precautions since compliance with IPC is the key to reducing the risk of postoperative infection in patients (Aziz, 2014).

According to WHO (2016) handout on stop infections after surgery infographic, the standard practices to reduce SSI afte surgeryr include the following:

- Make patients bath before surgery
- Patients should not be shaved
- Use antibiotics when recommended
- Chlorhexidine alcohol-based antiseptic should be used for skin preparation before surgery
- Surgical scrub for surgery should be done with water and soap or alcohol-based hand rub
- A limited number of people in the operation room during surgery
- Ensuring operation room doors well closed during surgery
- All items (instruments, gauze, gloves, etc) used invasively on the patient must be sterile and ensure maintain of asepsis throughout the operation such as the use of the facemask.

- Avoid unnecessary antibiotics used post-surgery to avoid antibiotic resistance and ensure standard wound dressing and monitoring.

Surgical skin preparation is very key in preventing SSI because the patient skin cannot be sterilized. There is the need for skin preparation to remove all debris and suppress microbe growth during operation (Caruthers et al., 2008).

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This is the road map to achieving the aim and objectives of this study. It compasses research design, the study site, the study population, the sample size determination, the sampling technique, the data collection tool, method of data analysis, inclusion and exclusion criteria and ethical consideration.

3.1 Research Design

This study was conducted using descriptive Cross-sectional survey. A descriptive research method is a research method of observing and describing issues of the study subject and not making any changes to it. A cross-sectional survey, also known as snapshots of the population, is the method of collecting data about the population at one point in time to be able to make inference about that population (Lavrakas, 2008).

Gay et al., (2010), also indicated that the descriptive survey is concerned with the conditions or relationships that prevail, such as determining the nature of existing conditions, practices and attitudes; opinions that are held; processes that are going on; or trends that are developed. They also argue that it is only descriptive studies that lead to making inference beyond the given sample and situation. This type of study design was chosen because, considering the purpose of this study, the research questions, and the target population, it is the most appropriate design that suits the aim/objectives of the study and to collect data from respondents.

3.2 Study Site

This study was conducted in the surgical department of Tamale Teaching Hospital. Tamale Teaching Hospital was first established in 1974 under the name Tamale Regional Hospital. The hospital was upgraded to the status of Teaching Hospital in 2005 by Act 525 of the Ghana Health Service and Teaching Hospitals Act of 1996.

Tamale Teaching Hospital is the third teaching hospital after the Korle Bu Teaching Hospital and the Komfo Anokye Teaching Hospital. It serves as a referral center for the Northern regions of Ghana. The Surgical Department of TTH is the largest and comprised of the following units: orthopedics, urology, neurology, maxilo-facial, thoracic, plastics, ear nose throat and the ophthalmology unit.

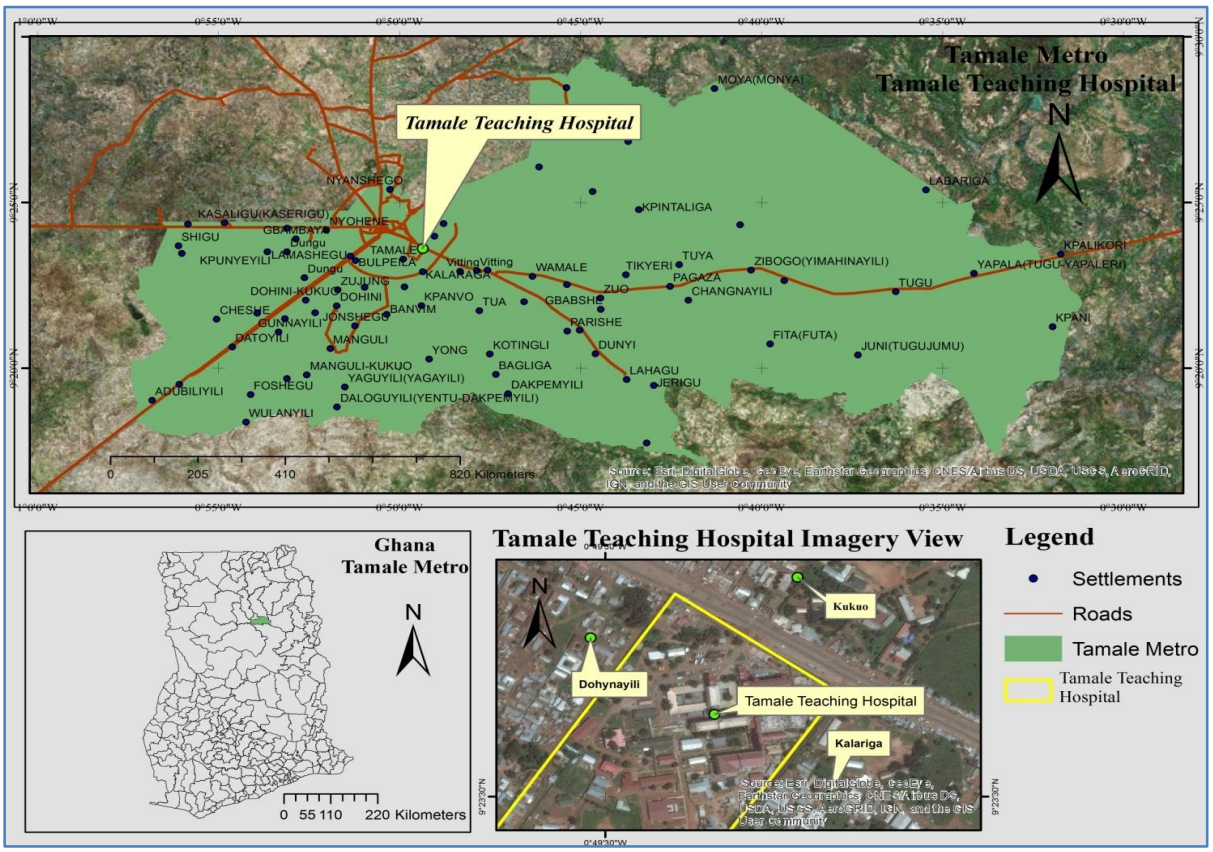


Figure 2.3 Map of Tamale Metro showing the location of Tamale Teaching Hospital (designed by the researcher)

3.3 Study Population

According to Hulley et al., (2013), a study population is the entire set of individuals or items that have or share common attributes such as age, sex, or health condition of interest to the researcher. It is from the available study population that researchers pencil in their samples.

The study population includes all the healthcare providers (Doctors, Anesthetics', Nurses, and Orderlies) working in surgical departments of Tamale Teaching Hospital. According to a report from 2017 annual performance review, there are 245 healthcare providers in the surgical department comprising of Doctors (34), Anesthetics' (18), Nurses (168) and Orderlies (25).

3.4 Data collection tool

Self-administrable close-ended structured questionnaire was used to collect data from the study group. Questions were divided into five sections: demography, knowledge on IPC, attitude about IPC, availability, and accessibility of IPC materials, and IPC compliance.

The demographic characteristics included questions such as sex of respondent, age, marital status, education level, occupational category, years of experience in the current occupation and years of experience in the surgical department.

The second section of the questionnaire which measured healthcare provider IPC knowledge level contained nine questions which were adopted from CDC, WHO and MOH Ghana guidelines on infection and control.

The third section of the questionnaire which measured healthcare provider IPC attitude level contained seven questions which were adopted from CDC, WHO and MOH Ghana guidelines on infection and control.

The fourth section of the questionnaire which measured healthcare provider IPC compliance level contained five standard precaution questions which were adopted from CDC, WHO and MOH Ghana guidelines on infection and control. The standard precautions examined were hand hygiene, gloves used, face mask use, apron or own use and sharp management. Multiple questions were used to examine each standard precaution.

The fifth section of the questionnaire which measured the level of availability of IPC material in the surgical department contained eleven questions which were adopted from CDC, WHO and MOH Ghana guidelines on infection and control.

Observational checklists were also used; one to observe for the availability of IPC materials and healthcare workers' compliance to IPC, and the second to observe compliance to IPC in the operating rooms of the theatre.

The study questionnaires were piloted to identify areas that needed to be corrected in order to make the necessary changes before going to the study area for the data collection. Thus; corrections were made before administering the questionnaire in the study area.

3.5 Sample Size Determination

The sample size for this study was determined using Krejcie and Morgan (1970) sample size determination table, which is efficient in getting the sample size representative of the given population. With the known population of 245 (from the report of 2017 annual performance review) the sample size for this study was estimated at 152 with reference to Krejcie and Morgan sample size determination plus 5.0% (8) nonresponse rate.

Table 3. 1 Sample framework for healthcare providers who will participate in this study

Category	Total per category	Proportion	Sample per category
Doctors	34	34/245 X 160	22
Nurses	168	168/245 X 160	110
Anesthetics'	18	18/245 X 160	12
Orderlies	25	25/245 X 160	16
Total	245		160

A sample size of 160 (minimum sample of 152 plus 8 (5.0%) for non-response) was divided proportionally among the professional groups as in table 3.1.

Table 3. 2 Krejcie and Morgan sample size determination

Table for Determining Sample Size of a Known Population

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

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

3.6 Sampling Technique

According to Denscombe (2014), sampling is the method of selecting a segment of the population to stand for the entire population of interest, so that by studying the sample, for probability sampling the researchers may fairly generalize the results of the study back to the population from which they were selected.

Stratified random sampling method was used to divide the study population into strata's according to their profession and simple random sampling used to select respondents from each stratum proportionally to their population.

Stratified random sampling (stratification) is used to divide the study population into smaller homogenous groups for an equal chance for the participation of each group. This is known as a quota or proportional random sampling (Hayes, 2019).

Simple random sampling is the method of ensuring an unbiased presentation of study sample by randomly selecting from the study population whereby each member has an equal opportunity of participation (Hayes, 2019).

This sampling method allowed for equal opportunity and chance for all categories of healthcare providers to participate in the study. The study population was stratified into professional groups (Doctors, Nurses, Anesthetics' and orderlies) and simple random sampling was used to proportionally select participants from each stratum.

3.7 Study Variables

The variables in this study were dependent variable (compliance with IPC practices by healthcare workers in the surgical department of Tamale Teaching hospital) and independent

variables (knowledge of IPC, attitude towards IPC and availability and accessibility of materials for IPC practice).

3.8 Method of Data Analysis

Data entry and analysis was done using Statistical Package for the Social Sciences (SPSS) version 20 and Graph Pad Prism version 6.05. Responses to categorical variables were coded to allow for quantitative analysis. Data cleaning was done to ensure data accuracy and to maintain good validity of the study.

Scores for knowledge, attitude, and compliance for IPC were done using a sum score for each respondent. The mean score for each section was used to categorize levels of scores for each of these sections (knowledge, attitude, and compliance) adopting a similar method used in a study by Kassahun et al., (2017) as a guide. And if the mean score for all respondents was below 60% of the maximum expected score, levels were classified into low (if respondent score was less than 60%), moderate (if respondent score is between 60%-80%) and high (if respondent score is greater than 80%) as guided by Bloom's cut off point (Bloom, 1956). In this study all respondents mean scores for knowledge, attitude and compliance were above 60% of the maximum expected scores, hence their mean score was used for classification.

Knowledge levels were classified as knowledgeable (if participants scored greater or equal to mean score of the correctly answered questions for the whole participants) or not knowledgeable (if a participant score is less than the mean score of the correctly answered questions for the whole participants).

Attitude levels were classified as good attitude (if participants scored greater or equal to mean score of the correctly answered questions for the whole participants) or poor attitude (if a

participant scored is less than mean score of the correctly answered questions for the whole participants).

Compliance levels were classified as good (if participants scored greater or equal to mean score of the correctly answered questions for the whole participants) or poor (if a participant scored is less than mean score of the correctly answered questions for the whole participants).

Meanwhile, the scores on the availability of IPC materials were calculated using the sum score of each outcome for each respondent. The sum score was further transformed into percentage scores by dividing the scores of each respondent by the possible maximum outcome and multiplied by 100.

IPC materials availability level were classified into not always available (if respondent rate score was less than 60%), sometimes (if respondent rate score is between 60%-80%) and always available (if respondent rate score is greater than 80%) as guided by Bloom's cut off point (Bloom, 1956).

The descriptive analysis was done by using pie chart, bar chart and arithmetic mean with standard deviation. Bivariate analysis such as chi-square analysis and Pearson correlation for the association between independent and dependent variables, analysis of variance (ANOVA) was used to compare the significance of mean score difference among groups and multiple logistic regressions to identify predictors of IPC compliance by healthcare workers in TTH.

Hosmer-Lemeshow test for goodness-of-fit (GOF) was applied to test how the model (multiple logistic regressions) fit the study data. The assumption according to H-L GOF test is that, if H-L GOF test *p*-value is less than 0.05, the model should be rejected and if the GOF *p*-value is more than 0.05 the model should be accepted, this implies that the model fits the data (Allison, 2013).

3.9 Inclusion

All healthcare providers (Doctors, Nurses, Anesthetics' and Orderlies) working in the surgical department of the Tamale Teaching Hospital.

3.10 Exclusion criteria

Any healthcare provider who is not randomly selected, those who denied consent to participate in this study and all those who have worked less than one month in the surgical department of TTH.

3.11 Quality Control

1. Data collected in the field was double-checked to guarantee that, all the information required was captured and recorded.

2. In circumstances where a questionnaire was not correctly filled, it had to be re-administered on the respondent by tracing the participant through his or her phone number.

3. Data security was maintained by entering the data on a personal computer with a password.

4. To ensure the quality of data entered, another person was made to separately recheck each entry.

3.12 Ethical Consideration

Prior approval for this study was obtained from the department of Community health and Family Medicine.

Prior to data collection, an introduction letter was obtained from the head of department of Community health and Family Medicine, which was presented to Tamale Teaching Hospital for certificate of authorization to conduct research in the hospital.

The process of data collection started immediately after a certificate of authorization to conduct research in the hospital was granted by the research department of Tamale Teaching Hospital.

Participants consent was obtained to answer the questionnaire, the information provided was treated with confidentiality and participants were given access to the results of the study.

Any form of physical or psychological harm towards participants was avoided.

All sources for information used in this research were duly acknowledged to avoid any form of plagiarism.

CHAPTER FOUR

RESULTS

4.0 Introduction

Data from the study were analyzed and presented in two parts; descriptive and analytic. The descriptive aspect covered the demographic characteristics of the respondents' (knowledge, attitude, compliance, and material availability), level about IPC and the items that describe the various levels.

The analytic aspect covered the association between demographic characteristics and knowledge on IPC, attitude towards IPC and IPC compliance. It also covered the association between Knowledge on IPC, attitude towards IPC, compliance to IPC and availability of IPC materials. This was done using Chi-square for categorical variables, Pearson correlation for continuous variables and ANOVA to compare means. Variables were further modeled with multiple regressions to identify predictors.

4.1 Demographic characteristics

A total of 160 questionnaires were administered of which 156 (97.5%) were satisfactorily filled and returned. Table 4.1 represents the demographic characteristics of the respondents. A majority (65.4%) of the 156 respondents were males whiles 34.6% were females (p = 0 .0001) with a male to female of 1.9: 1. The ages of the 156 respondents ranged from 21 to 58 years with a mean age of 32.78± 6.17 years and a median age of 32.00. The modal age group was 30 - 39 years (58.3%) followed by 20-29 (30.8%) (p = 0.0001). Many (69.9%) of the respondents were married (p = 0.0001).

Majority of the respondents' had tertiary education (91.0%) and the remaining (9.0%) had primary and secondary education (p = 0.0001)**.** With regards to occupation of respondents, the majority were registered general Nurses (68.6%), followed by practicing medical officers (14.1%), then Orderlies (9.6%) and finally certified registered Anaesthetics (7.6%) (p = 0.0001)**.**

The years of occupational work experience of respondents range between 0.5 to 31 years with mean 6.49 ± 5.32 years. The majority (73.7%) of the workers had between 0 – 9 years working experience followed by 21.8% with 10 – 19 years of experience (P = 0 .0001)**.**

The respondents' years of experience in the surgical department ranged from 0.5 – 25 years with a mean of 3.12 ± 3.00 years. Most (94.9%) of the respondents had between 0 – 9 years of working experience in the surgical department (p <0 .0001) **(Table 4.1).**

Table 4. 1 Socio-demographic characteristic of study respondents

		Frequency (n)	Percent (%)	*P* – values
Sex	Male	102	65.4	
	Female	54	34.6	0.0001
	Total	156	100.0	
Age group	20-29	48	30.8	
	30-39	91	58.3	0.0001
	40-49	12	7.7	
	50-59	5	3.2	
	Total	156	100.0	
Marital status	Married	109	69.9	
	Single	47	30.1	0.0001
	Total	156	100.0	
Education level	Primary	6	3.8	
	Secondary	8	5.1	0.0001
	Tertiary	142	91.0	
	Total	156	100.0	
Occupation	Doctor	22	14.1	
	Nurse	107	68.6	0.0001
	Anesthetics'	12	7.7	
	Orderly	15	9.6	
	Total	156	100.0	
Duration of Work	0-9	115	73.7	
	10-19	34	21.8	0.0001
	20-29	5	3.2	
	30-39	2	1.3	
	Total	156	100.0	
Duration of work in the surgical department	0-9	148	94.9	
	10-19	7	4.5	0.0001
	20-29	1	.6	
	Total	156	100.0	

Source: field survey, 2019.5

4.2 Respondents knowledge on IPC

There were nine items under this section of the questionnaire. All the questions were positively worded with yes response representing the correct answer and no representing incorrect answer.

4.2.1 Sources of surgical site infection

The great majority 151 (96.8%) of the respondents identified the hospital as a source of nosocomial infection $p < 0.0001$. This was followed by those said nosocomial infection can be transmitted by medical equipment such as syringes, needles, catheters, stethoscope and thermometers, 144 (92.3%) **(Table 4.2**).

4.2.2 Knowledge on surgical site wound infection preventive methods

A majority (96.8%) of the respondents said they know how to prevent and control hospital-acquired infections (P = 0.0001). 78.8% of respondents were, however, familiar with health acquired infections prevention guidelines. On the control of infections, a total of 144 (92.3%) agreed that microbial organisms are not destroyed by using clean water alone (P= 0.0001), and 142 (91.0%) also agreed that one cannot handle body fluids with bare hands if gloves are not available (P = 0.0001). More than half (53.8%) of the respondents were not aware of the WHO "five moments of hand hygiene" **(Table 4.2).**

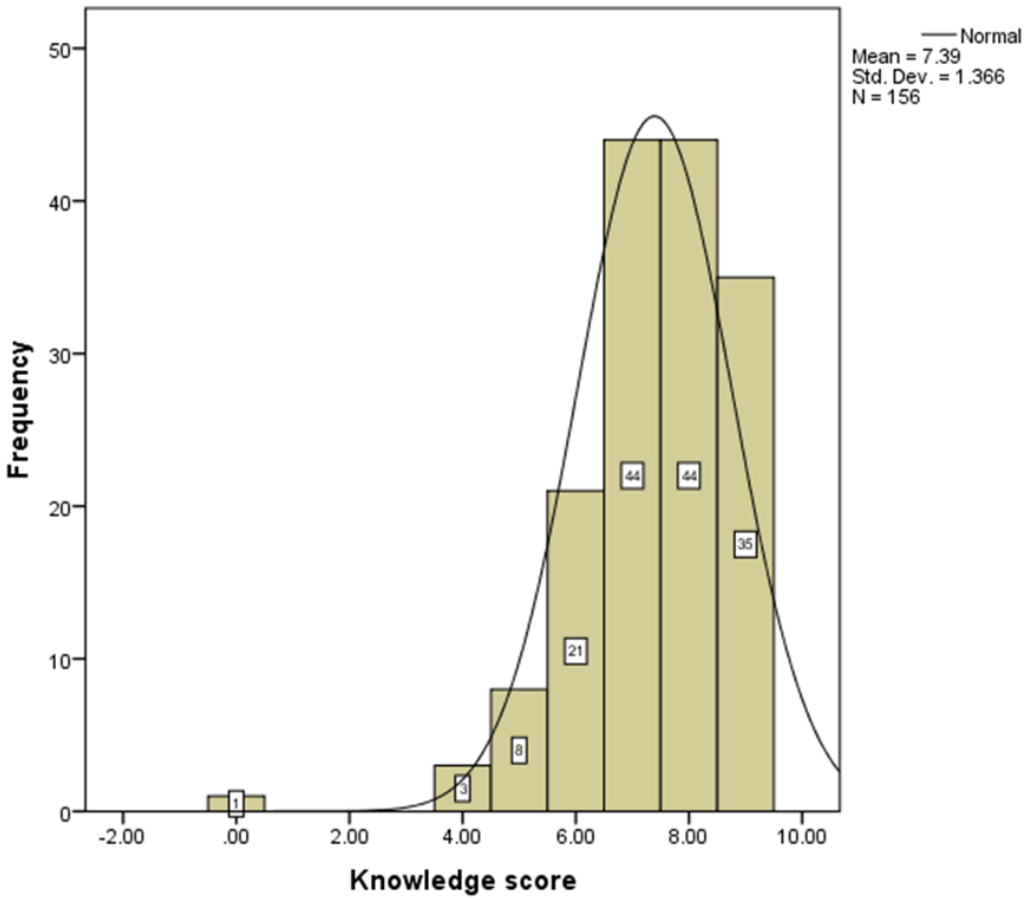
Table 4. 2 Respondents' response on IPC knowledge

Item or Question	Response	Frequency(n)	Percentage (%)	*P* - Values
Sources of surgical site wound infections				
Hospital is a source of nosocomial infection	No	5	3.2	
	Yes	151	96.8	0.0001
	Total	156	100.0	
Nosocomial infection can be transmitted by medical equipment such as syringes, needles, catheters, stethoscope, thermometers, etc.	No	12	7.7	
	Yes	144	92.3	0.0001
	Total	156	100.0	
All staffs and patients should be considered potentially infectious regardless of their diagnosis	No	5	3.2	
	Yes	151	96.8	0.0001
	Total	156	100.0	
Knowledge of surgical site wound infection preventive methods				
Do you know how to prevent and control hospital-acquired infections?	No	5	3.2	
	Yes	151	96.8	0.0001
	Total	156	100.0	
Are you familiar with hospital-acquired infection prevention guidelines	No	33	21.2	
	Yes	123	78.8	0.0001
	Total	156	100.0	
There is no infection control team in the hospital	No	81	51.9	
	Yes	75	48.1	0.5710
	Total	156	100.0	
Microbe organisms are not destroyed by using clean water alone?	No	12	7.7	
	Yes	144	92.3	0.0001
	Total	156	100.0	
Do you know WHO has '5 moments of hand hygiene?	No	84	53.8	
	Yes	72	46.2	0.2130
	Total	156	100.0	
You cannot handle body fluids with bare hands if gloves are not available	No	14	9.0	
	Yes	142	91.0	0.0001
	Total	156	100.0	

Source: field survey, 2019.

4.2.3 Knowledge Score of respondents on IPC

Each correct response was given 1 and incorrect 0. So the knowledge score of each respondent was done using a composite score by summing all correct answers. Since there were nine items in this section the highest score was 9 and the lowest 0. The mean score of all respondents was 7.39 ± 1.37, the median score 8.00 and modal score 7.00. A total of 35 (22.5%) respondents scored 9, followed by 44 (28.2%) who scored 8. The lowest score was 0.6% by one respondent **(Figure 4.1).**



Source: field survey, 2019.

Figure 4. 1 IPC knowledge score distribution of the respondents'

4.2.4 Analysis of Variability of IPC Knowledge Scores among Occupational Groups

One way ANOVA was applied to test the significance of variation of IPC knowledge, attitude and compliance among occupational groups. There was a significant mean knowledge score difference between the different occupational groups F (3, 155) = 13.30, p = 0.0010. Doctors had the highest knowledge mean score of 7.91 ± 1.02, followed by Nurses (7.54 ± 1.33), Anaesthetics' (7.42 ± 0.90) and Orderlies (5.53 ± 0.92)

4.2.5 Knowledge level of respondents on IPC

The mean score of all respondents (7.39± 1.37) was used as a cut-off point for categorizing knowledge level. Respondents were classified knowledgeable (if respondent scored greater or equal to mean score of the correctly answered questions for the whole respondents) or not knowledgeable (if a respondent scored is less than mean score of the correctly answered questions for the whole respondents). Seventy-nine (50.6%) of respondents were knowledgeable with regards to IPC while seventy-seven (49.4%) were not knowledgeable (*p* = 0.910).

4.3 Attitude of respondents towards IPC

There were seven items under this section of the questionnaire. All the questions were positively worded with yes response representing the correct answer and no representing incorrect answer. A majority (97.4%) of the respondents agree to wash their hands even if they used gloves (P = 0.0001). This was followed by 149 (95.5%) respondents who believed that following the prevention guidelines will reduce rates of hospital-acquired infection (P = 0.0001). A little above half (53.2%) (*p* = 0.0001) agreed that their workload does not affect the ability to apply infection prevention guidelines **(Table 4.3).**

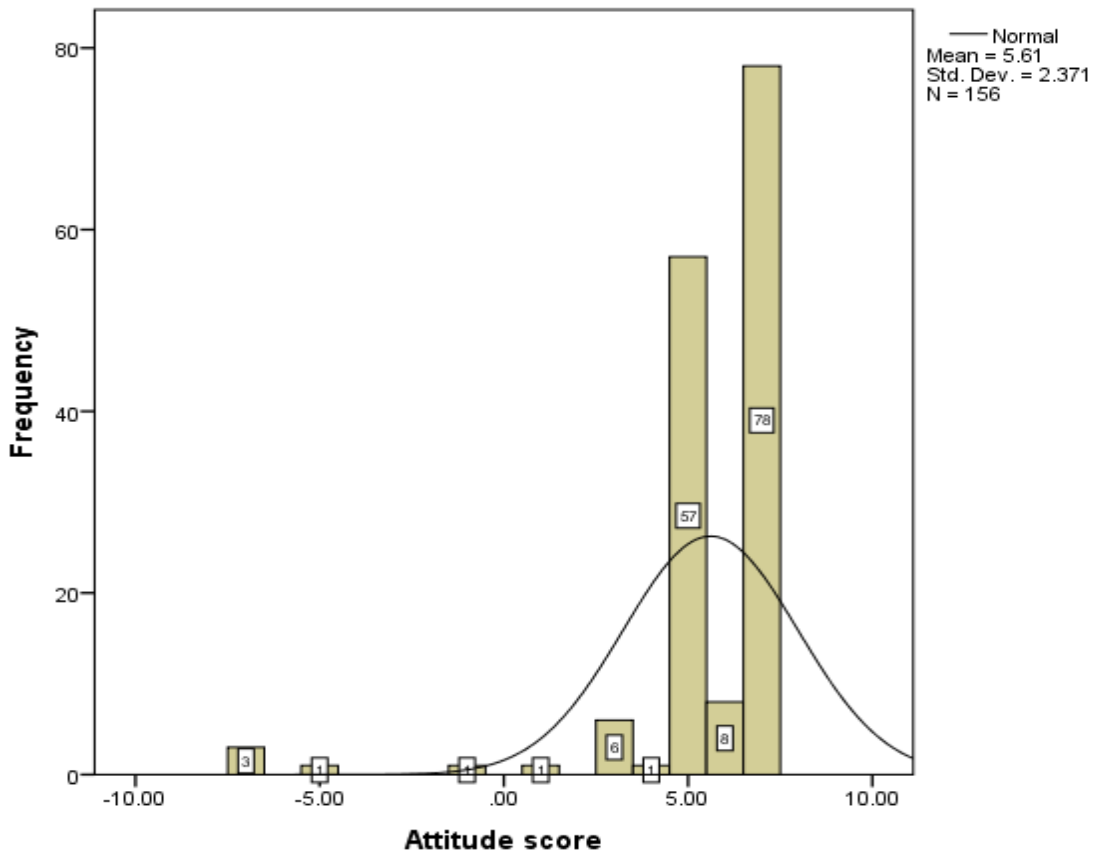
Table 4. 3 Respondents' response on attitude towards IPC

Item or Question	Response	Frequency(n)	Percentage (%)	P-values
I have to wash my hands even if I used gloves	Disagree	4	2.6	
	Agree	152	97.4	0.0001
	Total	156	100.0	
Policies and procedures for infection control should be adhered to at all times	Disagree	5	3.2	
	Agree	151	96.8	0.0001
	Total	156	100.0	
I should attend in-service training/workshop related to infection prevention and control regularly	Disagree	4	2.6	
	N/A	2	1.3	
	Agree	150	96.2	0.0001
	Total	156	100.0	
The workload does not affect my ability to apply infection prevention guidelines	Disagree	64	41.0	
	N/A	9	5.8	
	Agree	83	53.2	0.0001
	Total	156	100.0	
It is my responsibility to comply with the hospital-acquired infection guidelines	Disagree	9	5.8	
	N/A	2	1.3	
	Agree	145	92.9	0.0001
	Total	156	100.0	
I believe that following the prevention guidelines will reduce rates of hospital-acquired infection	Disagree	6	3.8	
	N/A	1	.6	
	Agree	149	95.5	0.0001
	Total	156	100.0	
I have to follow the procedural guidelines of the unit	Disagree	8	5.1	
	N/A	3	1.9	
	Agree	145	92.9	0.0001
	Total	156	100.0	

Source: field survey, 2019.

4.3.1 Attitude score of respondents towards IPC

Each correct response was given 1, the neutral answer was 0 and incorrect -1. So the attitude score of each respondent was done using a composite score by summing all correct answers. Since there were seven items in this section the highest expected score was 7 and the lowest -7. The mean score of all respondents on attitude was 5.61 ±2.37 **(Figure 4.2)**.



Source: field survey, 2019.

Figure 4. 2 Attitude score distribution among respondents'

4.3.2 Analysis of Variability of IPC attitude Scores among Occupational Groups

One way ANOVA was applied to test the significance of variation of IPC knowledge, attitude and compliance among occupational groups. There was a significant IPC attitude mean score variation among the occupational groups, F (3,155) = 3.12, p = 0.0280. Nurses had the

highest average score of 5.92 ± 2.01, second by Doctors (5.50 ± 1.44), then Anesthetics' (5.00 ± 2.26) and Orderlies (4.07 ± 4.57).

4.3.3 Respondents attitude level towards IPC

The mean attitude score of all respondents (5.61± 2.37) was used as a cut-off point for categorizing attitude level. Attitude levels were classified as good attitude (if participants scored greater or equal to mean score of the correctly answered questions for the whole participants) or poor attitude (if a participant scored is less than mean score of the correctly answered questions for the whole participants). Among all the respondents 86 (55.1%) of them had a good attitude and 70 (44.9%) had a poor attitude (p = 0.089).

4.4 Availability of IPC materials

Under this in the survey questionnaire, 11 items were examined with regards to the availability of IPC materials. The IPC material was either always available or sometimes available or always available. According the majority (71.8%) of the respondents, Safety boxes for disposal of used syringes and needles were always available followed by Detergents for decontamination of used instruments (58.3%), p = 0.0001. The least available IPC material according to 67.9% of the respondents was report on hospital feedback to health staff on surgical site infection followed by hand sanitizers (63.5%) P = 0.0001, **(Table 4.4).**

Table 4. 4 Respondents' response on availability of IPC materials

IPC material	Response	Frequency	Percentage (%)	*P* values
Sterile items for wound dressing e.g. gloves, gauze, lotion, etc.	Not always available	12	7.7%	0.0001
	Sometimes available	72	46.2%	
	Always available	72	46.2%	
Hand washing items e.g. water, soap	Not always available	5	3.2%	0.0001
	Sometimes available	56	35.9%	
	Always available	95	60.9%	
Hand sanitizers	Not always available	99	63.5%	0.0001
	Sometimes available	38	24.4%	
	Always available	19	12.2%	
Gloves on the ward	Not always available	12	7.7%	0.0001
	Sometimes available	57	36.5%	
	Always available	87	55.8%	
Personal protective equipment's for use on the ward	Not always available	71	45.5%	0.0001
	Sometimes available	48	30.8%	
	Always available	37	23.7%	
Detergents for decontamination of used instruments	Not always available	20	12.8%	0.0001
	Sometimes available	45	28.8%	
	Always available	91	58.3%	
Safety boxes for disposal of used syringes and needles	Not always available	12	7.7%	0.0001
	Sometimes available	32	20.5%	
	Always available	112	71.8%	

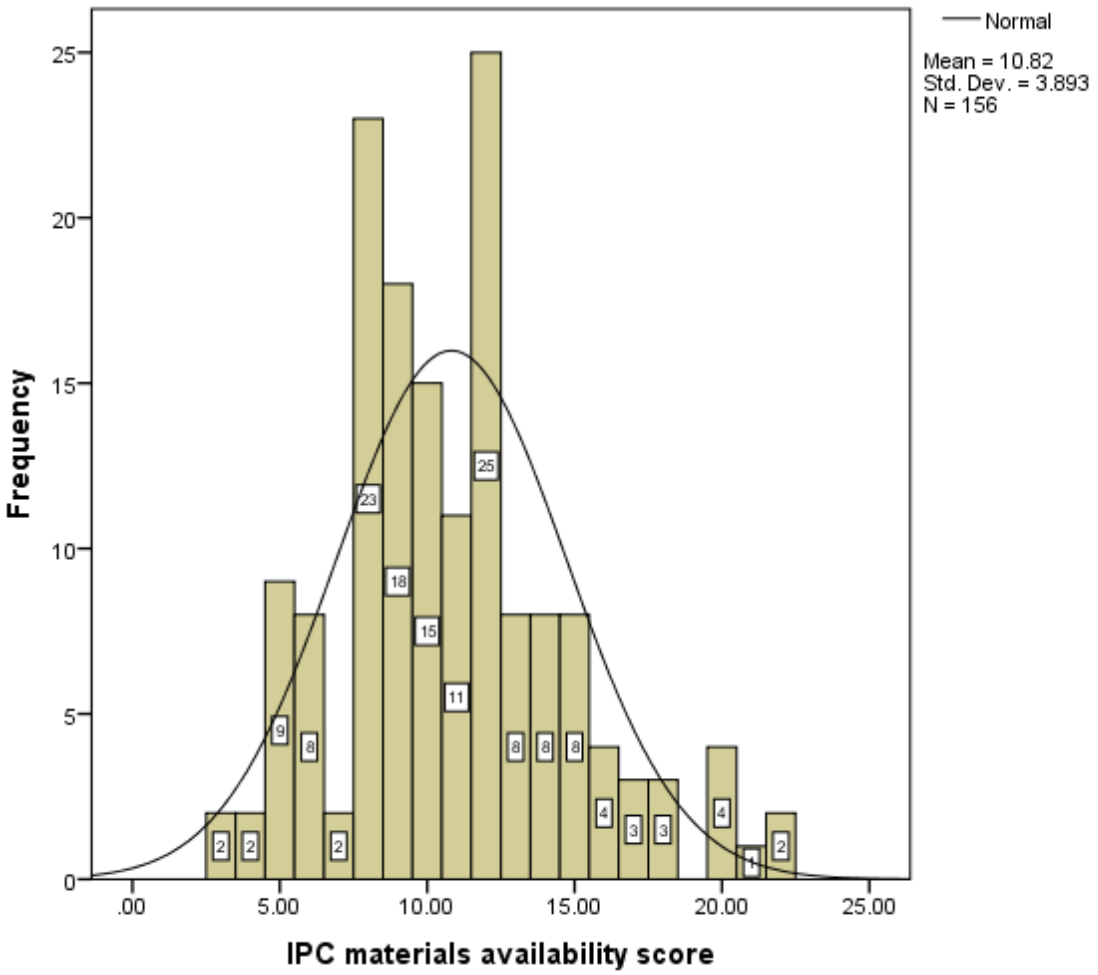
In-service training/workshop related to IPC	Not always available	86	55.1%	0.0001
	Sometimes available	64	41.0%	
	Always available	6	3.8%	
Hospital monitoring of surgical site infection	Not always available	76	48.7%	0.0001
	Sometimes available	61	39.1%	
	Always available	19	12.2%	
Hospital monitoring of staffs adherence to the prevention of surgical site infection	Not always available	96	61.5%	0.0001
	Sometimes available	42	26.9%	
	Always available	18	11.5%	
Hospital feedback to health staff on surgical site infection report	Not always available	106	67.9%	0.0001
	Sometimes available	39	25.0%	
	Always available	11	7.1%	

Source: field survey, 2019.

4.4.1 Respondents score for the Availability of IPC materials

Respondents' responses were used to score compliance with regards to the provision of IPC material in the surgical department. The scores ranged from 0 to 2, of which 0 = not always available, 1 = sometimes available and 2 = always available. This scoring was done for each item or question under the section of availability of IPC materials on the survey questionnaire and sum total of all scores is the respondent general score for the availability of IPC materials.

From the analysis the average score for the availability of IPC materials in the surgical department was 10.82 ± 3.89, the median score was 10.00, the mode score was 12.00, the minimum score was 3.00 and the maximum score was 22.00 **(Figure 4.3).**



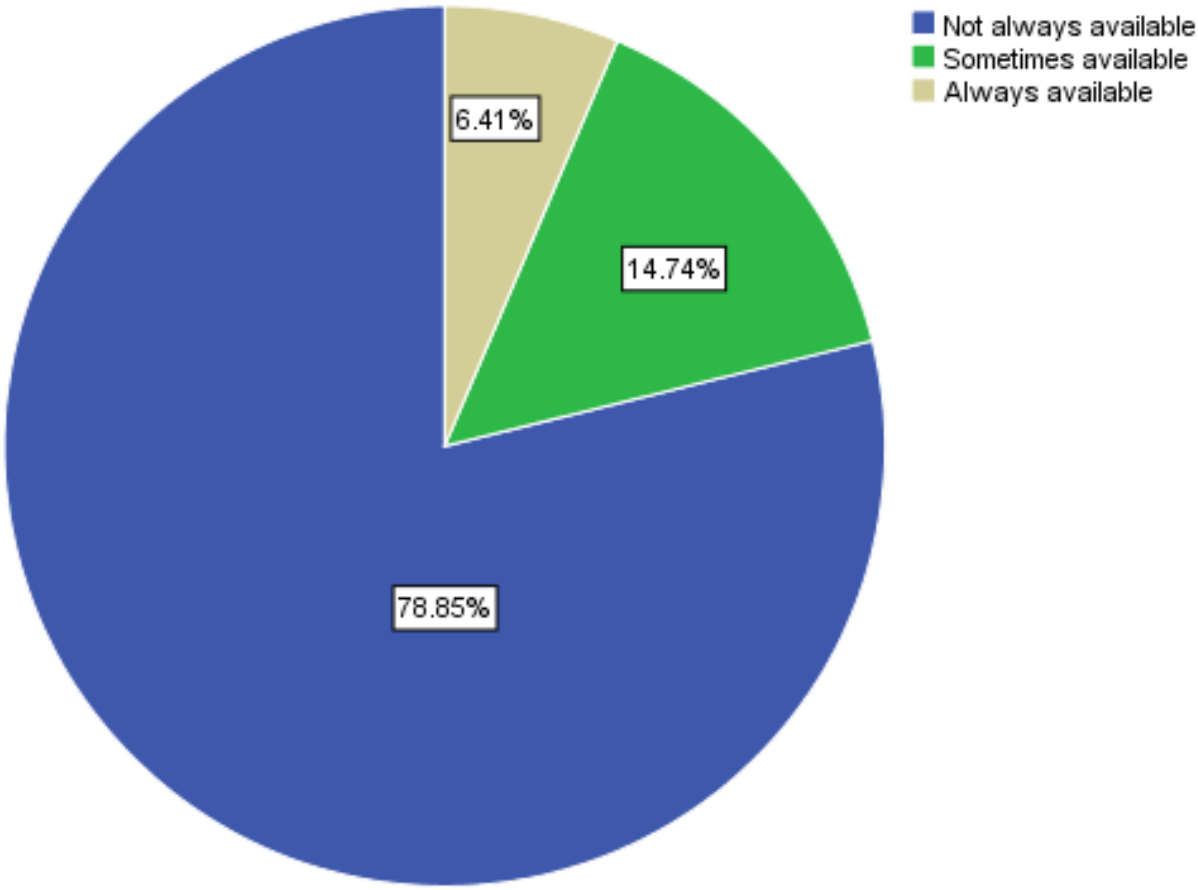
Source: field survey, 2019.

Figure 4. 3 Respondents' score distribution for the availability of IPC materials

4.4.2 Level of availability of IPC materials according to respondents'

The raw scores for IPC materials availability were transformed into percentages by dividing the total scoring of each respondent by the maximum expected score for each respondent and then multiply by 100.

IPC materials availability level were classified into not always available (if respondent rate score was less than 60%), sometimes (if respondent rate score is between 60%-80%) and always available (if respondent rate score is greater than 80%) as guided by Bloom's cut off point (Bloom, 1956). This is shown in **(Figure 4.4)**.



Source: field survey, 2019.

Figure 4. 4 IPC availability level in the surgical department of TTH

4.4.3 Respondents' Rating of Availability of the Studied IPC materials

The various IPC materials that were included in this study were further rated using the respondents rating on each of them with regards to their availability; 0 for not always available, 1 for sometimes available and 2 for always available. The aggregate score on each item from all the respondents' scores was divided by the expected maximum score (312) and multiply by 100 to get the percentage of availability. This informed contribution of each item towards the general availability of IPC materials. According to the respondents'. 59.0% said sterile items were always available, 79.0% said handwashing items were always available, 24.0% said hand sanitizer was always available, 74.0% said hand gloves were always available, 39.0% said PPE were always available, 73.0% said detergent for instrument

decontamination were always available, 82.0% said safety box was always available, 24.0% said in-service training was always available, 32.0% said hospital monitoring of SSI is always available, 25.0% said hospital monitoring of staff adherence to IPC was always available and 20.0% said report on hospital feedback to staff on SSI was always available .

4.5 Compliance of respondents toward IPC

Five items of standard precaution were used in assessing healthcare worker compliance to IPC. Each standard precaution item had questions which were all positively worded, (except recapping under sharp management), hence yes was the correct answer and no incorrect answer.

The most performed hand hygiene time was after contact with contaminated equipment or surface. And the least times for hand hygiene (41.7%) p = 0.0040 was: hand hygiene on arrival at work and before wearing gloves **(Table 4.5)**.

With gloves use, the most situations when the glove is used are changing gloves between patients' contacts (97.4%), p = 0.0001 and the least situations when gloves are used is changing gloves between different procedures on the same patient ((77.6%), p = 0.0001). When it came to facemask use, facemask was mostly ((94.9%), p = 0.0001) used when undertaking procedures likely to generate splashes. Majority of the respondents said they remove soiled /wet gown or apron as soon as possible (94.2%), p =0.0001. Finally, most ((36.5%), p = 0.0001) of the respondents does recapping of the needle after use, **(Table 4.5)**.

Table 4. 5. Respondents' response to standard precaution for IPC compliance

Hand hygiene	Response	Frequency correct (n=156)	Percentage correct	*p* values
After patient contact	Yes	156	100.0	0.0001
After contact with contaminated equipment or surfaces	Yes	150	96.2	0.0001
On arrival at work	Yes	65	41.7	0.0040
Before patient contact	Yes	105	67.3	0.0001
Before wearing gloves	Yes	65	41.7	0.0040
After wearing gloves	Yes	144	92.3	0.0001
Gloves use				
Use when touching blood or other body fluid or mucous membrane	Yes	150	96.2	0.0001
Change gloves between patients contacts	Yes	152	97.4	0.0001
Change gloves between different procedures on the same patient	Yes	121	77.6	0.0001
Never reuse disposable gloves	Yes	151	96.8	0.0001
Facemask use				
When dealing with patients' exposed wound	Yes	145	92.9	0.0001
Wear a facemask when undertaking procedures likely to generate splashes	Yes	148	94.9	0.0001
Wear nose mask when working within 1-2metres of patients with expectoration	Yes	132	84.6	0.0001
Never reuse disposable nose mask	Yes	142	91.0	0.0001
Apron or gown use				
Wear impermeable gown/apron	Yes	123	78.8	0.0001
Wear gown/apron to protect skin/clothing when undertaking procedures likely to generate splashes	Yes	143	91.7	0.0001
Remove soiled /wet gown or apron as soon as possible	Yes	147	94.2	0.0001
Never reuse disposable gown	Yes	146	93.6	0.0001
Sharps management				
Recapping	No	57	36.5	0.0001
Disposing of in safety box	Yes	148	94.9	0.0001

Source: field survey, 2019.

4.5.1 Scores for compliance of respondents towards standard precaution under IPC

Scoring was done by summing up all correct answers, each response had a score attached 1 for yes and 0 for no except the variable recapping where it is the otherwise. Various standard precaution items were added up to measure overall compliance towards IPC.

On hand hygiene, the mean was 4.39 ± = 1.27, the minimum score of 2.00 and a maximum score of 6.00. The most frequent score was 6.00 and the median score of 4.00.

With gloves use compliance, the mean score was 3.68 ± 0.53, minimum score 2.00 and maximum score 4.00, the modal score was 4.00 and the median score was 4.00.

The mean compliance on facemask use was 3.63 ± 0.68 (range: 1.0 -4.0) with a median and modal score of 4.0.

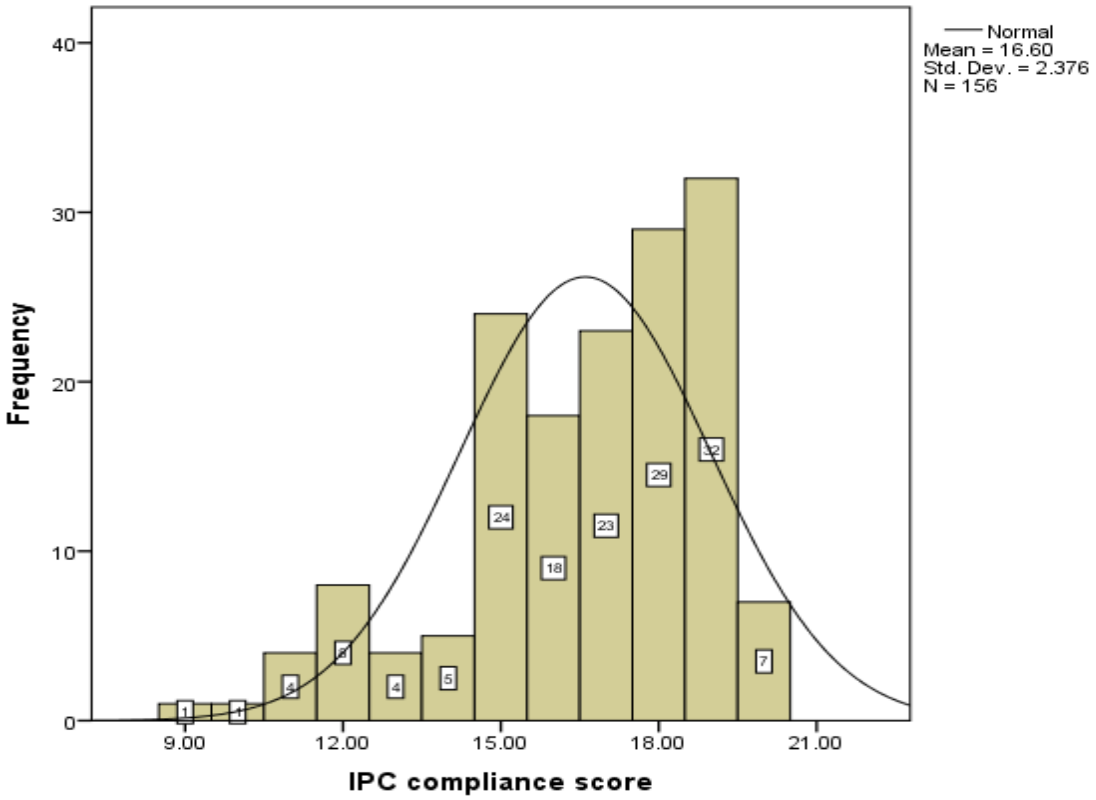
Also, with apron or gown use, the mean score on compliance was 3.58 ± 0.83 ranging from 0 to 4.0 with a median score of 1.00 and mode of 1.00.

Finally, on sharp management compliance, the mean score was 1.31 ± 0.47 (minimum and maximum of 1.0 and 2.0 respectively) with a median and mode of 1.0

On the overall compliance score on IPC, the mean was 16.60 ± 2.38 (minimum score of 9.0 and a maximum score of 20) with the median score 17.0 and mode of 19.0.

4.5.2 Scores for compliance of respondents towards IPC

IPC compliance score overall mean score was 16.60 ± 2.38, median score 17.0, a modal score of 19.0, minimum score 9.0 and maximum score 20 **(Figure 4.5)**.



Source: field survey, 2019.

Figure 4. 5 IPC compliance score distribution among respondents'

4.5.3 Analysis of Variability of IPC compliance Scores among Occupational Groups

One way ANOVA was applied to test the significance of variation of IPC knowledge, attitude and compliance among occupational groups. There was an evidence of significant IPC compliance score variation among occupational groups (F (3,155) = 12.58, P = 0.0010). Nurses had the highest average score of 17.26 ± 2.08, second by Doctors (15.68 ± 2.25), then Anaesthetics' (15.58 ± 2.81) and Orderlies (14.07 ± 1.83).

4.5.4 Respondents compliance level towards IPC

The respondents' overall compliance towards IPC was 91 (58.3%) for good compliance and 65 (41.7%) for poor compliance, p = .004, **(Table 4.6).**

The most complied standard precaution was: facemask use and apron/gown use ((73.7%) p = 0.0001). And the least complied standard precaution was sharps management ((31.4%), p = 0.0001) **(Table 4.6).**

Table 4. 6 Respondents compliance level towards IPC standard precaution

Standard precaution	Compliance level	Frequency (n)	Percentage (%)	*P*- values
Hand hygiene compliance level	Poor compliance with hand hygiene	79	50.6%	0.9090
	Good compliance with hand hygiene	77	49.4%	
Gloves use compliance level	Poor compliance with gloves use	45	28.8%	0.0001
	Good compliance with gloves use	111	71.2%	
Face mask use compliance level	Poor compliance with facemask use	41	26.3%	0.0001
	Good compliance with facemask use	115	73.7%	
Apron / gown use compliance level	Poor compliance with apron/gown use	41	26.3%	0.0001
	Good compliance with apron/gown use	115	73.7%	
Sharps management compliance level	Poor compliance with sharps management	107	68.6%	0.0001
	Good compliance with sharps management	49	31.4%	
Overall IPC compliance level	Poor compliance with IPC	65	41.7%	0.0040
	Good compliance with IPC	91	58.3%	

Source: field study, 2019.

4.6 Occupation of respondents against knowledge, attitude and compliance score

On the IPC knowledge score, Doctors had the highest mean score of 7.91 ± 1.02, followed by Nurses 7.54 ± 1.33, then Anaesthetics' 7.42 ± 0.90 and Orderlies 5.53 ± 0.92. With an attitude towards IPC score, Nurses had the highest average score of 5.92 ± 2.01, second by Doctors 5.50 ± 1.44, then Anesthetics' 5.00 ± 2.26 and finally Orderlies with the lowest attitude score of 4.07 ± 4.57. Also with compliance towards IPC, Nurses had the highest average score of 17.26 ± 2.08, second by Doctors 15.68 ± 2.25, then Anaesthetics' 15.58 ± 2.81 and finally Orderlies 14.07 ± 1.83.

On IPC knowledge level, majority ((57.0%) p = 0.7630) were knowledgeable. Also on attitude level, majority of Nurses ((62.6%) p = 0.0001) had a good attitude towards IPC and finally with compliance towards IPC, greater number of Nurses ((73.8%) p = 0.0001) had good compliance (**Table 4.7).**

Table 4. 7. Occupation of respondents against knowledge, attitude compliance level

	Doctor	Nurse	Anesthetics'	Orderly
	Count (%)	Count (%)	Count (%)	Count (%)
Not knowledgeable	10 (45.5%)	46 (43.0%)	6 (50.0%)	15 (100%)
Knowledgeable	12 (54.5%)	61 (57.0%)	6 (50.0%)	0 (0%)
P-values	0.7630	0.0550	1.0000	0.0001
Poor attitude	13 (59.1%)	40 (37.4%)	8 (66.7%)	9 (60.0%)
Good attitude	9 (40.9%)	67 (62.6%)	4 (33.3%)	6 (40.0%)
P-values	0.3660	0.0001	0.2200	0.4660
Poor compliance	14 (63.6%)	28 (26.2%)	8 (66.7%)	15 (100%)
Good compliance	8 (36.4%)	79 (73.8%)	4 (33.3%)	0 (0%)
P-values	0.1300	0.0001	0.220	0.0001

Source: field survey, 2019.

4.7 Relationship between predictor variables and dependent IPC variables

Under bivariate analysis, Pearson Chi-square analysis was used to measure the association between two categorical variables and Phi (ϕ) or Cramer's' V coefficient was used to the strength of association. While Pearson correlation used for two continuous variables and multivariate analysis binary logistic regression was used for dichotomizing categorical outcome dependent variables.

4.7.1 Bivariate measure of association between respondents' demography and knowledge level on IPC

Pearson Chi-square analysis was done to identify an association between respondent's demographic characteristics and knowledge level. There was significant association between educational level (X^2(1, N = 156) = 15.78, p = 0.0000) with medium effect (ϕ = 0.32), occupation (X^2(1, N = 156) = 17.26, p = 0.0010) with medium effect (ϕ = 0.33), age group (X^2(2, N = 156) = 12.336, p = 0.0020) with medium effect (V = 281) and marital status (X^2(1, N = 156) = 4.68, p= 0.0300) with small effect (ϕ = 0.17) **(Table 4.8).**

Among all the continuous demographic characteristics that were correlated with IPC knowledge score using Pearson correlation, only age of respondent in years had a weak negative association with knowledge score (r(156) = -0.17, p = 0.034) and the rest were: years of occupational experience and duration of work in the surgical department and IPC knowledge score and not statistically significant.

Table 4. 8. Chi-square analysis of the association between respondents' demography and knowledge level on IPC

		IPC Knowledge level						
		Not knowledgeable	Knowledgeable	Total	X^2	df	*P* values	Phi (ϕ) / Cramer's V
Sex	Male	51	51	102	.048[a]	1	0.8260	0.018
	Female	26	28	54				
Total		77	79	156				
Marital Status	Married	60	49	109	4.681[a]	1	0.0300	0.173
	Single	17	30	47				
Total		77	79	156				
Age group	20-29	14	34	48	12.336	2	0.0020	0.281
	30-39	55	36	91				
	40 -59	8	9	17				
Total		77	79	156				
Educational level	Lower	14	0	14	15.780[a]	1	0.0000	0.318
	Higher	63	79	142				
Total		77	79	156				
Occupation	Doctor	10	12	22	17.262[a]	3	0.0010	0.333
	Nurse	46	61	107				
	Anesthetics	6	6	12				
	Orderly	15	0	15				
Total		77	79	156				

Source: field survey, 2019.

4.7.2 Bivariate measure of association between respondents' demography and attitude towards IPC

The Chi-square analysis of attitude level of respondents and respondents' demographic characteristics identified evidence of only respondents' occupation to be associated with attitude level $X^2(3, N = 156) = 7.92$, $p = 0.0480$ with medium effect $V = 0.23$, **(Table 4.9).**

There was no correlation between respondents' age in years, years of occupational experience and duration of work in the surgical department and attitude score.

Table 4. 9. Chi-square analysis association between respondents' demography and attitude towards IPC

		IPC level Attitude						
		Poor	Good	Total	X^2	df	*p*-values	Phi / Cramer's V
Sex	Male	51	51	102	3.133[a]	1	0.0770	0.142
	Female	19	35	54				
Total		70	86	156				
Marital Status	Married	46	63	109	1.043[a]	1	0.3070	-0.082
	Single	24	23	47				0.082
Total		70	86	156				
Age group	20-29	20	28	48	1.568	2	0.4570	0.100
	30-39	40	51	91				
	40 -59	10	7	17				
Total		70	86	156				
Educational level	Lower	8	6	14	.936[a]	1	0.3330	0.077
	Higher	62	80	142				
Total		70	86	156				
Occupation	Doctor	13	9	22	7.916[a]	3	0.0480	0.225
	Nurse	40	67	107				
	Anesthetics'	8	4	12				
	Orderly	9	6	15				
Total		70	86	156				

Source: field survey, 2019.

4.7.3 Bivariate measure of association between respondents' demography and IPC compliance

The demographic variable found to be associated with IPC compliance were: occupation, (X^2(3, N = 156) =39.03, p = 0.0000) with large effect, (V = 0.50), age group (X^2(2, N = 156) = 9.500, p = 0.0090) with medium effect (V =0.247) and educational level (X^2(1, N = 156) = 21.53, p = 0.0000) with medium effect (ϕ = 0.37) **(Table 4.10).**

There was no correlation between respondents' age in years, years of occupational experience and duration of work in the surgical department and IPC compliance score using Pearson correlation.

Table 4. 10. Chi-square measure of association between respondents' demography and IPC compliance level

		IPC compliance level						
		Poor	Good	Total	X^2	df	*P* values	Phi / Cramer's V
Sex	Male	46	56	102	1.427[a]	1	0.2320	0.096
	Female	19	35	54				
Total		65	91	156				
Marital Status	Married	45	64	109	.022[a]	1	0.8830	-0.012
	Single	20	27	47				0.012
Total		65	91	156				
Age group	20-29	12	36	48	9.500	2	0.0090	0.247
	30-39	47	44	91				
	40 -59	6	11	17				
Total		56	91	156				
Educational level	Lower	14	0	14	21.532[a]	1	0.0000	0.372
	Higher	51	91	142				
Total		65	91	156				
Occupation	Doctor	14	8	22	39.029[a]	3	0.0000	0.500
	Nurse	28	79	107				
	Anesthetics'	8	4	12				
	Orderly	15	0	15				
Total		65	91	156				

Source: field survey, 2019.

4.7.4 Effect of IPC Knowledge Level, IPC Attitude Level and IPC Materials Availability Level on IPC Compliance Level

There was significant evidence of association between IPC materials availability level and IPC compliance level $X^2(1, N = 156) = 18.76$, $p = 0.0000$) with medium effect ($V = 0.35$). There was also evidence of significant association between knowledge level and IPC compliance level ($X^2(1, N = 156) = 14.98$, $p = 0.0000$) with medium effect ($\phi = 0.31$). Also, attitude level was significantly associated with IPC compliance level ($X^2(1, N = 156) = 6.54$, $p = 0.0110$) with small effect ($\phi = 0.21$) **(Table 4.11).**

Table 4. 11. Effect of IPC Knowledge Level, IPC Attitude Level and IPC Materials Availability Level on IPC Compliance Level

		IPC compliance level						
		Poor compliance with IPC	Good compliance with IPC	Total	X^2	df	*P*-values	Phi / Cramer's V
Knowledge level	Not knowledgeable	44	33	77	14.983[a]	1	0.0000	0.310
	Knowledgeable	21	58	79				
Total		65	91	156				
Attitude level	Poor attitude	37	33	70	6.542[a]	1	0.0110	0.205
	Good attitude	28	58	86				
Total		65	91	156				
IPC materials availability level	Not always available	62	61	123	18.761[a]	2	0.0000	0.347
	Sometimes available	3	20	23				
	Always available	0	10	10				
Total		65	91	156				

Source: field survey, 2019.

4.7.5 Multivariate analysis of IPC compliance and associated variables

The six variables that were identified to be significantly associated with IPC compliance in Chi-square test of independence were modeled using binary logistic regression. These variables were occupation ($X^2(3, N = 156) = 39.03$, $p = 0.0000$), educational level($X^2(1, N = 156) = 21.53$, $p = 0.0000$), age ($X^2(2, N = 156) = 9.500$, $p = 0.0090$), IPC materials availability level ($X^2(1, N = 156) = 18.76$, $p = 0.0000$), IPC knowledge level ($X^2(1, N = 156) = 14.98$, $p = 0.0000$) and attitude level towards IPC ($X^2(1, N = 156) = 6.54$, $p = 0.0110$)

Table 4. 12. Logistic regression for IPC compliance level

			H-L GOF test $X2(8) = 10.292$, $p = .245$	
	COR (95%, C.I.)	*p* value	AOR (95% C.I.)	*p* values
Age group				0.0240
30-39 / 20-29	0.312 (0.144 - 0.675)	0.004	.310 (.117-.821)	0.0180
40-59 /20-29	0.611 (0.1858 - 2.010)	0.53	.454 (.318-12.939)	0.4540
Education level	51.52 (3.009 - 882.3)	0.0001	3.734	1.0000
Occupation				0.0060
Nurses / Doctors	4.938 (1.872 - 13.02)	0.0001	5.511 (1.700 - 17.863)	0.0040
Anaesthetics / Doctors	0.8750 (0.199 - 3.851)	.033	.613 (.075 - 4.990)	0.6470
Orderlies / Doctors	0.055 (0.003 - 1.042)	1.000	.000	1.0000
IPC Knowledge level	3.683 (1.879 - 7.219)	.000	1.603 (.677 - 3.795)	0.2840
IPC attitude level	2.323 (1.211 - 4.454)	.014	1.709 (.737 - 3.959)	0.2120
IPC materials availability level				0.0820
Sometimes available / Not always available	6.776 (1.914 23.99)	.001	7.630 (1.285 - 45.312)	0.0250
Always available / Not always available	21.34 (1.223 to 372.5)	0.002	1418037485.898	0.9990
Constant			.115	1.0000

Source: field survey, 2019.

Among the modeled variables, the statistically significant variables were: occupation, attitude level, and IPC material availability. The highest predictor variable was IPC materials availability level, comparing IPC materials sometimes available to not always available, (AOR = 7.630, 95% C.I. = 1.285 – 45.312) **(Table 12)**. This means that the healthcare providers with IPC materials sometimes available to them are 663% more likely to comply with IPC as compared to those not always having IPC material available to them.

Also, the occupation of healthcare provider was also a predictor, comparing Nurses to Doctors, (AOR = 5.511, 95% C.I. =1.700 - 17.863) **(Table 12)**. This means comparing nurses to doctors, nurses are 451.1% more likely to comply with IPC.

Finally, comparing healthcare providers within the age groups (30-39 years) and (20-29 years), (AOR = .310, 95% C.I. = .117 - .821) **(Table 12)**, the healthcare providers within the age group 30-39 years are 69% less likely to comply with IPC as compare to healthcare providers within the age group 20 – 39 years.

The logistic regression model appropriately explained the outcome variable (IPC compliance level) since the Hosmer-Lemeshow goodness-of-fit test p - value was more than 0.05, ($X^2(8) = 10.292$, $p = .245$) **(Table 4.12)**, hence the model fits the study data.

4.8 Observational study results analysis

An observational study was added to check healthcare worker compliance level toward IPC. Two observational checklists were used; first observational checklist for healthcare worker compliance to IPC and second observational checklist for operation room compliance towards IPC.

4.8.1 Observation on healthcare workers' compliance to IPC

The checklist was categorized into demographic characteristics of the observed healthcare worker in the surgical department, the availability of IPC materials and compliance using the standard precautions towards IPC.

4.8.1.1 Demographic characteristics of observed healthcare workers

Forty healthcare workers were observed comprising 25 (62.5%) males and 15 (37.5%) females. A little above half 21 (52.5%) were nurses **(Table 4.13).**

With the number of years of experience of the observed staff, the minimum years was 0.5 and the maximum 8.0 years, the average years of experience was 2.33± 1.92, the median and mode years of experience was 2.00 and 1.0 respectively

Table 4. 13 Demographic characteristics of observed healthcare workers

		Frequency	Percent	*P*-values
Sex of staff	Male	25	62.5	
	Female	15	37.5	0.0430
	Total	40	100.0	
Occupation	Doctor	7	17.5	
	Nurse	21	52.5	
	Anesthetics'	6	15.0	0.0001
	Orderly	6	15.0	
	Total	40	100.0	

Source: field observational study, 2019.

4.8.1.2 Observation for the availability of IPC materials

From the observation, there was 100 percent availability of sterile items for wound dressing (e.g. gloves, gauze, lotion, etc.) and safety boxes for sharps disposal which was contrary to

availability of IPC guide in the ward (posters, manuals, etc.) which scored 0 percent **(Table 4.14)**.

Table 4. 14 Observed availability of IPC materials

		Frequency (n)	Percent (%)	*p* - values
Sterile items for wound dressing e.g. gloves, gauze, lotion, etc.	Yes	40	100.0	0.0001
Hand washing items e.g. water, soap	No	3	7.5	
	Yes	37	92.5	0.0001
	Total	40	100.0	
Gloves on the ward	No	5	12.5	
	Yes	35	87.5	0.0001
	Total	40	100.0	
Personal protective equipment's for use on the ward	No	15	37.5	
	Yes	25	62.5	0.0430
	Total	40	100.0	
Detergents for decontamination of used instruments	No	9	22.5	
	Yes	31	77.5	0.0001
	Total	40	100.0	
Safety boxes for disposal of used syringes and needles	Yes	40	100.0	0.0001
IPC guide in the ward (posters, manuals, etc.)	No	40	100.0	0.0001

Source: field observational study, 2019.

4.9.1.3 Observation IPC materials availability score and level

Their availability was measure on yes for available and no for unavailable. This was further coded (yes for 1 and no for 0) for SPSS entering and calculation of scores for IPC availability. The minimum score was 3.00 and the maximum score was 6.00, the average score was 5.20± 1.09.

The mean score of all observed scores was used to categorize IPC materials availability level into Available and unavailable. From the observation IPC materials were 57.5% available and 42.5% unavailable (P = 0.2635).

4.8.1.4 Observe IPC compliance

Five items of standard precaution were used in observing healthcare worker compliance to IPC. These standard precautions were: hand hygiene, wearing of gloves, wearing of facemask, use of apron or gown and sharps management. Each standard precaution item had questions which were all positively worded (except recapping under sharp management) of which yes which was the correct answer and was scored 1 and no incorrect answer was scored 0.

Change gloves between patients' contacts and never reuse disposable gloves were the most complied standard precaution observed (100%), and the least observed complied standard precaution was hand hygiene after contact with contaminated equipment or surfaces **(Table 4.15)**.

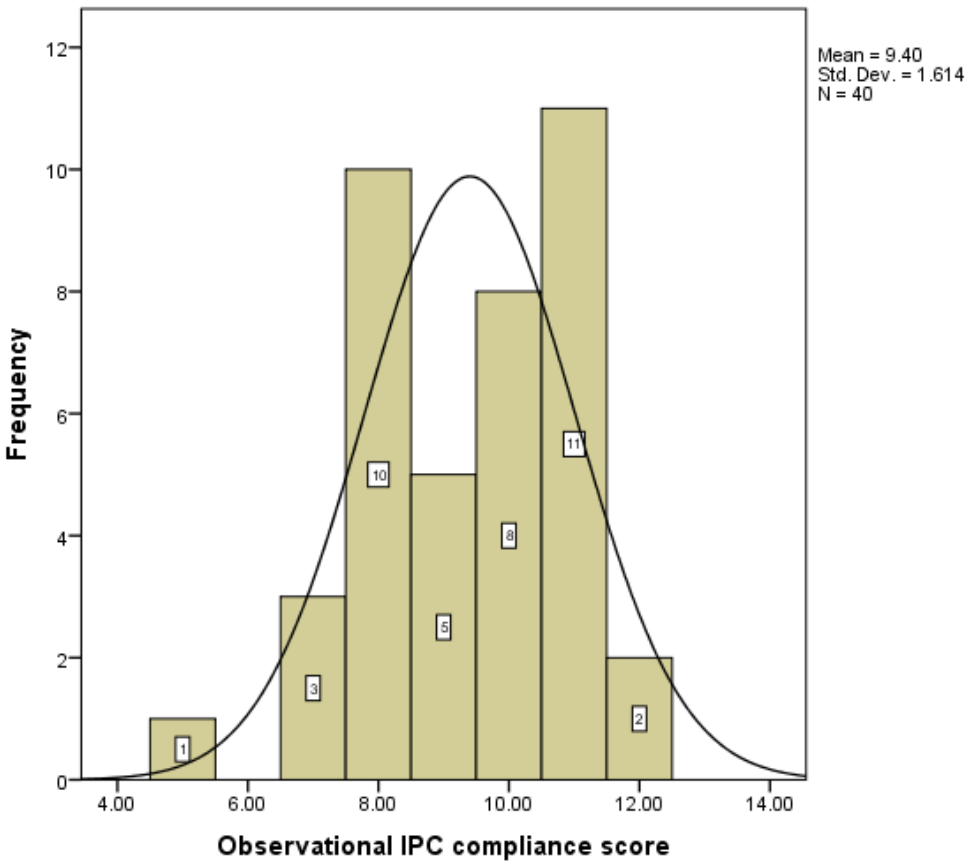
Table 4. 15. Observation on healthcare staffs towards compliance to standard precaution for IPC

		Frequency (n)	Percent (%)	*p* value
Hand hygiene				
On arrival at work	No	35	87.5	<0.0001
	Yes	5	12.5	
Before patient contact	No	35	87.5	<0.0001
	Yes	5	12.5	
After patient contact	No	7	17.5	<0.0001
	Yes	33	82.5	
After contact with contaminated equipment or surfaces	No	1	2.5	<0.0001
	Yes	39	97.5	
After wearing gloves	No	6	15.0	<0.0001
	Yes	34	85.0	
Gloves use				
Change gloves between patients contacts	Yes	40	100.0	<0.0001
Change gloves between different procedures on the same patient	No	11	27.5	<0.0001
	Yes	29	72.5	
Never reuse disposable gloves	Yes	40	100.0	<0.0001
Facemask use				
When dealing with patients' exposed wound	No	24	60.0	0.1170
	Yes	16	40.0	
Wear a facemask when undertaking procedures likely to generate splashes	No	10	25.0	<0.0001
	Yes	30	75.0	
Never reuse disposable nose mask	No	6	15.0	<0.0001
	Yes	34	85.0	
Apron or facemask use				
Wear gown/apron to protect skin/clothing when undertaking procedures likely to generate splashes	No	24	60.0	0.1170
	Yes	16	40.0	
Remove soiled /wet gown or apron as soon as possible	No	29	72.5	<0.0001
	Yes	11	27.5	
Sharps management				
Recapping	Yes	27	67.5	0.0030
	No	13	32.5	
Disposing of in safety box	No	9	22.5	<0.0001
	Yes	31	77.5	

Source: field observational study, 2019.

4.8.1.5 Observe IPC compliance score and level

The various scores for the various standard precautions were calculated for by summing scores for all questions under each standard precaution and summation of all score for all questions was the complete compliance towards IPC. The minimum score was 5.00 and maximum score 12.00, the mean score was 9.40± 1.61, the median and mode scores were 10.00 and 11.00 respectively **(Figure 4.6).**



Source: field observational study, 2019.

Figure 4. 6. Scores distribution for observed staff compliance towards IPC

The mean score (9.40± 1.61**)** was used as the cutoff point to categorize observes compliance level into poor and good. Out of the 40 staffs observed 21 (52.5%) did good complied with IPC and 19 (47.5%) did poor complied with IPC **(Table 4.16)**.

Table 4. 16. Observed healthcare workers compliance level towards IPC standard precaution

Standard precaution		Frequency (n)	Percent (%)	*p* values
Hand hygiene compliance level	Poor compliance with hand hygiene	12	30.0	0.0001
	Good compliance with hand hygiene	28	70.0	
	Total	40	100.0	
Glove use compliance level	Poor compliance with gloves use	11	27.5	
	Good compliance with gloves use	29	72.5	0.0001
	Total	40	100.0	
Facemask use compliance level	Poor compliance with facemask use	28	70.0	
	Good compliance with facemask use	12	30.0	0.0001
	Total	40	100.0	
Apron/gown use compliance level	Poor compliance with apron/gown use	23	57.5	0.2630
	Good compliance with apron/gown use	17	42.5	
	Total	40	100.0	
Sharps management compliance level	Poor compliance with sharps management	34	85.0	
	Good compliance with sharps management	6	15.0	0.0001
	Total	40	100.0	
Overall observed IPC compliance level	Poor overall IPC compliance	19	47.5	
	Good overall IPC compliance	21	52.5	0.8230
	Total	40	100.0	

Source: field observational study, 2019.

4.8.1.6 Observation of IPC compliance by occupational categories

On general observational performance, Orderlies had the highest mean score 9.83± 1.32, followed by the Doctors 9.57± 1.72 then Nurses 9.29± 1.79 and finally the Anesthetics' 9.17± 1.33.

On the observe compliance level Doctors had 57.1% and for the Anesthetics' and Orderlies only half (50.0%) of those observed complied with IPC **(Table 4.17)**. However, there observed IPC mean score variation was not evidenced significant among the occupational groups, F (3, 40) = 0.233, p = 0.873.

Table 4. 17. Occupation * Observed IPC compliance level Cross tabulation

		Observed IPC compliance level		Total	p values
		Poor	Good		
Occupation	Doctor	3	4	7	1.0000
		42.	57.1%	100.0%	
	Nurse	10	11	21	1.0000
		47.6%	52.4%	100.0%	
	Anesthetics'	3	3	6	1.0000
		50.0%	50.0%	100.0%	
	Orderly	3	3	6	1.0000
		50.0%	50.0%	100.0%	
Total		19	21	40	0.8230
		47.5%	52.5%	100.0%	

Source: field observational study, 2019.

4.8.2 Observation of operation room compliance to IPC

The total numbers of cases observed were 45 and the observational checklist used contained 24 questions and each question was coded 0 for no and 1 for yes. The sum total of all the correct answers for each case observed was the IPC compliance observed under that case. The variables that were observed with observations made are presented in **(Table 4.18).**

Table 4. 18. Operation room checklist variables and their response

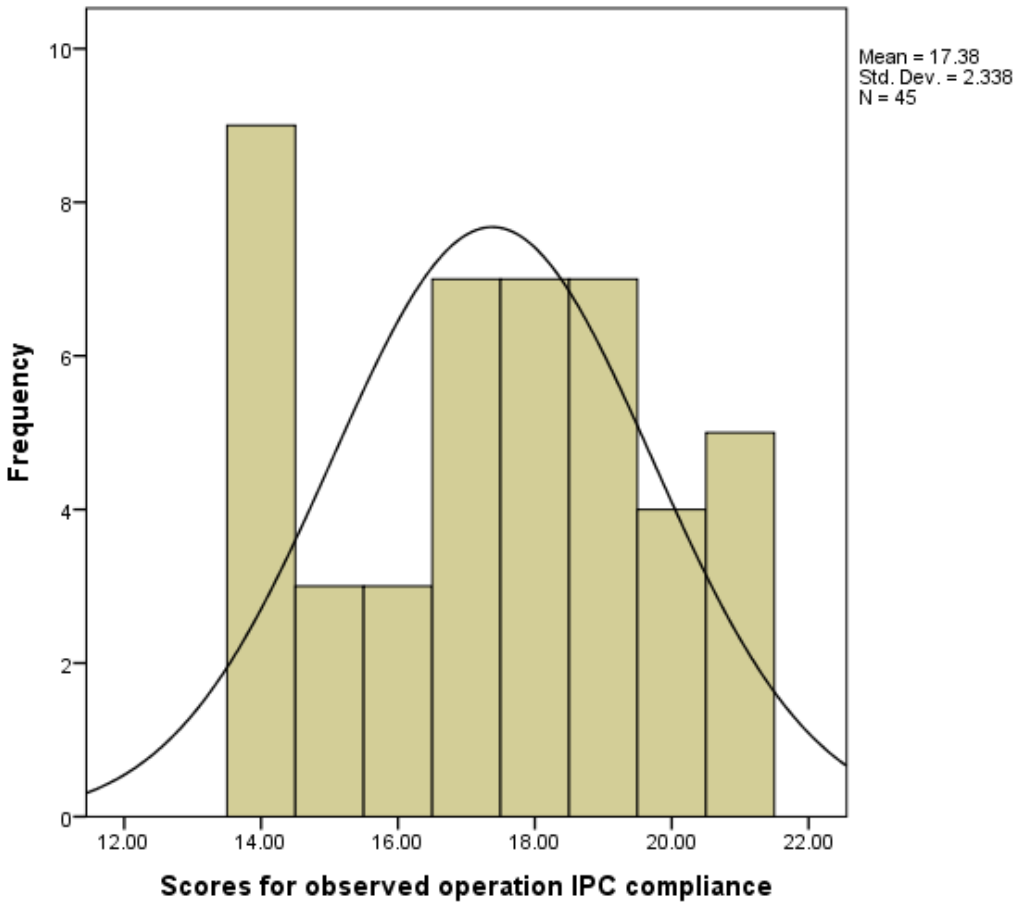
Operation room Variable	No	Yes	Total	*p*-values
Sterile items used before their expiry date	0	45	45	0.0000
All doors/hatch windows of operating rooms are well-sealed	20	25	45	0.3990
All areas & surfaces are clean, dry & dust free	2	43	45	0.0000
Scrub facilities are available & well located	21	24	45	0.6730
Hands scrub with an antiseptic detergent	0	45	45	0.0000
After performing the surgical scrub, keep hands up and away from the body (elbows in a flexed position)	1	44	45	0.0000
Scrubbed arms not touching objects	1	44	45	0.0000
Hands dried using a separate sterile towel for each hand.	18	27	45	0.0910
A poster demonstrating a good hand washing technique is available by at least one sinks	45	0	45	0.0000
Pre-operative hair removal if needed is to be done in the least possible skin area, as close as possible from operating time (not more than 2 hours).	9	36	45	0.0000
Pre-operative skin antisepsis is achieved by the use of the proper antiseptic and being left over the skin for spontaneous drying.	1	44	45	0.0000
A surgical mask is covering the mouth nose and beard when entering the operating room before and during operation	3	42	45	0.0000
Mask is worn throughout the operation by all.	3	42	45	0.0000
Dirty instruments and waste are properly handled and transported	0	45	45	0.0000
Single-use items are not reused	0	45	45	0.0000
Surgical instruments are not washed manually in the theatre.	45	0	45	0.0000
Only the required surgical team is present in the operating room.	18	27	45	0.0910
Telephones, supplies, charts are not touched with bloody	0	45	45	0.0000

gloves, new clean gloves should be used if needed				
The team does not remove surgical attire until the wound has been dressed and the risk of contact with bloody drapes had been eliminated	26	19	45	0.2050
Surgical attire is taken off, gloves are the first to be taken off, hands and forearms are washed.	10	35	45	0.0000
The team does not leave operating room with bloody shoe or gown	37	8	45	0.0000
Antibiotics administered during the operation	1	44	45	0.0000
Suitable operation room temperature	25	20	45	0.3990

Source: field observational study, 2019.

4.8.2.1 Observation of operation room IPC compliance score and level

The sum total of all the correct answers for each case observed was the IPC compliance observed score under each case. The maximum score was 21.00 and the minimum score was 14.00 with a score of 17.38± 2.34, the mode score was 14.00 and the median score was 18.00 **(Figure 4.7).**



Source: field observational study, 2019

Figure 4. 7. Scores distribution for observed IPC compliance in the operation room

The mean score of all cases was used to classified IPC compliance level of each case into Good or poor. Twenty-three (51.1%) of the case had good compliance as against twenty-two (48.9%) with respect to operation room IPC practice **(Table 4.19)**.

Table 4. 19. Cross-tabulation of type of operation and operation room compliance level

		Operation room compliance level			
		Low	High	Total	*p* value
Type of operation	Amputation	3 75.0%	1 25.0%	4 100.0%	0.4850
	Appendectomy	2 40.0%	3 60.0%	5 100.0%	1.0000
	Bladder repair	0 0.0%	1 100.0%	1 100.0%	1.0000
	Excision biopsy	1 33.3%	2 66.7%	3 100.0%	1.0000
	Exploratory laparotomy	9 64.3%	5 35.7%	14 100.0%	0.2560
	Hernia repair	7 53.8%	6 46.2%	13 100.0%	1.0000
	Secondary wound closure	0 0.0%	1 100.0%	1 100.0%	1.0000
	Skin craft	0 0.0%	3 100.0%	3 100.0%	0.1000
	Tube thoracostomy	0 0.0%	1 100.0%	1 100.0%	1.0000
Total		22 48.9%	23 51.1%	45 100.0%	1.0000

Source: field observational study, 2019.

It is obvious that out of the 45 cases observed 23 complied with IPC and 22 did not, **(Table 4.19).**

CHAPTER FIVE

DISCUSSION OF RESULTS

5.0 Introduction

This chapter contains a discussion of the study results. It involves a comparison of the results with other studies on IPC. This includes; demographic characteristic of respondents, knowledge of respondents on IPC, respondents' attitude towards IPC, availability of materials for IPC compliance, compliance of respondents towards IPC and observational studies for IPC compliance in the wards and in the operation room.

5.1 Demographic Characteristics

The use of standard operating manual and the adherence to the guidelines is an important step in preventing surgical site wound infection globally and in Ghana. Prolonged stay in the surgical ward due to wound infection contributes significantly to the financial burden of patients and their relatives, reduced productivity, prolong bed occupancy, and increased mortality. The effect of surgical site wound infection is thus of great concern to health workers (Alharbi et al., 2019).

The current study conducted at the surgical ward of the TTH found the respondents to be young with a mean age of 32.78± 6.17 years; many (65.4%) being males. Again, the majority (69.9%) were married. This differs from two previous studies conducted in southern Ghana where most of the participants were females (Kondor, 2018: Hayeh, 2012). For instance, Hayeh (2012), study at the La General Hospital in Accra found 71.4% of their study population to be females. Majority of the respondents' had tertiary education (91.0%) and

this is in line with Kondor, (2018) study where the majority (64.0%) of the respondents' also had tertiary education.

The study found that many of the participants were registered general nurses (68.6%), followed by practicing medical officers (14.1%), then Orderlies and certified registered Anaesthetics. Nurses were the highest respondents because nurses had the highest representation among the healthcare providers in the surgical department (from the report of 2017 TTH annual performance review).

The mean years of occupational work experience of respondents was 6.49 ± 5.32 years. Again, the mean duration of respondents' years of experience particularly in the surgical ward was 3.12 ± 3.00 years. However, the great majority (94.9%) had stayed for 9-years or less in the unit. This is in line with other previous publications (Kondor, 201; Hayeh, 2012).

5.2 Knowledge of Respondents' on IPC

The current study regarding IPC in the surgical ward of the TTH revealed a mean knowledge score among the healthcare of 7.39± 1.37, and that 50.64% of respondents were knowledgeable. These values are lower than the findings published in previous studies in Ghana and other West African Countries, (Kondor, 2018: Iliyasu, et al., 2016: Sha, 2015). For instance, Kondor study on IPC conducted in La General Hospital in Accra Ghana found that the great majority (97.0%) of the participants were knowledgeable (Kondor, 2018). Similarly, Iliyasu et al., (2016) in their study on knowledge and practices of infection control among healthcare workers in a Tertiary Referral Center in North-Western Nigeria, reported an overall high median knowledge of 70.0% (Iliyasu et al., 2016). A study on Infection Control Practice in the Operating Room: Staff Adherence to Existing Policies in a

Developing Country by Cawich et al., (2013), identified 81% of staffs with knowledge of infection control practices against 41% of them with compliance with IPC.

However, the proportion of the participants in the Tamale study who were knowledgeable was higher than the 20.3% reported in Trinidad and Tobago (Unakal et al., 2017). Going by KAP model by Bano et al,. (2013), healthcare providers in TTH are more likely to comply with IPC as compare to those in Unakal et al.,(2017) study.

In this study, 96.8%, of the respondents identified the hospital as the main source of nosocomial infection. They also agreed that all staffs and patients should be considered potentially infectious regardless of their diagnosis and knew how to prevent and control hospital-acquired infections. This is in line with Stubblefield (2016), that to confirm infection as nosocomial, the source of infection must be from the hospital and must be 48 hours after admission or 72 hours after discharge or up to 30 days after an operation.

Again the great majority (92.3%) agreed nosocomial infection can be transmitted by medical equipment such as syringes, needles, catheters, stethoscope, and thermometers, and that microbe organism are not destroyed by using clean water alone. This supports a study by Al-Khalidi, (2017), that nosocomial infections are acquired during healthcare delivery from patient or healthcare staff or through contaminated equipment's, instruments, hands, bed linen or air droplets.

In this study, 91.0% of the respondents knew that you cannot handle body fluids with bare hands if gloves are not available. The study found that 48.1% of the study population did not have idea with regards to presence or absence of an infection control team in the hospital. Furthermore, 78.8% were familiar with hospital-acquired infection prevention guidelines. This is lower as compare to Mukwato et al., (2008), which indicated 86.0% of respondents' having heard of infection prevention guidelines.

Less than average (46.2%) of the respondents' knew about the WHO '5 moments of hand hygiene. According to Mathur, (2011), the most efficient, easiest and least cost method of infection prevention in a healthcare setting is hand hygiene. And the five moments of hand hygiene by WHO is a proven tested approach, which is reasonable and user-friendly for hand hygiene in all healthcare setting that all healthcare must know (WHO, 2009).

In this study respondents' occupation had influence on IPC knowledge level (X^2(1, N = 156) = 17.26, p= 0.0010) with medium effect (ϕ = 0.33). There was significant mean knowledge score difference among the different occupational groups (F (3, 155) = 13.30, p = 0.0001). Doctors had the highest knowledge mean score of 7.91± 1.02, followed by Nurses 7.54± 1.33, then Anesthetics' 7.42± .90 and Orderly 5.53± 0.92. This is in line with the findings of the previous study among students of different health occupational groups in Ghana, which indicated different knowledge score among the study participants; medical students had a mean score of 70.58 ± 0.62, next was physiotherapy students 65.02 ± 2.07, then radiography students 64.74 ± 1.19 and nursing students 61.31 ± 2.35 (Bello et al., 2011).

Even though Doctors had the highest Knowledge mean score, Nurses had the highest (57.0%) number of them Knowledgeable with regards to IPC, followed by the Doctors (54.5%), then the Anesthetics' (50.0%) and all the participated Orderlies scored below the average IPC knowledge score of all the respondents. This result was quite different from another study in Nigeria, where a good proportion of Doctors (75.0%) had good knowledge score, followed by laboratory personnel (63.6%), then Nurses (46.6%) and finally the Orderlies (6.7%) (Alice et al., 2013).

Also, there was significant association between educational level (X^2(1, N = 156) = 15.78, p = 0.0000) with medium effect (ϕ = 0.32) and respondents' IPC knowledge level. This is similar to a study in Ethiopia, which had an education status association with IPC knowledge (Desta

et al., 2018). This, however, differs from a study that found no significant association between respondents' education level and IPC knowledge level (Shrestha et al., 2018).

The mean knowledge score difference among respondents with different educational was statistically significant (F (1, 155) = 36.17, p = 0.001). In this study, respondents' with tertiary education had higher knowledge mean score (7.58± 1.26) than those without tertiary education (5.50± .94). The study also found a significant association between respondents' marital status and their IPC knowledge level (X^2(1, N = 156) = 4.68, p = 0.0300) with small effect (ϕ = 0.17). This is in line with Desta et al., (2018) study which indicated associated between marital status, educational level, and IPC knowledge level. However, IPC knowledge scores difference was not statistically significant with regards to respondents' marital status(F (1, 155) = 4.11, p = 0.1380); the mean IPC knowledge score was 7.28± 1.40 for the respondents' who were married and 7.64± 1.26 those single. Majority of those married (60 out of 109) were not knowledgeable and the majority of those singled were knowledgeable (30 out of 47).

Finally, age of respondents in years had negative Pearson correlation with IPC knowledge score (r (156) = -0.17, p = 0.0340), this means that as the healthcare worker becomes older the lower the IPC knowledge score. This is not in line with Iliyasu et al., (2016) study which indicated no association between age and IPC knowledge. However, the other continuous demographic variable such as years of occupational experience and duration of work in the surgical depart did not share a significant association with knowledge score.

5.3 Respondents' Attitude towards IPC

Among the study variables for attitude towards IPC, the following had most correct response; 97.4% of the respondents agree to have to wash hands even after gloves use, 96.8% agreed

that policies and procedures for infection control should be adhered to at all times, 96.2%agree to attend in-service training/workshop related to infection prevention and control regularly. This is required because Desta et al. (2018) identified a significant association between in-service training and IPC practice.

The great majority of the respondent believed following infection prevention guidelines will reduce nosocomial infection as Desta et al. (2018) identified a significant association between adherence to infection prevention guidelines and IPC practice. Similarly, 92.9% of the respondents agree it is their responsibility to comply with IPC guidelines and procedure guidelines of their unit. Healthcare providers must comply with IPC guidelines (MOH, 2015).

The least performed attitude variable was of the belief that the workload affects their ability to apply infection prevention guidelines. Approximately, 41.0% agreed that workload affects their ability to comply with IPC guidelines while 5.8% were indifferent. This differs from the findings of Kondor, (2018) study who reported that time constraint contributed 66.4% to noncompliance towards IPC.

The mean score of all respondents on attitude was 5.61± 2.37; 86 (55.1%) of them had a good attitude and 70 (44.9%) had a poor attitude. There is a need for improvement since one of the strongest pillars of IPC compliance is a positive or good attitude towards IPC (Gulilat et al., 2014).

A similar study among student Nurses and their mentors revealed a negative attitude of students towards IPC and the major cause of this negative attitude was their perception that IPC is additional workload as opposed to an important aspect of safety and quality healthcare (Ward, 2012). A qualitative study by Travers et al., (2015), revealed that; language/culture, knowledge/training, per-diem/part-time staff, workload and accountability were barriers to IPC compliance by Nurses and recommended increase staffing as one of the solutions.

Healthcare facility bed occupancy exceeding the standard capacity of the health facility is associated with increased risk of nosocomial infection and this is complicated with inadequate healthcare providers (WHO, 2018).

A study by Unakal et al., (2017) in three hospitals in Trinidad and Tobago indicated attitude level of 53.3% which is translated to practice level of 56.0% of infection prevention and control, a sign that attitude has influence over the practice.

In Gulilat et al., (2014) study on Assessment of knowledge, attitude and practice of health care workers on infection prevention in health institution in Bahir Dar city administration; attitude score of 55.6% translated to almost the same practice of 54.2%.

The Chi-square analysis of attitude level of respondents and respondents' demographic characteristics identified occupation to be associated with attitude level ($X^2(3, N = 156) = 7.92, p = 0.0480$) with medium effect (V = 0.23).

However, there was statistical evidence of significant IPC attitude mean score variation among the occupational groups (F (3,155) = 3.12, p = 0.0280). Nurses had the highest mean score of 5.92± 2.0, followed by Doctors 5.50± 1.44, then Anesthetics' 5.00± 2.62 and finally Orderlies 4.07± 4.57. Majority of Nurses (62.6%) had a good attitude towards IPC, next to them were Doctors with 40.9 percent of them having a good attitude, then orderlies with 40 percent of them with good attitude towards IPC and lastly the Anesthetics' with only 33.3 percent of them with good attitude towards IPC. This is a similar result as compared to a study by McGaw et al., (2012) in West Indies, Jamaica, which indicates overall higher attitude (p = 0.0010) towards IPC by Nurses than Doctors.

5.4 Availability of Materials for IPC Compliance

According to WHO (2004) practical guidelines on infection control in healthcare facilities, the role of providing IPC materials in a healthcare facility is on the administrators of the healthcare facilities. The problem of healthcare worker exposure to blood-borne pathogens like HIV and hepatitis B while caring for patients is on increase in both developed and developing countries due to inadequate IPC resources (Ojulong et al, 2013).

In this current study at the TTH, approximately 78.9% of respondents indicated that IPC material was not always available. This is very bad since compliance with infection prevention will be positive relative to the availability of IPC materials. This is low as compared to a similar study in La General Hospital, which indicated (31.4%) availability of IPC materials (soap, water, and towel) for healthcare care workers to comply with IPC (Kondor, 2018).

According to the 59.0% of the respondents', sterile items were always available, 79.0% said hand washing items were always available, 24.0% said hand sanitizer was always available, 74.0% said hand gloves were always available, 39.0% said PPE were always available, 73.0% said detergent for instrument decontamination were always available, 82.0% said safety box was always available, 24.0% said in-service training was always available, 32.0% said hospital monitoring of SSI is always available, 25.0% said hospital monitoring of staff adherence to IPC was always available and 20.0% said hospital feedback to staff on SSI was always available.

5.5 Compliance towards IPC

The most important problem in the healthcare system is an infection. Most morbidities, mortalities related to clinical, diagnostic and therapeutic procedures are related to infection

and the solution is good compliance toward IPC (Alharbi et al., 2019). This study was to identify healthcare providers' compliance level in surgical department towards IPC.

Compliance to IPC standard precautions was used to measure respondents' IPC compliance level. According to MOH (2015), standard precaution is the baseline for infection prevention and control and this base on the assumption that all body fluids, blood, secretions, excretions (such as sweats), open skin and mucous membrane are sources for infection. Standard precaution is applied to all patients irrespective of their diagnosis. The standard precautions studied in this study were: hand hygiene, gloves use, facemask use, sharps management, and an apron or gown use.

On hand hygiene, less than half of the total respondents had good compliance 77 (49.4%) against 79 (50.6%) who had poor compliance. This is low compared to Randle et al. (2014) observational study of hand hygiene adherence following the introduction of an education intervention. Randle et al found that educational program on hand hygiene is a good predictor of hand hygiene practice among healthcare workers. There was increase adherence to hand hygiene practice from the baseline of 53.0% post educational intervention to 67.7% for point 2 observation and 70.8% for point 3 observation.

A good number (71.2%) of the respondents had good compliance with gloves use while 45 (28.8%) had poor compliance. MOH (2015) National Policy and Guidelines for Infection Prevention and Control in Health Care facilities recommends the following: gloves should be used when touching body fluids and mucous membrane of patients (in the study there was 96.2% compliance with this), gloves should be changed between patients (compliance was 97.4% compliance with this in the study) or between different procedures on the same patient (this was the least complied activity for gloves used in the study, 77.6%) and gloves should be disposed immediately without reuse (96.8% complied to this in the study).

The respondents' compliance levels were the same for facemask use and an apron/gown use; 115 (73.7%) for good compliance and 41 (26.3%) for poor compliance. The least complied standard precaution was sharps management, 49 (31.4%) for good compliance and 107 (68.6%) for poor compliance. Majority of the respondents (67.5%) practiced recapping which is against CDC current recommended guidelines for sharps management (CDC, 2012).

On the overall IPC compliance level among the respondents', 91 (58.3%) of them had good compliance and 65 (41.7%) of had poor compliance.

The IPC compliance in this is study was higher compared to a similar study in La General Hospital in Ghana which was low (30.7%) (Kondor, 2018) but lower as compared to a similar study in Wolaitta Sodo Otona Teaching and Referral Hospital Ethiopia, where IPC practice was 60.5% (Hussen et al., 2017).

There was significant association between respondents' occupation and IPC compliance level (X^2(3, N = 156) =39.03, p = 0.0000) with large effect, (V = 0.50). Compliance score variation among occupational groups was statistical significant, F (3,155) = 12.58, P = 0.0001. Again Nurses had the highest mean score of 17.26± 2.08, followed by Doctors 15.68± 2.25, then Anesthetics' 15.58± 2.81 and finally Orderlies 14.07± 1.83. A similar study in India indicated practice mean score to be higher among Nurses than Doctors (Kapil et al., 2013).

Greater number of Nurses (73.8) had good compliance, 36.4% of Doctors had good compliance towards IPC, and 33.3 percent of Anesthetics' had good compliance and all Orderly scored below the cutoff point to be categorized as having good compliance towards IPC. This is in line with a study by Alice et al. (2013), in Nigeria, where IPC compliance was significantly related to the occupation of the healthcare worker (p =0.00); with IPC practice being highest among the Nurses than the other professional groups. The good proportion of

Nurses (61.4%) had good standard precaution practice, followed by laboratory personnel (55.9%), then the Doctors (29.2%) and finally the orderlies (28.6%).

Contrary to the results of this study is that by Iliyasu et al., (2016), who did not find any association between occupation and IPC practice.

Also, there was significant association between respondents' educational level and IPC compliance level, ($X^2(1, N = 156) = 21.53$, $p = 0.0000$) with medium effect ($\phi = 0.37$). There was higher IPC compliance mean score among those with tertiary education (16.86± 2.27) than those without tertiary education (14.00± 1.88), ($F(1,155) = 20.80$, $P = 0.0010$). Among those with tertiary education (142), only 91 had good compliance toward IPC and all those without tertiary had poor compliance towards IPC. A similar study by Desta et al. (2018) identified a significant association between higher educational status and IPC practice.

Finally, the demographic characteristics that was associated with IPC compliance was age group ($X^2(2, N = 156) = 9.50$, $p = 0.0090$) with medium effect ($V = .247$). To meet the Chi-square analysis expected cells counts, the age groups; 40-49 and 50-59 years were re-coded into 40-59 years. 44 of those within 30-39 years had good IPC compliance, then 12 respondents within 20-29 year and finally 6 for the age group 40-59 years. A similar study by Desta, et al. (2018) identified a significant association between older age and IPC practice.

There was significant evidence of association between IPC materials availability level and IPC compliance level, ($X^2(1, N = 156) = 18.76$, $p = 0.0000$) with medium effect ($V = 0.35$). In a similar a study in Ethiopia, availability of IPC materials was significantly associated with IPC practice (Desta et al., 2018).

There was also evidence of significant association between knowledge level and IPC compliance level ($X^2(1, N = 156) = 14.98$, $p = 0.0000$) with medium effect ($\phi = 0.31$). A

literature review of ten articles on IPC compliance by healthcare workers identified compliance was low and the major predictor was a low level of knowledge (Al-Mahdali, 2015). Equally, a study Ethiopia by Desta et al. (2018) identified a significant association between in-service training and IPC practice.

Infection prevention and control education and training should be directed towards all categories of healthcare staffs (MOH, 2015). All healthcare workers must have adequate knowledge with regards to the mode of infection transmission and various ways of breaking infection circle including knowledge on hand washing techniques and the use of personal protective equipment such as gloves, gowns, mask, face shield, goggles, headgear, boots, rubber aprons, etc.

Attitude level and compliance level ($X^2(1, N = 156) = 6.54$, $p = 0.0110$) with small effect ($\phi = 0.21$) were also found associated significantly. This is confirmed by a similar study in Ethiopia, where a positive attitude towards IPC guidelines was significantly associated with the availability of IPC materials (Desta et al., 2018).

To identify IPC compliance predictor variables in this study, the variables that were associated with IPC compliance in the two-variable analysis was put into multiple variable analysis using binary logistics regression model. The variables with a significant association with IPC compliance during the bivariate analysis were: age, educational level, occupation, knowledge level of IPC, attitude towards IPC and availability of IPC material.

After the analysis, the statistically significant variables were three and the highest predictor was IPC materials availability level, comparing IPC materials sometimes available to not always available, (AOR = 7.630, 95% C.I. = 1.285 – 45.312). This means that the healthcare providers with IPC materials sometimes available to them are 663% more likely to comply with IPC 630% as compared to those not always having IPC material available to them. This

confirms a study in Ethiopia by Desta et al., (2018) where healthcare providers who get IPC materials such as soap, mask and infection prevention guidelines were more likely to practice IPC compare to those without these materials, (AOR = 2.156, 95%. CI = [1.90–4.357]).

Also, the occupation of healthcare provider was also a predictor, comparing Nurses to Doctors, (AOR = 5.511, 95% C.I. =1.700 - 17.863). This means that Nurses are 451.1% more likely to comply with IPC as compare to Doctors. This is contrary to Kondor (2018), study where the occupation of the healthcare provider did not predict IPC compliance, comparing doctors to nurses (p = 0.683).

Finally, age group, comparing the age groups (30-39 years) to (20-29 years), (AOR = .310, 95% C.I. = .117 - .821). This means that the healthcare providers within the age group 30-39 years are 69% less likely to comply with IPC as compare to healthcare providers with the age group 20 – 39 years. This is opposite to a similar study in Ethiopia by Desta et al., (2018) were those aged 31 years above were more likely (two times) to compile with IPC as compare to those age 21-25 years, (AOR = 2.04,95%, CI = [1.279–4.5793]).

5.6 Observation for Staff Compliance towards IPC in the Ward

The observation checklist composed of observation for IPC materials in the ward and observation of staff performance of duty with IPC compliance.

5.6.1 Observation of IPC materials availability

The IPC materials that were observed for their availability were: sterile items for wound dressing (e.g. gauze, lotion, etc.), hand washing items e.g. water, soap, sterile gloves on the ward, Personal protective equipment for use on the ward, detergents for decontamination of used instruments. Safety boxes for disposal of used syringes and needles and IPC guides in the ward (posters, manuals, etc.). From the observation there was 100 percent availability of

sterile items for wound dressing (e.g. gloves, gauze, lotion, etc.) even though sterile forceps were observed not always available, instead sterile gloves for wound dressing were observed almost always available and according to the survey the respondents' 46.2% indicated always, 46.2% for sometimes available and 7.7% indicated not always available.

And regarding safety boxes for sharps disposal, the standard safety boxes were not observed always available but improvised safety boxes (hard to puncture gallons) were observed always available. The galloons even though not standard but at least will serve some purpose of IPC practice according to CDC (2012), that needles should never be recap and bend and should be discarded into puncture-resistant sharps containers since these activities will reduce the risk of the needle stick. And this explained why the respondents' in the survey responded 71.8% for safety boxes always available 20.5% for sometimes available and 7.7% for not always available.

The availability of IPC guide in the ward (posters, manuals, etc.) was 0 percent; there was no single manual on IPC observed available and not posters on IPC observed. This is against MOH, (2015) guidelines on IPC compliance that management of health facilities must make available posters and manuals on IPC for healthcare workers use.

Hand washing items e.g. water, soap was mostly observed available 92.5% and in the survey, 79% said handwashing items were always available.

Personal protective equipment's such as boots waterproof aprons etc. for use on the ward were 62.5% available (mostly in the theatre but were mostly unavailable in the wards). In the studied survey results there was 60.9% always availability of handwashing items, 35% sometimes available and 3.2% not always available.

On overall average score for the availability of IPC materials on observation was 5.20± 1.09 out a maximum score of 6.

5.6.2 Observation of staff compliance with IPC

In all forty healthcare workers were observed and among them 25 were males and 15 were female. In terms of the occupational category, Doctors were 7, Nurses were 21, 6 were Anesthetics' and 6 were orderlies.

The overall compliance 52.5% of the observed staffs did comply with IPC and 47.5 percent did not even though more than average this lower to the survey result (58.3%). Majority (57.1%) of doctors observed had good compliance, then nurses (52.4%) and 50.0% for both Anaesthetics and orderlies. This is not in line with an observational study by Randle et al., (2010), which results indicated compliance level high for allied health professionals (78%), then Nurses (75%) and doctors (47%).

5.7 Observation of operation room compliance to IPC

Theatre operation room compliance to IPC is of greater importance due to the vulnerability of patients who are highly exposed to infection due to the invasive nature of the procedures. It therefore very important to maintain standard precaution since compliance with IPC is the key to reducing the risk of postoperative infection in patients (Aziz, 2014).

The total numbers of cases observed were 45 and the number of items studied here was 24. Twenty-three (51.1%) of the case observed had good compliance as against twenty-two (48.9%) with respect to operation room IPC practice.

In almost 43 (95.6%) all the cases observed, all areas and surfaces were clean and dry and according to Spagnolo et al., (2013), the state of the operation theatre has a great influence on the rate of SSI, the floor of the operating room must be clean and dry. Meanwhile, the doors

of the operating were not well closed in 20 (44.4%) of the cases observed due to the nature of some of the doors and frequent movement in and out of the operating theatre. These movements were mostly necessitated due to unavailability of the necessary items in an operating room at a time and this lead unnecessary movement members in 26.7% of the cases observed.

In 55.6% of cases, the air conditions in the operating theatre were not functional, making the room warm. The quality of ventilation, humidity, and temperature of the operating room are influential in controlling SSI (Spagnolo et al., 2013).

In all the cases observed, sterile items were used before their expiry date and single-use item were not re-used, and this is welcomed because expired medical items are toxic medical waste and can be very harmful when used on the patient (MOH, 2015).

Antibiotics were administered in 97.8% of cases observed. A study by AlBuhairan, Hind, & Hutchinson, (2008) proved that intra-operation antibiotics used reduced SSI by 80.0%. But unnecessary antibiotics used in post-surgery need to be avoided to avoid antibiotic resistance but standard wound dressing and monitoring must be ensured (WHO, 2016).

When it came to surgical hand scrubbing, even though sinks for hand scrubbing were well located at each operation room, in 46.7% of the cases observed their taps for handwashing were not functional and there was no single poster demonstrating hand scrubbing technique. In all the cases observed hand scrubbing was done using antiseptic soap and mostly (97.8%) hands were kept up and did not touch objects and in 40.0% of the case, sterile towels were not used for hand drying. The purpose of surgical hand scrubbing is to prevent post-surgery SSI by reducing contamination during surgery (Brewster, 2019).

Surgical skin preparation is very key in preventing SSI because the patient skin cannot be sterilized. There is the need for skin preparation to remove all debris and suppress microbe growth during operation (MOH, 2015: Caruthers et al., 2008). This was achieved in this observational study where pre-operative hair removal was done in 80 percent of the cases and this is was dependent on the type of case and in almost (97.8%) all the cases observed skin preparation was done using savlon and methylated spirit. Only areas that hair could interfere with the procedure were removed.

There was better face mask use practice as a surgical masks were worn when entering the operation room in 93.3% of the cases observed. In 100% of the cases, none of the operating team members did touch telephone, chart, or anything unsterile item with their bloody gloves. The surgical mask does not only minimize contamination of sterile area but protects the healthcare provider mouth and nose from sprays, droplets, and splashes (MOH, 2015).

It was observed that in 82.2% of the cases the surgical team left the operation room with bloody boots. This has a negative impact on IPC compliance in the surgical theatre since this will lead to cross-contamination and give the cleaner extra job to do.

After each operation, in all the case used instrument was properly transported and washed manually. The best method for washing surgical instruments is ultrasonic cleaning, which is 16 times more effective as compared to manual cleaning only (Sharn, 2009).

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

6.0 Introduction

This chapter is comprised of three sections. The first section is about the summary of findings from the study in relation to demographic characteristics of respondents' and the set objectives. The second section gives the conclusions and the last section suggests recommendations.

6.1 Summary of Findings

6.1.1 Demographic Characteristics of Respondents'

An examination of the demographic characteristics of the people showed that there were more male respondents (65.4%) as compared to their female counterpart. The ages of respondents were between 21 to 58 years, the average age of respondents was 32.78± 6.17 and the most frequent age was 30. Among the respondents' majority were married and the rest were single. On educational level majority (91.0%) of the respondents' had tertiary education, 5.1% had secondary education and 3.8% had primary education.

On respondents' type of occupation majority (68.6%) were Nurses, 14.1% were Doctors, 9.6% were Orderlies and 7.7% were Anesthetics'. The years of occupational work experience of respondents was between 0.5 to 31 years, the mean 6.49± 5.32. Among the respondents, the maximum years of experience in the surgical department were 25 years and the minimum was 0.5 years. The mean years of respondents' experience in the surgical depart was 3.12± 3.00.

Among the staffs observed under the observational studies, 25 were males and 15 were female. In terms of occupational category, Doctors were 7, Nurses were 21, 6 were Anesthetics' and 6 were Orderlies.

6.1.2 The Knowledge level of respondents' on IPC

The mean IPC knowledge score of all respondents was 7.39± 1.37. Seventy-nine (50.6%) of respondents were Knowledgeable with regards to IPC while seventy-seven (49.4%) were not knowledgeable with regards to IPC.

The factor identified to be statistically associated with IPC knowledge were: age, educational level, marital status, and occupation.

Doctors had the highest knowledge mean score 7.91± 1.02, followed by Nurses 7.54± 1.33, then Anesthetics' 7.42± 0.90 and finally Orderly 5.53± 0.92.

Even though Doctors had the highest average IPC knowledge score, Nurses had the highest (57.0%) number of them Knowledgeable with regards to IPC, followed by the Doctors (54.5%), then the Anesthetics' (50.0%) and all the participated Orderlies scored below the average IPC knowledge score of all the respondents.

6.1.3 The Attitude level of respondents' on IPC

The mean attitude score of all respondents was (5.61± 2.37), a good number of the respondents 55.1% had a good attitude and the remaining poor attitude toward IPC.

Nurses had the highest mean score 5.92± 2.01, followed by Doctors 5.50± 1.44, then Anesthetics' 5.00± 2.62) and finally Orderlies 4.07± 4.57.

Majority of Nurses (62.6%) had a good attitude towards IPC, next to them were Doctors with 40.9 percent of them having a good attitude, then orderlies with 40.0% of them with good

attitude towards IPC and lastly the Anesthetics' with only 33.3% of them with good attitude towards IPC.

6.1.4 The availability of IPC Materials

In overall the majority of respondents' (78.9%) responded IPC material not always available, 6.4% responded their sometimes available and 14.7% responded they are always available.

The least reliable available IPC materials were: hand sanitizer, Personal protective equipment, in-service training on IPC, hospital monitoring and feedback on SSI and IPC. And more average reliable available IPC materials were: sterile items for wound dressing, hand washing items, hand gloves, detergents for decontamination of instruments and safety boxes.

From the observational study, except for IPC guide in the ward (posters, manuals, etc.), the following were almost always available: sterile items for wound dressing, gloves, detergents, safety boxes, and hand washing items. Personal protective equipment was always available in the surgical theatres but not in the wards.

6.1.5 Compliance towards IPC

The overall compliance score on IPC was 16.60± 2.38, among the respondents' 91 (58.3%) had good compliance and 65 (41.7%) had poor compliance.

The factor identified to be statistically associated with IPC compliance level at the bivariate analysis stage were age, educational level, occupation, IPC knowledge level, IPC attitude level, and IPC materials availability level. And at the multivariate analysis state age, occupation and IPC material availability level were associated with compliance with statistical significance.

On IPC compliance score Nurses had the highest score 17.26± 2.08, followed by Doctors 15.68± 2.25, then Anesthetics' 15.58± 2.81 and finally Orderlies 14.07± 1.83.

Greater number of Nurses (73.8) had good compliance, 36.4% of Doctors had good compliance towards IPC, and 33.3% of Anesthetics' had good compliance and all Orderly scored below the cutoff point to be categorized as having good compliance towards IPC.

6.1.6 Observational study

From the observation the average score for IPC compliance was 9.40± 1.61, the minimum score was 12.00 and the maximum score was 9.00. Out of the 40 staffs observed 21 (52.5%) did good complied with IPC and 19 (47.5%) did poor complied with IPC.

Among the standard precautions observed, there was 70.0% good compliance for hand hygiene, 72.5% for glove use, 42.5% for apron or gown use, 30.0% for face mask use and 15.0% for sharps management.

6.2 Conclusion

This study revealed more than half of the healthcare providers were knowledgeable about IPC, majority of Nurses compare to the other professional groups were more knowledgeable and most of the Orderlies were not knowledgeable.

Also, more than 50.0% of the respondents reported good attitude towards IPC, again the majority of Nurses compare to the other professional groups had a good attitude towards IPC and those with a least good attitude toward IPC were Anaesthetics.

Similarly, IPC compliance was good with more than 50.0% of respondents reporting good compliance level. Majority of Nurses compare to the other professional groups had good IPC compliance and none of the Orderlies showed good compliance level. The identified

predictors of compliance were the availability of IPC materials, occupation of respondents and age of the respondents'.

With the observational study, IPC compliance level was good among more than half the staffs and cases observed.

6.3 Recommendations

Tamale Teaching Hospital

The management of TTH needs to set up a very active and functional Infection prevention and control committee. This is to help monitor staff compliance with IPC and monitor the state of nosocomial infections in the hospital.

Special training on infection control must be organized for Orderlies of the hospital especially those in the surgical department.

Regular workshops and refresher courses should be organized by management for staffs, especially new staffs.

Management must make available to staffs IPC materials, such as manuals and posters, personal protective equipment, etc. for IPC compliance.

Ministry of Health

The ministry of health must ensure health facilities compliance with IPC by setting a monitoring team that will monitor to ascertain if the management of healthcare facilities are supplying the needed IPC materials and if the staffs are complying with IPC.

The ministry must enforce IPC training is included in all health programs curriculum.

Researchers

Further research on an observational study on barriers to healthcare workers compliance to IPC.

There must be research in other departments of the hospital to find out the incidence and prevalence of hospital-acquired infection.

6.4 Limitations of the Study

Even though the data collection was done by the researcher himself who is a health professional with knowledge on IPC using questionnaires and observational checklist and applying adequate sample size according to the standard sample size determination table. Some of the limitations engulf with this study were: time and financial constraint for the observational study, which should be the best tool to assess IPC compliance among the healthcare providers. Since it was difficult to observe all the understudied standard precautions for IPC compliance in one staff under one shift hence more time and finance was needed for an adequate sample and not the limited 40 staffs observed.

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APPENDIX

Study Survey Questionnaire

UNIVERSITY FOR DEVELOPMENT STUDIES

Graduate School

Department of Community Health and Family Medicine

Name: Abdul Rauf Alhassan

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Tamale

Our Ref:

Your Ref:

QUESTIONNAIRE

TITLE: INFECTION PREVENTION AND CONTROL PRACTICES AMONG HEALTHCARE WORKERS AT SURGICAL DEPARTMENT OF TAMALE TEACHING HOSPITAL

BY: ABDUL RAUF ALHASSAN

RESPONDENT ID NO: .....

DATE: .....

Invitation/informed consent

I am a student from above school and wish to invite you to participate in this study, on the topic: **Infection Prevention and Control Practices among Healthcare Worker the s at the Surgical Department of Tamale Teaching Hospital**. This study is in partial fulfillment of the requirements for the award of Master of Public Health (MPH). Your involvement requires you to provide answers to questions concerning infection prevention and control (IPC).

You would be involved in the study for not more than 20 minutes. Any information you provide will strictly be confidential. Participation is voluntary, you can withdraw at any point in time should you decide to do so without any consequences. However, I hope that you participate in this study since your views are relevant. Please tick or write in the spaces provided to answer the following questions (guided by WHO CDC and Ghana guidelines for IPC).

Do you agree to be part of this study?

Yes……. (Signature) Questionnaire ID No……

No …….. (Then stop)

Thank you

SECTION (A) - DEMOGRAPHY

1. Sex: 1) male [ ] 2) female [ ]
2. Age in years ……..
3. Marital status: 1) married [ ] 2) single [ ]
4. Education: 1) Not educated[ ] 2) Primary[ ] 3) Secondary[ ] 4) Tertiary [ ]
5. Occupation: 1)Doctor[ ] 2)Nurse [ ] 3) Anesthetics[ ] 4) Orderly [ ]
6. Years / months of experience in this occupation……
7. Years / months of experience in the surgical department……

	SECTION B – KNOWLEDGE LEVEL (KNL)	YES (2)	NO (1)
1	Hospital is a source of nosocomial infection.		
2	Nosocomial infection can be transmitted by medical equipment such as syringes, needles, catheters, stethoscope, thermometers, etc.		
3	All staffs and patients should be considered potentially infectious regardless of their diagnosis.		
4	Do you know how to prevent and control hospital-acquired infections?		
5	Are you familiar with hospital-acquired infection prevention guidelines		
6	There is no infection control team the in the hospital		
7	Microbe organisms are not destroyed by using clean water		

	alone.		
8	Do you know WHO has '5 moments of hand hygiene?		
9	You cannot handle body fluids with bare hands if gloves are not available.		

	SECTION C – ATTITUDES LEVEL (ATTL)	**DISAGREE (1)**	**N/A (2)**	**AGREE (3)**
1	I have to wash my hands even if I used gloves			
2	Policies and procedures for infection control should be adhered to at all times			
3	I should attend in-service training/workshop related to infection prevention and control regularly			
4	The workload does not affect my ability to apply infection prevention guidelines.			
5	It is my responsibility to comply with the hospital-acquired infection guidelines.			
6	I believe that following the prevention guidelines will reduce rates of hospital-acquired infection			
7	I have to follow the procedural guidelines of the unit.			

	SECTION D - COMPLIANCE LEVEL (CPL)		
	When do you usually do hand hygiene?	**YES (2)**	**NO (1)**
1	On arrival at work		
2	Before patient contact		
3	After patient contact		
4	After contact with contaminated equipment or surfaces		
5	Before wearing gloves		
6	After wearing gloves		
	Gloves use	**YES**	**NO**
1	Use when touching blood or other body fluid or mucous membrane		
2	Change gloves between patients contacts		
3	Change gloves between different procedures on the same patient		
4	Never reuse disposable gloves		
	Face mask use	**YES**	**NO**
1	When dealing with patients' exposed wound		
2	Wear a facemask when undertaking procedures likely to generate splashes		
3	Wear nose mask when working within 1-2metres of patients with expectoration		
4	Never reuse disposable nose mask		
	Gown/apron use	**YES**	**NO**
1	Wear impermeable gown/apron		
2	Wear gown/apron to protect skin/clothing when undertaking procedures		

	likely to generate splashes		
3	Remove soiled /wet gown or apron as soon as possible.		
a	Never reuse a disposable gown.		
	Sharps management is	**YES**	**NO**
1	Recapping		
2	Detaching needle off and disposing of in safety box		

	SECTION E – AVAILABILITY AND ACCESSIBILITY OF IPC MATERIALS			
	How available and accessible are the following :	**Always available (1)**	**Sometimes available (2)**	**Not always available (3)**
1	Sterile items for wound dressing e.g. gloves, gauze, lotion, etc.			
2	Hand washing items e.g. water, soap			
3	Hand sanitizers			
4	Gloves on the ward			
5	Personal protective equipment's for use on the ward e.g. boots, goggles, aprons			
6	Detergents for decontamination of used instruments			
7	Safety boxes for disposal of used syringes and needles			
8	In-service training/workshop related to infection			

	prevention and control			
9	Hospital monitoring of surgical site infection			
10	Hospital monitoring of staffs the adherence to the prevention of surgical site infection			
11	Hospital feedback to health staff on surgical site infection report			

Observational Study Checklist

OBSERVATIONAL CHECKLIST

Date: ..... **Respondent Id No: .....**

Section (A) - Demography

1. Sex: 1) male [ ] 2) female [ ]
2. Occupation: 1)Doctor[ ] 2)Nurse [ ] 3) Anesthetics[ ] 4) Orderly [ ]
3. Months / Years of work in the surgical department……

Are the following available	**Yes (2)**	**No (1)**
4. Sterile items for wound dressing e.g., gauze, lotion, etc.		
5. Hand washing items e.g. water, soap		
6. Sterile gloves on the ward		
7. Personal protective equipment's for use on the ward		
8. Detergents for decontamination of used instruments		
9. Safety boxes for disposal of used syringes and needles		
10. IPC guides in the ward (posters, manuals, etc.)		

SECTION C - COMPLIANCE LEVEL		
When is hand hygiene done by HCW?	**YES (2)**	**NO (1)**
11. On arrival at work		
12. Before patient contact		

13. After patient contact		
14. After contact with contaminated equipment or surfaces		
15. After wearing gloves		
Gloves use	**YES**	**NO**
16. Change gloves between patient contacts		
17. Change gloves between different procedures on the same patient		
18. Do not reuse disposable gloves		
Face mask use	**YES**	**NO**
19. Wear a facemask when working on a patient with an exposed wound		
20. Wear a facemask when undertaking procedures likely to generate splashes		
21. Do not reuse disposable nose mask		
Gown use	**YES**	**NO**
22. Wear gown/apron to protect skin/clothing when undertaking procedures likely to generate splashes.		
23. Remove soiled /wet gown as soon as possible.		
Sharps management	**YES**	**NO**
24. Recapping		
of25. Disposing of in safety box		

Operation Room Checklist for IPC

Date: …/…/…. …… Type operation ----------Procedure----------

	DESCRIPTION	YES	NO
1	All areas & surfaces are clean, dry & dust free		
2	Sterile items before their expiry date		
3	All doors/hatch windows of operating rooms are well sealed		
4	Scrub facilities are available & well located		
5	Hands scrub with an antiseptic detergent (3-5 minutes) or (1-the minutes) for the subsequent case.		
6	After performing the surgical scrub, keep hands up and away from the boa day (elbows in a flexed position) so that water runs from the tips of the fingers toward the elbows		
7	Scrubbed arms not touching objects.		
8	Hands dried using a separate sterile towel for each hand starting from the fingers to the elbow before donning a sterile gown and gloves		
9	A poster demonstrating a good hand washing technique is available by at least one sinks.		
10	Pre-operative hair removal if needed is to be done on least possible skin area, as close as possible from operating time (not more than 2 the hours) using the electric hair clipper		
11	Pre-operative skin antisepsis is achieved by the use of the proper antiseptic and being left over the skin for spontaneous drying.		

	If yes specify…….		
12	A surgical mask is covering the mouth nose and beard when entering the operating room if an operation is about to begin or already underway, or if sterile instruments are exposed.		
13	Mask is worn throughout the operation; other personnel in the operating theatre are wearing a surgical mask if an operation is being performed.		
14	The team is calm with minimal movement and talking.		
15	Dirty instruments and waste are properly handled and transported		
16	Single-use items are not reused		
17	Surgical instruments are not washed manually in the theatre.		
18	Only the required surgical team is present in the operating room during the procedure.		
19	Telephones, supplies, charts are not touched with bloody gloves, new clean gloves should be used if needed		
20	The team does not remove surgical attire until the wound has been dressed and the risk of contact with bloody drapes had been eliminated		
21	Surgical attire is taken off, gloves are the first to be taken off, hands and forearms are washed.		
22	The team does not leave operating room with bloody shoe or gown		
23	Intra-op antibiotics		
24	Suitable operation room temperature		

	Total		

Introduction Letter from the University for Development Studies

UNIVERSITY FOR DEVELOPMENT STUDIES

School of Medicine and Health Sciences

(Department of Community Health and Family Medicine)

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11/02/2019

Office of the Head

The Head of Research
Tamale Teaching Hospital
Tamale, N/R

LETTER OF INTRODUCTION

Abdul Rauf Alhassan

This is to introduce to you, ***Abdul Rauf Alhassan***, a Master of Public Health student of School of Medicine and Health Sciences of the University for Development Studies. Rauf is a second year master of public health student and is currently working on his project titled: '**Infection prevention and control practices among healthcare providers of surgical department at Tamale Teaching Hospital**.' Rauf want to have access to the Teaching Hospital to help him carry out this important academic exercise. I would be grateful if you could grant him access to the hospital and the staff of the above mentioned department and any other information he may need to strengthen the quality of his work.

Thank you.

Dr. Yidana Adadow
SENIOR LECTURER H O D
DEP. OF COM. HEALTH & FAM MED
SMHS-UDS, TAMALE

Yidana Adadow *(PhD)*
(Head of Department, CHFM)

Authorization certificate from the Research Department of Tamale Teaching Hospital

Department of Research &Development
Tamale Teaching Hospital

TTH/R&D/SR/031
14/02/2019

TO WHOM IT MAY CONCERN

CERTIFICATE OF AUTHORIZATION TO CONDUCT RESEARCH IN TAMALE TEACHING HOSPITAL

I hereby introduce to you **Mr. Abdul Rauf Alhassan,** a Master of Public Health Student at the Department of Community Health and Family Medicine, School of Medicine and Health Sciences, University for Development Studies (UDS). He has been duly authorized to conduct a study titled **"Infection Prevention and Control practices among Healthcare Providers of Surgical Department at Tamale Teaching Hospital"**

Kindly accord him the necessary assistance to enable him complete the study. If in doubt, kindly contact the Research Unit on the second floor of the administration block or on Telephone 0209281020. In addition, report any misconduct of the Researcher to the Research Unit for necessary action.

Please note that this approval is given for a period of six months, beginning from 14th February, 2019 to 13th of July, 2019.

Thank You.

ALHASSAN MOHAMMED SHAMUDEEN.
(HEAD, RESEARCH & DEVELOPMENT)