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INFECTION PREVENTION AND CONTROL PRACTICES AMONG NURSES IN SELECTED HEALTH FACILITIES IN GREATER ACCRA REGION OF GHANA

PRESENTED

BY

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THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF A MASTER OF PUBLIC HEALTH DEGREE

OCTOBER 2019
DECLARATION

I declare that, apart from references made to work done by other authors, which have been duly acknowledged, this work is independently done by me under the supervision of Dr. Samuel Sackey. I further declare that this work has not been submitted for the award of any degree in this university or elsewhere.

HANNAH AMPADU (STUDENT) DATE

DR. SAMUEL SACKEY (SUPERVISOR) DATE
DEDICATION

I dedicate this dissertation to God almighty, the loving memory of my late mother, Madam Rose Yeboah, my father, Mr. Kwame Agyarkwa Ampadu and my siblings; Lexie, Jovie and Mandy.

I also dedicate it to all my Spiritual fathers for their support and guidance and finally, to all my loved ones.
ACKNOWLEDGEMENT

I am so grateful to God Almighty for His grace, mercies and favour throughout this academic programme and for successful completion of this dissertation.

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Finally, I say thank you to the head of department and staff of the department of Epidemiology and Disease Control and all lecturers and staff of the School of Public Health, university of Ghana.
ABSTRACT

Background

Nurses play a pivotal role in healthcare delivery and they are responsible for ensuring the safety of patients as well as their own safety in the clinical setting. Nurses are in more contact with patients than other healthcare professionals and hold the key to infection prevention and control challenges. Inadequate knowledge and failure of nurses to comply with infection prevention and control (IPC) practices at healthcare settings is a major contributory factor to the burden of healthcare associated infections (HCAIs).

Objective

The study is aimed at assessing the knowledge, compliance and factors influencing compliance with IPC practices among nurses

Method

A descriptive cross-sectional study involving 237 nurses from three hospitals in the Greater Accra Region of Ghana was conducted. The hospitals were randomly selected through balloting and proportionate sampling method was used to select nurses from the three hospitals. In the facilities, nurses were conveniently selected to participate in the study if they met the inclusion criteria and gave their consent. Validated standardized questionnaires were used to collect the data. Descriptive statistics and inferential statistics using bivariate analysis (Chi-square and Fisher’s exact test) and multivariable logistics regression were used to analyze the data with the help of Stata IC version 15.0
Results

Findings from the study showed that, majority (83.7%) of the nurses had good knowledge of IPC practices in general, however; only 25% and 43% of the nurses were knowledgeable about nosocomial infections and safe injection practices respectively. The study also showed high level (79.1%) of self-reported compliance with IPC practices among nurses. Majority of the nurses (68.4%) reported they recapped needles after use. About 93.5% of the nurses reported they always washed hands with soap under running water in their units, however, only 50% were observed to practice frequent hand wash with soap under running water. Perception of risk of infection measured by vaccination status [AOR= 3.46, 95% CI (1.64, 7.31)] and accessibility to personal protective equipment (PPE) [(AOR=2.13, 95% CI (1.06, 4.27)] were factors found to be significantly associated with compliance with IPC practices.

Conclusion

The study revealed that the level of knowledge and compliance of nurses with IPC practices were generally good. However, there were some lapses in knowledge and compliance with respect to the various IPC procedures and what was observed in practice. Health institutions need to intensify training and education on the various IPC procedures to achieve complete and accurate IPC practices in the clinical settings for safe healthcare delivery. There is the need for larger observational studies using observational checklist to ascertain compliance with IPC practices.
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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>AIDS</td>
<td>Acquired Immune Deficiency Syndrome</td>
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<tr>
<td>CAUTI</td>
<td>Catheter Associated Urinary Tract Infections</td>
</tr>
<tr>
<td>CDC</td>
<td>Center for Disease Control and Prevention</td>
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<tr>
<td>CLABSI</td>
<td>Central line-Associated Blood Stream Infections</td>
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<tr>
<td>HAI</td>
<td>Hospital Acquired Infections</td>
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<td>HBV</td>
<td>Hepatitis B Virus</td>
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<td>HCAI</td>
<td>Healthcare Associated Infections</td>
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<td>HCV</td>
<td>Hepatitis C Virus</td>
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<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
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<tr>
<td>ICU</td>
<td>Intensive Care Unit</td>
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<td>IP</td>
<td>Infection Prevention</td>
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<td>IPC</td>
<td>Infection Prevention and Control</td>
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<tr>
<td>MOH</td>
<td>Ministry of Health</td>
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<tr>
<td>NHIS</td>
<td>National Health Insurance Scheme</td>
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<tr>
<td>PEP</td>
<td>Post Exposure Prophylaxis</td>
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<td>PPE</td>
<td>Personal Protective Equipment</td>
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<td>SSI</td>
<td>Surgical Site Infections</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>UTI</td>
<td>Urinary Tract Infections</td>
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<tr>
<td>VAP</td>
<td>Ventilator Associated Pneumonia</td>
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<td>WHO</td>
<td>World Health Organization</td>
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CHAPTER ONE

INTRODUCTION

1.1 Background

Effective control and prevention of infections in healthcare settings is very critical for the delivery of safe, as well as good quality services to patients (Horan & Gaynes, 2004). Nurses play a crucial role in healthcare delivery and are in more contact with patients than other healthcare professionals. Their roles, which include invasive procedures, may expose them to dangerous blood-borne and air-borne pathogens, which they can also transmit to other patients. Preventing and controlling infections depend on adequate knowledge and the ability of nurses and other healthcare staff to adhere to infection prevention and control (IPC) guidelines at all levels of organization. The practice of good IPC by healthcare professionals is important for reduction of disease load on health facilities, patients and the entire nation (WHO, 2018). Practicing hand hygiene, instrument decontamination and disinfection practices, accessibility to post-exposure prophylaxis (PEP), safe injection and medication practices, personal protective equipment (PPE) use, vaccination and Healthcare waste management practices constitute major infection prevention practices at healthcare settings.

Health Care-Associated Infections (HCAI), also known as Nosocomial infections remain a relevant public health problem worldwide (Vaz et al., 2015). They are infections presenting in patients undergoing health care in health facilities, which were previously not available or cultivating during admission period. In addition, infections that patients acquire in the clinical settings but presenting following discharge and also job-related infections acquired by healthcare professionals at the health facility are all nosocomial infections. Healthcare facilities serve as a suitable pathway that facilitates the transmission of hospital acquired infections and this may be
either as a result of poor IPC practices among nurses and other healthcare professionals or
overcrowding of patients in most clinical settings (Samuel et al., 2009). Major mortality and
morbidity occurring among hospitalized patients are as a result of nosocomial infections. Patients
and their families suffer major economic challenges due to prolong hospitalization and increase
healthcare cost following acquisition of nosocomial infections (Weinstein, 2001). Health
facilities and the community also suffer economic challenges following nosocomial infections
outbreak and there is reduced work output by hospital staffs who acquire the infections.

The most common adverse event in the delivery of health care globally are hospital acquired
infections. Hundreds of millions patients are reportedly affected by hospital acquired infections
globally annually (WHO, 2018). Estimates from WHO fact sheet showed that for every 100
hospitalized patients at any given time, seven in developed and ten in developing countries will
acquire at least one health care-associated infection (WHO, 2018). Even though the risk of
developing HCAI is worldwide and diffuses through all health-care facilities and systems
throughout the world, due to challenges of putting together dependable diagnostic data, the
overall worldwide burden is not known. It is estimated that over 1.4 million patients globally in
both developed and developing countries are influenced at any given period (World alliance for
safety, 2005).

Statistics from WHO fact sheet 2018 on the encumbrance of healthcare associated infections
(HCAI) estimated that HCAIs result in about 16 million extra days of hospital stay and 37 000
attributable deaths, annually in Europe (WHO, 2018). Another major challenge that HCAIs pose
is the yearly loss of finances about €7 billion, including direct costs only (WHO, 2018). In the
year 2000, about 99000 mortalities were associated with nosocomial infections in the United
States of America and about $6.5 billion yearly economic impact in the year 2004 (WHO, 2018).
Health care-associated infection poses a serious challenge in countries with middle- and low-income economy than in countries with high income economy and it is most common among neonatal as well as other intensive care unit patients.

Resource-limited settings have high nosocomial infections burden than develop countries. The burden of health care-associated infections varies between 5.7% and 19.1% in low- and middle-income countries (WHO, 2018).

Few researches have been conducted on infection control and prevention practices among nurses and other healthcare workers in Ghana. Studies by Bello et al., 2011, demonstrated average knowledge of nosocomial infection isolation precautions among majority of the health care students used as participants in the study. A baseline assessment of IPC in major hospitals in Ghana by the health ministry in 2005 revealed poor infection prevention practices and lack of adherence with IPC guidelines by health professionals (MOH, 2015).

The role of nurses has always been pivotal in healthcare delivery. Their roles include, providing medications, dressings, sterilization, disinfection, invasive procedures and many others. Compared with other health professionals, nurses are in more contact with patients. Their role in solving challenges associated with infection control and prevention is very significant. They represent a strength of capacities capable of structuring and improving patient outcome. Nurses perform a crucial duty in lessening the burden of HCAIs by embracing standard practice guidelines. Knowledge of IPC and the implementation of IPC guidelines by nurses is very important in the prevention of microorganisms’ transmission in the clinical settings. The choice of nurses to be the population for this study other than other healthcare professionals stems from their involvement and constant contact with patients on daily basis exposing them to various nosocomial infections. Poor infection prevention practices and failure of nurses to comply with
IPC guidelines put them at a greater risk of developing nosocomial infections and the risk of spreading infectious agents to patients. The study is designed to assess the level of knowledge of nurses on IPC practices, their compliance with IPC practices and factors that influence nurses’ ability to comply with IPC practices in selected hospitals in Greater Accra region of Ghana.

1.2 Problem statement

The burden of nosocomial infections acquired in health facilities pose a significant challenge to public health. The role of nurses has always been pivotal in healthcare delivery. They are in more contact with patients than other health workers and play a major contributory duty in confronting challenges to IPC practices in clinical settings. Inadequate knowledge and failure to comply with IPC guidelines by nurses put them, patients and the community at risk of developing Healthcare associated infections (HCAI) (Shinde & Mohite, 2014). Nurses stand a greater potential of frequent exposures to microorganisms that causes major infections at health facilities owing to their role as frontline health service deliverers. They may serve as potential carriers of these microorganisms transmitting them from patient to patient (Cawich et al., 2012).

Healthcare associated infections are known as the most common adverse event in healthcare delivery globally. Though the exact global estimates of HCAI are yet unavailable in World Health Organization (WHO) fact sheets, total estimates indicate that more than 1.4 million patients worldwide in developed and developing countries are affected at any time (World alliance for safety, 2005) resulting in major deaths and health systems financial challenges.

Few studies conducted in Africa have indicated that most nurses working in various health facilities have inadequate knowledge, skills and lack proper training together with limited conformance with standard protocols on infection prevention practices (Mdegela et al., 2016). Thus contributing substantially to the burden of HAI in Africa than developed countries.
Studies on infection prevention (IP) practices among nurses and other healthcare workers in Ghana are lacking. Studies conducted by Hesse, Adu-Aryee, Entsu-Mensah (2006) indicated a gap in practice and knowledge of safety precautions among some medical personnel in Korle-Bu Teaching Hospital. Many consequences have been associated with nurse’s failure to conform to standard protocols on infection prevention and control measures. Some of these consequences include acquisition of nosocomial infections which can cause prolong hospital admissions, high antibiotics resistance, permanent disabilities, and excess death. Additionally, it results in financial burden on health systems and reduced work output by nurses who develop HCAI. Examining critically the role of nurses in our healthcare settings, poor practice and knowledge of IPC and suboptimal compliance with IPC guidelines will pose a threat to patients, health professionals and the public due to the risk of acquiring nosocomial infections. Most of these infections are caused by multidrug resistant strains of microorganisms and are very difficult to treat. Considering nurses’ constant contact with patients on daily basis and their sensitive roles including invasive procedures, infection prevention practices cannot be overlooked among nurses in Ghana.

The limited studies on infection prevention and control practices which focused on health workers in general does not give a detailed information about the extent of IPC practices among nurses in Ghana. This study has therefore been designed to assess infection prevention practices among nurses in three selected hospitals in Greater Accra region and information gathered from the study will help reveal the extent of IPC practices among nurses in these three facilities.
1.3 Justification

Nurses play a major contributory role in spreading healthcare associated infections and their ability to adhere to standard IPC protocols is critical in controlling and preventing Healthcare associated infections.

Ghana government, through the health ministry has in place interventions to ensure effective and safe IPC practices among healthcare workers through formulation and provision of national policy guidelines to health facilities, addressing various IPC procedures. However, despite the intervention, there still remain a significant gap in achieving appropriate IPC practices among health staffs. This research focuses exclusively on nurses due to their crucial role in healthcare delivery and their frequent contact with patients. In addition, being on the frontline of healthcare delivery, nurses are seen routinely taking care of the sick, providing counselling to patients and positively influencing the healthcare system processes.

The study, which focuses on IPC practices among nurses in some hospitals in the Greater Accra region of Ghana, will assess the knowledge of nurses on infection control and prevention, compliance with IPC practices and also determine factors influencing nurses’ ability to comply with IPC practices. The findings obtained from the study will assist in filling the gap and help develop appropriate strategies for successful infection control and prevention program and interventions.
1.4 Research Questions

The questions below guided the conduct of the research to help find answers to address the objectives;

1. What is the level of knowledge of nurses on infection prevention and control (IPC) practices in healthcare settings?
2. What is the compliance level of nurses with IPC practices?
3. What are the factors that can influence nurses’ ability to comply with IPC practices at healthcare settings?

1.5 Conceptual Framework

The figure on page 9 is a conceptual framework of IPC practices among nurses in healthcare settings. The diagram focuses on knowledge of IPC practices, compliance and factors influencing compliance with IPC practices. Infection control and prevention can only be effective if nurses have sufficient knowledge on general infections, especially those occurring in healthcare settings, their mode of transmission, consequences associated with their transmission and importantly how they can be prevented and controlled. Knowledge of infection prevention practices such as use of PPE, practicing of hand hygiene and safe injection, proper waste management practices and other IPC practices among nurses are relevant to achieve effective infection control and prevention in clinical settings. Institutional factors such as provision of training on IPC, existence of IPC guidelines and policy in health institutions and adequate supply of materials such as PPEs, disinfectant, appropriate sharp containers, hand washing facility are all factors needed to achieve effective IPC practices among nurses in clinical settings. In addition, the knowledge of nurses on existence of a national policy document governing...
infection control and prevention will influence practice of infection prevention because it is only when they are aware of the existence of the document and its content before they can put it into practice to achieve the effective infection prevention outcome that is desired nationally. The broken arrow linking the socio-demographic characteristics and knowledge of IPC basically shows that socio-demographic characteristics may not necessarily have effect on nurses’ knowledge of IPC practices. However, a factor such as work experience may have an effect on the practice and knowledge of IPC. Furthermore, some institutional factors such as provision of in-service training and existence and accessibility to IPC guidelines may influence knowledge of IPC practices. Hence, the broken arrow linking factors influencing compliance and knowledge.
Figure 1.1: Conceptual Framework of Infection prevention practices among nurses
1.6 Objectives

The objectives of the study are categorized into the general objective and the specific objectives.

1.6.1 General objective

To assess infection prevention and control practices among nurses in selected healthcare facilities in Greater Accra Region of Ghana.

1.6.2 Specific Objectives

The specific objectives of the study are;

1. To assess the level of knowledge of nurses on infection prevention and control practices.
2. To assess the compliance level of nurses with infection prevention and control practices.
3. To determine factors that influence compliance with infection prevention and control practices by nurses.
CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter is a review of existing literature on IPC practices among nurses in various healthcare settings. The chapter begins with an overview of IPC, followed by infections in general, their sources and mode of transmission. Healthcare associated infections and the various types are also reviewed in this chapter. This is followed by IPC measures at healthcare settings. Literature on the specific objectives of the study, which includes nurses’ knowledge of IPC practices, their compliance with IPC practices and factors influencing their compliance with IPC practices are also reviewed in this chapter.

2.1 General review of infection prevention and control (IPC)

Infection prevention and control relates to procedures directed at controlling and preventing infections in general and also transmission of infections in health care settings. These infections may already be present on admission or may be developed in the clinical settings (MOH, 2015). IPC is a significant aspect in healthcare system grounded in various disciplines including epidemiology, communicable diseases, health system strengthening and social sciences. Infection prevention and control is a practically oriented and standard solution aimed at protecting patients and health workers from harm that may be caused by infections at healthcare settings. IPC is of significance to patients and health workers at every point of health care encounter and has contributed importantly to universal health coverage and patient safety (WHO, 2018).

Infections transmission occurring at health care settings may be from one patient to the other, from patients to health professionals and from health professionals to patients or among health
professionals. IPC plays a crucial role in dealing with these factors associated with transmissions. IPC consist of preventive measures such as practice of hand hygiene, use of personal protective equipment, sterilization and disinfection, vaccination, post-exposure prophylaxis, active surveillance of suspected infections and outbreak investigation and management (MOH, 2015).

Mode of spread of infectious agent, underlying patient’s host defenses as well as procedures performed during patient care are some factors that contribute to the risk acquiring nosocomial infections (https://www.health.state.mn.us/facilities/patientsafety/infectioncontrol).

2.2 Infections

An in-depth knowledge about infectious disease in general is a requisite for comprehending the transmission of infections in health care settings. Three major elements are required in the spread of infectious diseases and these are; a source of infecting agent, a susceptible host, and a mode of transmission for the agent (https://www.cdc.gov/infectioncontrol/trace). The diagram below describes the chain of transmission of infections;
2.2.1 Source of Infections

Major sources of infecting agent at healthcare settings include patients, staff, or visitors. Carriers of infectious agent, individuals of the active disease and those in the disease incubation period may also be potential sources of transmission. A patient’s own endogenous flora may be another source of infection and this infection types are difficult to treat. Other sources of infection include contaminated inanimate environmental objects such as equipment and medications (Collins, 2008).
2.2.2 Host Susceptibility

Another element in the spread of infection is the host susceptibility. Susceptibility occurs among people lacking effective resistance to particular microorganisms. People vary greatly about their resistance to pathogenic microorganisms. Some people may be immune to colonization by an infectious agent whilst others exposed to the same infectious agent may form a commensal relationship with the agent and become carriers; others on the other hand may end up with the clinical disease. Host features such as age; underlying diseases such as diabetes; certain treatments with antimicrobials, corticosteroids, or other immunosuppressive agents; irradiation; and breaks in the first line of defense mechanisms caused by factors such as surgical operations, anesthesia, and indwelling catheters may render patients more susceptible to infection (MOH, 2015).

2.2.3 Mode of Transmission

There are several routes by which microorganisms can be transmitted in health care settings. One organism may however be transmitted by many routes. Major modes of transmission are; Direct contact, through droplet and by airborne.

2.2.3.1 Transmission via Contact

This is the crucial and most common way of transmitting nosocomial infection. Contact transmission can be grouped into indirect and direct contact transmission.

1. Transmission by direct contact is characterized by direct contact between two body surfaces and by microorganisms transfer physically between a susceptible host and an infected person. This contact transmission occurs when a person performs patient-care activities that require
direct personal contact such as giving a patient bath, dressing wounds etc. Direct spread can also take place between two patients (Collins, 2008).

2. Indirect-contact transmission on the other hand is characterized by contact between inanimate contaminated objects such as contaminated instruments, dressings or needles and susceptible host. Furthermore, using unchanged gloves between patients and contaminated hands that are not washed can result in indirect contact transmission (Collins, 2008).

2.2.3.2 Transmission by droplet
Generation of droplets may result from coughing, sneezing and talking whilst undertaking some procedures including bronchoscopy and suctioning. Droplets that contain germs generated from an infected person that are transferred via the air and deposited on the nasal mucosa, conjunctivae, or mouth of the host results in transmission. “The source and the susceptible host need to be within approximately 1 meter (3 feet) of one another, for transmission to occur” (MOH, 2015).

2.2.3.3 Transmission by Airborne
Airborne transmission results from spreading of dust particles containing the infectious agent. Microorganisms transmitted in this way are spread widely by air currents and a susceptible host within the same room or a long distance from the source patient, depending on environmental factors, could breathe this in. Examples of pathogens transmitted by airborne include Varicella virus, rubella virus, Mycobacterium tuberculosis etc. Infections transmitted via airborne are difficult to bring under control and expects that air flow is controlled through special ventilation systems (MOH, 2015).
2.3 Healthcare Associated Infections (HCAI)

Health-care-associated infections are frequent recurrent adverse event that pose threats to patients’ safety globally (Burke, 2003; Larizgoitia, Prasopa-Plaizier, Jha, & Bates, 2009; Pittet & Donaldson, 2005). They are also referred to as nosocomial infections or hospital acquired infections (HAI). HCAI is defined as “an infection occurring in a patient during the process of care in a health-care facility which was not present or incubating at the time of admission. This includes infections acquired in the hospital but appearing after discharge, and also occupational infections among staff” (WHO, 2016). Patients in burn units, undergoing organ transplant and those in Intensive Care Units (ICUs) as well as neonates stand a greater chance of developing nosocomial infections.

The overall burden of HCAI in developed countries, ranges between 5.1% and 11.6% based on a literature review of national or multicentre studies published from 1995 to 2008 (WHO, 2016). The European Centre for Disease Prevention and Control estimated that several thousands of patients are affected by multiple episodes of HCAI every year in Europe (WHO, 2016). “In the United States, the estimated HCAI incidence rate was 4.5% in 2002, corresponding to 9.3 infections per 1000 patient-days and 1.7 million affected patients” (WHO, 2016). Results from European multicentre study indicated that the percentage of patients infected with HCAI could be as high as 51% in intensive care units (ICU). The duration of stay in ICU directly affects the risk of infection and number of people affected with HCAI. The most frequently observed healthcare-associated infections (HCAIs) at healthcare settings are catheter-associated urinary tract infections, ventilator-associated pneumonia, central line-associated bloodstream infections and surgical site infections (Khan, Baig & Mehboob, 2017).
2.3.1 Central line-associated bloodstream infections (CLABSI)

These HCAIs are usually fatal with mortality incidence rate of 12%–25% (Morb Mortal Wkly Rep, 2011). Prolonged use of catheters can cause serious bloodstream infections as they are used to provide medicine and fluid by placing them in central line (WHO, 2016).

2.3.2 Catheter associated urinary tract infections (CAUTI)

Globally, the most frequent type of nosocomial infections is CAUTI (Warren, 2001). UTIs are the frequent type of HCAIs. Catheter is a tube inserted into the bladder via the urethra to drain urine. It is estimated that urinary catheters are responsible for about 75% UTIs acquired in hospitals (CDC, 2016). CAUTIs are usually caused by endogenous local micro flora of the patients. Catheters serve as a channel for entry of bacteria whereas the impaired drainage from catheter retains some volume of urine in the bladder providing stability to bacterial residence (Warren, 2001). Examples of complications that can develop from CAUTIs include orchitis, pyelonephritis, cystitis etc. in all patients (CDC, 2016). A major risk factor that leads to development of CAUTI is prolonged use catheter.

2.3.3 Surgical Site Infections (SSI)

Surgical site infection refers to an infection occurring after surgery in the part of the body where the surgery took place. Surgical site infections can be serious especially if it involves tissues under the skin, organs, or implanted material (CDC, 2012). Staphylococcus aureus are the major causes of SSI resulting in prolonged period of stay in the hospital and risk of death (Anderson, 2011). SSI causative pathogens often arise from patients’
own endogenous micro flora. Based on the procedure and surveillance criteria used, the incidence of SSI can be estimated to be about 20% (Owens, 2008).

2.3.4 Ventilator Associated Pneumonia (VAP)

VAP is a kind of lung infection, which affects patients on ventilator machine (CDC, 2012). An infection usually results from pathogens entering the patient’s lungs via the ventilator tube. VAP often appears within 48 hours following tracheal incubation (Hunter, 2012). Ventilation is associated with about 86% of hospital acquired pneumonia (Steven & Koenig, 2006). Common symptoms of VAP include fever, leucopenia, and bronchial sounds (Hjalmarson, 2010).

2.3.5 Determinants of Healthcare Associated Infections

The environment in which care is given is a major risk factor associated with nosocomial infections. Other risk factors include the condition and susceptibility of the patient, and ignorance of such predominating infections among healthcare providers and staff. Improper waste management and poor hygienic environment in healthcare setting, prolong stay at intensive care unit, misuse of antibiotics and lack of basic knowledge about IPC are all potential risks associated with HCAI or nosocomial infections (Khan, Baig & Mehboob, 2017).

2.4 Infection prevention and control measures at healthcare settings

Practicing of proper IPC by nurses is the basis for quality of care and relevant for protection of patients, health workers, and communities. IPC aims to protect staff, patients and visitors from being infected and to control the transmission of infections when identified. Disinfection practices and instrument decontamination, hygienic hand practices, personal protective equipment (PPE) use, healthcare waste management practices, post-exposure prophylaxis (PEP)
and safe injections and proper sharp disposal practices are fundamental IPC practices at healthcare settings (WHO, 2008).

2.4.1 Hygienic hand Practices

One of the crucial ways of improving the safety of health professionals as well as patients and avoiding hospital acquired infections transmission is through good hand hygiene practices (Ronnebeck, 2008). Evidence has shown that proper hand washing is essential in reducing pathogen transmission to patients and the spread of antimicrobial resistance microorganisms (Trampuz & Widmer, 2004). Antiseptic hand wash, routine hand wash and surgical hand antisepsis or antiseptic hand rub constitute various forms of hand hygiene practices. There are two types of germs found on the hand. Germs that normally reside on and within the skin and are difficult to remove represent one type. The second type can be removed easily and are acquired during routine activities (MOH, 2015).

To improve effective hand hygiene, it is essential that nails are kept short, unpolished and natural and skin should be intact, forearms and hands should be free of jewelry; and in addition, sleeves should be above the elbow. The three major types of hand washing are discussed as follows:

➢ Routine/Social hand washing

This basically requires the use of running water with plain soap to wash hands for a minimum of 40 to 60 seconds with the aim of removing soil and germs that are temporal residents (e.g. P. aeruginosa) on the hand (MOH, 2015).

➢ Hygienic hand washing or hand antisepsis

This method of hand washing involves the use of soap containing antimicrobial agent under running water. Hand antisepsis aims to get rid of both normal flora and transient germs on the hand as well as soil and debris.
Surgical hand wash/scrub

Performing any surgical procedure should be preceded by removal of soil, debris and transient organisms. Surgical hand wash serves this purpose. It also reduces resident flora. Surgical hand scrub is crucial in preventing germs from arms and hands of surgical staff from contaminating wounds.

Proper hand hygiene must be carried out prior to contact with a patient, following contact with patient, prior to performing an aseptic process and after being exposed to body fluid. Additionally, it should be carried out prior to wearing PPE and donning gloves, following PPE removal upon leaving the care area and on entry into isolation room/area (WHO, 2009).

2.4.2 Personal Protective Equipment (PPE)

These are specialized clothing that health professionals use to provide protection for themselves as well as patients from germs. PPE creates a barrier between the virus, fungi or bacteria and healthcare worker. Examples of PPE are gowns, goggles, gloves, face shields and mask.

Gloves assist in reducing the spread of germs and also provide protection from germs to the hand. Various types of gloves are available in health facilities and this includes sterile surgical gloves which are used for performing processes that involves contact with blood or other body fluids and sterile areas of the body. There are also non-sterile gloves which are often used for non-sterile processes including contact with intact mucous membrane. Utility or Heavy-duty household gloves are also available for non-surgical activities such as handling contaminated items and housekeeping (MOH, 2015).

Masks provides covering for the nose and mouth. The use of surgical mask plays major roles like providing protection against the chances of breathing in germs and also halts germs in the
mouth and nose from spreading. There are special respiratory mask which are specifically useful for protecting against breathing in smaller microorganisms like Mycobacterium tuberculosis by creating a strong seal around the mouth and nose.

The eyes can be protected from body fluids by using goggles and face shield. Mucous membranes in the eyes serve as a channel through which germs penetrate the body, thus contact with body fluids can cause microorganisms in the fluid to penetrate the body via the mucous membranes of the eye (MOH, 2015).

**Protective clothing** use in health facilities includes aprons, gowns, shoe coverings and head covering. These clothing are usually used in surgical procedures to protect staff and the patient. Gowns are worn by visitors making a visit to patient in isolation suffering from an illness that is easily transmissible.

### 2.4.3 Disinfection

Complete removal of most pathogens excluding bacterial spores from inanimate objects requires the process of disinfection. Physical or chemical methods are the two major ways through which disinfection can be achieved. Disinfectants are chemicals used in disinfection. The following are examples of disinfectants and their uses in health facilities: 0.5% Hypochlorite (Bleach) used for equipment, cleaning spillage of blood and other body fluids, utensils etc., phenols for disinfecting floor and alcohol, Chlorine plus Detergent for disinfecting working surfaces. Other examples include peracetic and glutaraldehyde used for chemical sterilization of endoscopes (MOH, 2015).
2.4.4 Safe injection practices and appropriate disposal of sharps

An injection is said to be safe if it neither causes harm to the recipient nor exposes the provider to any preventable risk. In addition, safe injection practices should not generate any waste that poses threat to other individuals. It is estimated by WHO that about half of all injections are not safe and constitutes serious threats to patients, health providers and the general public. Majority of new infections with HIV, Hepatitis B and C virus occurring in many developing countries are the consequences of overusing and practicing unsafe injection. According to WHO estimates in the year 2000, “injections with contaminated needles or syringes caused 21 million new infections with hepatitis B, 2 million with hepatitis C and 260,000 new infection of HIV/AIDS” (WHO, 2000). Thus avoiding unnecessary injections is an important pre-requisite to prevent injection-associated infections. The use of sterile injection equipment, health workers taking necessary precautions to avoid needle stick injury, keeping needles that have been used away from the community and protecting injection equipment and medication from contamination are best ways to achieve safe injection practices.

2.4.5 Good infection prevention practices

Good infection prevention practices can be achieved through the following:

1. Hand washing prior to and following a touch with each patient

2. Use of appropriate PPE and donning gloves by nurses and other health workers when contact with mucous membranes, body fluids, excretions and secretions is expected.

3. Safe handling of sharps including hypodermic needles for protection of health providers, cleaners and the community as a whole.

4. Aseptic handling of specimens including body fluids, tissues etc.
5. Disinfecting working surfaces and decontaminating all instruments that have come in contact with body fluids for about 10 minutes in 0.5 percent chlorine solution.

6. Performing proper sterilization

7. Storing and handling of decontaminated instruments properly

8. Managing activity pattern and controlling overcrowding in procedure areas, wards and operating theater

9. Isolation precautions should be followed properly when dealing with highly infectious patients

10. Proper and safe waste disposal and management

11. Needle stick injuries, accidental exposure to body fluids must be reported to management

12. Monitoring and supervision of infection prevention practices and infection rates (Federal Ministry of Health Ethiopia, 2004).

2.5 Knowledge of infection prevention and control practices among nurses

The role of nurses in healthcare settings is critical and as frontline caregivers, they are responsible for ensuring the safety and well-being of patients as well as their own safety on the basis of their understanding and knowledge of basic IPC measures. An updated knowledge of IPC guidelines is required in controlling nosocomial infections. Implementation of standard precautions at clinical settings is dependent on the knowledge of nurses and other health professionals on IPC practices. Knowledge about nosocomial infections, their mode of transmission and their consequences are all stipulated in the IPC policy and guidelines (MOH, 2015). Also knowledge of basic IPC practices such as safe injections, sterilization and disinfection, hand hygiene, utilization of PPE, waste management are all indicated in the guidelines. However, some previous studies have shown that nurses exhibit poor knowledge
about IPC practices. In a tertiary care hospital in Delhi, a cross-sectional study conducted to determine the knowledge level and practices of infection control involving 293 nurses, showed that 97.9 percent of nurses had poor level of knowledge regarding standard precautions (Kataria, Sharma, Tilak, Khandekar & Acharya, 2013). Another study in a tertiary hospital in India showed that about 70% of the nurses had average or below average knowledge on transmission-based and standard precautions on infection prevention and control (Kanwalpreet, Manender, Muktanjali, & Anupam, 2013). The risk of acquiring pathogens and transmitting them is higher among nurses because of their greater contact with patients and relatives more than other health professionals. A good knowledge about IPC practices and the ability of nurses to comply with standard precautions is relevant in avoiding the spread of nosocomial infections at health facilities.

Thus, to achieve effective IPC practices in health facilities, it is imperative for nurses to have adequate knowledge about all the IPC procedures stipulated in the IPC policy and guidelines.

2.6 Compliance with infection prevention and control practices

The duty of nurses in the clinical settings is pivotal and they are in constant contact with patients than other health professionals. Therefore, nurses’ ability to comply with standard precautions has been identified as an influential way to control and avoid the transmission of hospital acquired infections (Yakob, Lamaro & Henok, 2015). Studies have proved that adequate knowledge about IPC guidelines is essential for safe healthcare delivery, however having the knowledge alone and not complying with the guidelines will not produce the desired safe healthcare delivery needed. A study conducted in Delhi hospital with the aim to determine practice and level of knowledge among nurses revealed a major gap in practice and knowledge of IPC practices in hospitals (Archarya et al., 2013). There are several consequences associated
with nurse’s inability to comply with IPC policies and guidelines. These include increase mortality and morbidity; also, there is a high possibility of lawsuit against the health care facility, health ministry, and the particular nurse responsible for any harm that may be caused to patients or their relatives. Furthermore, a nurse who fails to comply with IPC guidelines and policies stand the risk of having their license revoked by the professional council or regulatory body in situation where a proven negligence caused loss of revenue, damage to patients or loss of confidence of the public in the health facility. It is therefore essential for nurses to comply with IPC guidelines (MOH, 2015).

2.7 Factors influencing compliance of nurses with IPC practices

Findings from a review of literature has indicated that lack of compliance with IPC practices among nurses and other healthcare workers is associated with certain factors. Some reported factors include lack of knowledge of IPC policy and guidelines and its content (Oliveira, Cardoso & Mascarenhas, 2010), inadequate time to follow standard operating procedures by healthcare workers (Raafat et al., 2002), inadequate supply of resources to work with, examples lack of PPE, disinfectant, soap etc. (Madan et al., 2010). In addition, failure of health institutions to provide in-service training on IPC practices and inadequate water supply are all factors reported to influence compliance with IPC guidelines. A qualitative study in Mbagathi district hospital located in Nairobi to assess factors that influence nurses’ ability to comply with IPC standard protocols revealed workload as a factor for non-compliance with IPC guidelines (Moyo, 2013). The nurses interviewed ascribed high workload to the reason why they were unable to comply with standard precautions. Other factors indicated from other studies include forgetfulness to comply with standard precautions, uncomfortable equipment and skin irritation
resulting from PPE use. Furthermore, some sociodemographic factors such as work experience, sex, marital status, age, hospital working site and job category have been associated with compliance with IPC practices (Felix, Victor, Malagutti, & Gir, 2013; Najeeb & Taneepanichsakul, 2008). A previous study on factors influencing compliance with infection control precautions among nurses and physicians in Jordan showed a positive correlation of age and work experience with compliance with IPC practices (Nofal & Al-Kalaldeh, 2017). Another study by Timilshina et al., (2011) indicated that younger nurses had a higher compliance compared to the matured ones and this according to Osborne (2003) could be due to reluctance and resistance to change of practice caused by longer years of experience.
CHAPTER THREE

METHODS

3.0 Introduction

Description of the sampling method, study population, design of the study, sample size, variables of the study, tool for collection of data, data management and analysis as well as ethical considerations for the study are discussed in this chapter.

3.1 Study Design

A cross-sectional descriptive study design that engaged quantitative approach using structured questionnaires that were self-administered and observational checklist to collect data was employed in this study.

3.2 Study Area

The study was conducted in three selected health facilities in the Greater Accra region of Ghana. These included Achimota Hospital, Ga West Municipal Hospital and Tema General Hospital. These are government hospitals that are largely accessed by patients on daily basis. Amasaman hospital is located in the Ga West municipality of Accra. It is the major referral hospital in that municipality and provides services to residents of Amasaman, Pokuase and its environs. Achimota hospital is located in the Accra Metropolis and provides services to residents of Achimota and its environs. Tema General Hospital is located in the Tema Metropolis. Tema General Hospital serves as a referral point for other smaller health care facilities in the Tema Metropolis and provides services to all residents in the Tema community. These hospitals provide generalized and specialized services including Medical, Surgical, Obstetrics and Gynaecology, Laboratory, Pharmacy, Paediatrics, Accident and Emergency, Radiology,
Anaesthesia and Public health for the entire population. In addition to the services, the hospitals have a central administration, procurement units and records departments. The three hospitals are National Health Insurance Scheme (NHIS) accredited so they are enormously accessed by huge numbers of patients, making them infectious prone areas due to overcrowding. Because of this, rapid spread of infections can take place between staff and patients if appropriate IPC practices are not in place.

3.3 Study Population

The study population were nurses in the three selected hospitals in Greater Accra Region

3.3.1 Inclusion criteria

The study included all nurses in direct contact with patients. These included theater nurses, midwives, nurses at neonatal intensive care and paediatric units and all other general nurses working in close contact with patients in other departments.

3.3.2 Exclusion criteria

Nurses who were sick and therefore unavailable, those who were on assignment outside their facility during the time of the study, nurses holding administrative positions and were therefore not in direct contact with patients were all excluded from the study.
3.4 Study variables

3.4.1 Dependent variable

The dependent variable for the study is compliance of nurses with IPC practices. This is a binary variable measured by determining whether nurses comply or did not comply with IPC practices at healthcare settings.

3.4.2 Independent variable

Table 3.1: Definition of study variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition of variable</th>
<th>Indicator</th>
<th>Type of variable</th>
<th>Scale of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurses knowledge of IPC</td>
<td>Measured by scoring</td>
<td>Good knowledge: score of 80% and above</td>
<td>Categorical</td>
<td>Ordinal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Average knowledge: score of 79%-66%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poor knowledge: score of 65% and below</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>Self-reported age</td>
<td>Age at last birthday. This was categorize into age groups (&lt;20, 20-29, 30-39, 40-49, &gt;50)</td>
<td>Categorical/Continuous</td>
<td>Nominal</td>
</tr>
<tr>
<td>Sex</td>
<td>Self-reported sex</td>
<td>Male or Female</td>
<td>Categorical (binary)</td>
<td>Nominal</td>
</tr>
<tr>
<td>Work experience</td>
<td>Self-reported number of years of work</td>
<td>&lt;1 year, 1-3 years, 4-8 years, &gt;8 years</td>
<td>Categorical</td>
<td>Ordinal</td>
</tr>
<tr>
<td>Marital status</td>
<td>Self-reported marital status of nurses</td>
<td>Married/cohabiting Single Divorced/separated</td>
<td>Categorical</td>
<td>Nominal</td>
</tr>
<tr>
<td>Educational level</td>
<td>Self-reported highest level of education attained</td>
<td>Certificate, Diploma, Bachelor’s degree, Master’s degree and above</td>
<td>Categorical</td>
<td>Ordinal</td>
</tr>
<tr>
<td>Religion</td>
<td>Self-reported religion</td>
<td>Christian, Moslem, others</td>
<td>Categorical</td>
<td>Nominal</td>
</tr>
<tr>
<td>----------</td>
<td>------------------------</td>
<td>---------------------------</td>
<td>-------------</td>
<td>---------</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Self-reported Ethnic group</td>
<td>Akan, Ga/Adangme, Ewe, Mole-Dagbani, others</td>
<td>Categorical</td>
<td>Nominal</td>
</tr>
<tr>
<td>Vaccination status</td>
<td>Self-reported vaccination status</td>
<td>Yes or No</td>
<td>Categorical (Binary)</td>
<td>Nominal</td>
</tr>
<tr>
<td>Institutional Factors; availability and accessibility to PPE, Provision of in-service training, monitoring of IPC, existence of IPC guidelines, availability of handwashing station, consistent water supply, high workload, forgetfulness</td>
<td>Measured by determining from the nurses if these factors are available or in existence at the facilities</td>
<td>Yes, No, Sometimes</td>
<td>Categorical</td>
<td>Nominal</td>
</tr>
</tbody>
</table>

### 3.5 Sampling

#### 3.5.1 Sample size determination

Using Cochrane’s single proportion formula, a sample size of 215 was estimated as follows;

\[ n = \frac{(Z^2pq)}{d^2} \]

considering 5% margin of error, 95% confidence interval, \( Z_{0.025} = 1.96 \) and a proportion knowledge of 83.21% (Chitimwango, 2017). Where;

- \( n \) = Estimated sample size
- \( p \) = Knowledge proportion of IPC practices among nurses (Chitimwango, 2017)
- \( q \) = \( 1-p \)
d = margin of error

Z = Test Statistic

Adding 10% to cater for non-response increased the estimated sample size to 237.

3.5.2 Sampling Method

The three health facilities were selected by simple random sampling. A list of all hospitals in greater Accra region was obtained from Ghana Health Service website and the three hospitals were randomly selected through balloting. Number of nurses in the three facilities was selected by stratified proportionate sampling. In each facility, nurses who met the inclusion criteria and consented to participate in the study were conveniently selected.

3.6 Data collection

The data collection instrument used for the study were self-administered structured questionnaires to assess the knowledge of nurses on IPC practices, compliance and factors that influence compliance with IPC practices. An observational checklist was also used to ascertain compliance of nurses with IPC practices so as to compare the self-reported compliance with the observed compliance. The questionnaire for the study was adapted from previous studies on IPC practices among nurses by Oluwatosin et al., (2017), Chitimwango, (2017) and Kanwalpreet et al., (2013). The structured questionnaire was designed to cover the following sections; Section A covered the participant’s socio-demographic characteristics, Section B covered knowledge of IPC practices, Section C covered compliance with IPC practices and Section D covered factors influencing compliance with IPC practices. In the various facilities, questionnaires were administered to nurses who met the inclusion criteria and agreed to be part of the study from all departments including outpatient departments, surgical wards, labor wards, neonatal intensive care units, paediatric units and all other units with nurses in direct contact with patients. The
questionnaires were administered after participants had voluntarily accepted to partake in the study after reading the participant information sheet, understanding its content and knowing their rights as participants and finally appending their signatures to the consent form as a proof to participate in the study. The questionnaire had about 46 questions and participants were given a maximum of about an hour in a day at their own convenience and privacy to complete the questionnaire. Some nurses were observed for compliance with IPC practices unaware to avoid bias using an observational checklist.

3.6.1 Data processing and analysis

The data collected were coded and entered into Excel data management software and finally imported into statistical software Stata IC version 15.0 for analysis using descriptive statistics and inferential statistics. A univariate analysis of socio-demographic characteristics, level of knowledge, and the various factors such as availability of hand washing station, in-service training, and accessibility to PPE etc. were performed. Knowledge level and self-reported compliance with IPC were determined by scoring. A score of 80% and above was coded as good knowledge, from 79% to 66% was average knowledge and a score of 65% and below was coded poor knowledge. A score of 80% and above was coded compliance and below 80% was non-compliance. These cut-offs were defined based on the educational level of the nurses as IPC practices are incorporated in the nursing educational curriculum (WHO, 2009). Another justification for these cut-offs is the relevance of IPC practices among nursing professionals which cannot be underestimated or overlooked. Bivariate analysis was performed using chi-square test to determine association between the dependent and independent variables. Fisher’s exact test was used when at least one of the expected frequencies in the chi-square was less than five. A multivariable logistic regression model was built using a backward elimination method
with a threshold of 0.1. However, variables included in the stepwise model were those with p-value of 0.2 or less at bivariate analysis. The purpose of the multivariable analysis was to determine the strength of the association between the independent and dependent variables at a 95% confidence interval and p-value of less than 0.05 and also to control for possible confounders. Thus, a p-value of less than 0.05 (p<0.05) is the measure of significance in this study. Test for multicollinearity of the independent variables was performed to determine if the variables were linearly related. Variance inflation factor (vif) and tolerance statistics (1/vif) were used to test for multicollinearity. A variance inflation factor greater than 10 or tolerance statistics less than 0.10 indicates the presence of multicollinearity.

3.7 Quality control

The data collection instrument was pre-tested using nurses from other health facilities other than the three selected hospitals for the study to ensure validity and clarity of questions, to eliminate repetitive and ambiguous questions as well as to test for respondents understanding. In addition, the questionnaire was edited by a supervisor to ensure accuracy and standardization of questions. The research assistant was well trained to understand the ethical issues and respect the rights of the participants and also to properly administer the questionnaires. The observational checklist was handled by the principal investigator. The completed questionnaires were checked for completeness and accuracy.

3.8 Ethical consideration

The ethical principles concerning research on human participants were strictly followed to safeguard the rights of the individual and institutions.
Ethical approval was obtained from Ghana Health Service Ethics Review Committee on research with approval number GHS-ERC021/02/19 before commencement of the study. An organizational consent was also obtained from the management of Achimota Hospital, Ga West Municipal Hospital (Amasaman Hospital) and Tema General Hospital through the regional health directorate and the respective district health directorates prior to data collection. Before inclusion of participants in the study, their consents were sought after explaining the objectives of the study to them. Participants who consented to partake in the study were made to append their signatures to the consent form before responding to the items on the questionnaire. Participants were made to understand that participation in the study was voluntary and that they had the right to withdraw at any time during the study at no cost.

The following are details of the ethical issues which were addressed in the study:

3.8.1 Consenting

Consent was sought from study participants by the Principal investigator and research assistant before their inclusion in the study. This was achieved by providing nurses with participant’s information sheet to read and understand what the study entailed, what was required of them and their rights as participants. Those who consented to partake in the study after reading the information sheet were given the consent form to voluntarily append their signatures as evidence for agreement to partake in the study.

3.8.2 Potential risks/benefits

There were no foreseen direct risks involved in participation of this study by participants except for their time and the need to provide some personal information, which could have been a form
of inconvenience to them. However, participants were given assurance that no such personal information given would be released to a third party. The study had no direct individual benefits in terms of compensations in cash or in relation to job position and these were clearly spelt out in the participant’s information sheet. Despite this, participants were made aware that the study aimed to provide information on the extent of IPC practices among nurses and the information gathered would assist in minimizing the burden of nosocomial infections and help policy makers to develop strategies for successful IPC programs and interventions. By participating in the study, participants were made aware they could assess their level of knowledge about IPC practices and be informed about the contents of IPC guidelines and the need to comply with them.

3.8.3 Privacy and confidentiality

Participants were given assurance of privacy and confidentiality of information provided. Priority was given to protect all information provided by the participants in this research. It was ensured that responses were not discussed outside the research team. All responses were treated as confidential as no forms of identification were put on the questionnaires.

3.8.4 Data Storage and usage

Hard copies of all documents were kept in a sealed cabinet which could only be accessed by the principal investigator. All data files were saved on a personal computer and password protected.
3.8.5 Voluntary withdrawal

The research purpose was explained to respondents after which they were given the chance to partake in the study on their own volition. It was made known to participants that they could withdraw from the study anytime when they felt the need to.

3.8.6 Reward / compensation

Participants were not required to pay any fees for taking part in the study. Neither did the principal investigator pay respondents any money for their participation.

3.8.7 Conflict of interest

There are no conflicts of interest to the current study.

3.8.8 Funding of the study

The study is in partial fulfilment of requirements for the award of a Master of Public Health (MPH) degree at the School of Public Health, College of Health Sciences, University of Ghana, Legon and was solely funded by the principal investigator.
CHAPTER FOUR

RESULTS

4.0 Introduction

The current study assessed the knowledge of infection prevention and control (IPC) practices and the compliance of nurses with IPC practices. Factors influencing compliance with IPC practices were also determined in the study. The study was conducted in three hospitals in Greater Accra region of Ghana including Achimota Hospital, Ga West Municipal Hospital and Tema General Hospital. This chapter presents the analysis of the results and findings from the study.

4.1 Socio-demographic characteristics of participants

A total of 215 completed questionnaires were retrieved for analysis giving a response rate of 90.7%. Table 4.1 below gives a summary of the socio-demographic characteristics of the 215 participants.

The age range of the nurses was from 18 to 55 years with majority (65.6%) of them within the age category 20 – 29 years. Majority (90.2%) of the nurses were females and most (61.9%) of them reported single as their marital status. Their educational level ranged from certificate to master’s degree. Majority (57.2%) of the nurses were diploma holders, 25.1% of them were first degree holders, 13.5% of them were certificate holders and 4.2% of them were master’s degree holders. Majority (49.3%) of the nurses had less than a year work experience, 17.7% of them had 1-3 years of work experience, 17.2% of them had 4-8 years of work experience and 15.8% of them had more than 8 years of work experience. Majority (92.1%) of them were Christians and majority (54.4%) of the nurses belonged to Akan ethnic group.
Table 4.1: Socio-demographic characteristics of Participants

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Frequency (N= 215)</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age Category</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 20 years</td>
<td>5</td>
<td>2.3</td>
</tr>
<tr>
<td>20- 29 years</td>
<td>141</td>
<td>65.6</td>
</tr>
<tr>
<td>30 – 39 years</td>
<td>55</td>
<td>25.6</td>
</tr>
<tr>
<td>40 – 49 years</td>
<td>13</td>
<td>6.1</td>
</tr>
<tr>
<td>≥ 50 years</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>194</td>
<td>90.2</td>
</tr>
<tr>
<td>Male</td>
<td>21</td>
<td>9.8</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>133</td>
<td>61.9</td>
</tr>
<tr>
<td>Married/Cohabiting</td>
<td>81</td>
<td>37.6</td>
</tr>
<tr>
<td>Divorced</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Religion</strong></td>
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<td></td>
</tr>
<tr>
<td>Christian</td>
<td>198</td>
<td>92.1</td>
</tr>
<tr>
<td>Moslem</td>
<td>17</td>
<td>7.9</td>
</tr>
<tr>
<td><strong>Ethnic group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Akan</td>
<td>117</td>
<td>54.4</td>
</tr>
<tr>
<td>Ga/Adangme</td>
<td>40</td>
<td>18.6</td>
</tr>
<tr>
<td>Ewe</td>
<td>35</td>
<td>16.3</td>
</tr>
<tr>
<td>Mole-Dagbani</td>
<td>9</td>
<td>4.2</td>
</tr>
<tr>
<td>Others</td>
<td>14</td>
<td>6.5</td>
</tr>
<tr>
<td><strong>Educational Level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certificate</td>
<td>29</td>
<td>13.5</td>
</tr>
<tr>
<td>Diploma</td>
<td>123</td>
<td>57.2</td>
</tr>
<tr>
<td>First degree</td>
<td>54</td>
<td>25.1</td>
</tr>
<tr>
<td>Master’s degree</td>
<td>9</td>
<td>4.2</td>
</tr>
<tr>
<td><strong>Work Experience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1 year</td>
<td>106</td>
<td>49.3</td>
</tr>
<tr>
<td>1 – 3 years</td>
<td>38</td>
<td>17.7</td>
</tr>
<tr>
<td>4 – 8 years</td>
<td>37</td>
<td>17.2</td>
</tr>
<tr>
<td>&gt;8 years</td>
<td>34</td>
<td>15.8</td>
</tr>
<tr>
<td><strong>Vaccination status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaccinated</td>
<td>171</td>
<td>79.5</td>
</tr>
<tr>
<td>Not vaccinated</td>
<td>44</td>
<td>20.5</td>
</tr>
</tbody>
</table>
4.2 Level of knowledge of infection prevention and control practices among Nurses

Table 4.2 gives a summary of nurses’ level of knowledge of various IPC procedures.

Out of the 215 nurses, majority (83.7%) had good knowledge, 10.2% of them had average knowledge and the rest (6.1%) had poor knowledge.

![Pie Chart showing the level of knowledge of nurses on IPC](http://ugspace.ug.edu.gh)

**Figure 4.1: Pie Chart showing the level of knowledge of nurses on IPC**

However, the level of knowledge of nurses differ with respect to the various IPC measures. 80% of them were knowledgeable about hand hygiene practices whilst 83% of them were knowledgeable about personal protective equipment use. Furthermore, 98% of the nurses were knowledgeable about proper waste management (separation of infectious waste from non-infectious waste), 75% of them were knowledgeable about disinfection and instrument decontamination and 87% of them were knowledgeable about post-exposure prophylaxis. Only 25% of the nurses were knowledgeable about Nosocomial infections whilst only 43% of them
were knowledgeable about safe injection practices (proper handling and disposal of needles and other sharps).

**Table 4.2: Level of Knowledge of Nurses on various IPC procedures**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Knowledgeable</th>
<th>Not knowledgeable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe Hand washing practices</td>
<td>171 (80%)</td>
<td>44 (20%)</td>
</tr>
<tr>
<td>Personal Protective Equipment use</td>
<td>179 (83%)</td>
<td>36 (17%)</td>
</tr>
<tr>
<td>Safe injection practices (Proper handling and disposal of needles and other sharps)</td>
<td>93 (43%)</td>
<td>122 (57%)</td>
</tr>
<tr>
<td>Disinfection and instrument decontamination</td>
<td>161 (75%)</td>
<td>54 (25%)</td>
</tr>
<tr>
<td>Proper waste management (separating infectious waste from non-infectious waste)</td>
<td>210 (98%)</td>
<td>5 (2%)</td>
</tr>
<tr>
<td>Knowledge about Nosocomial infections</td>
<td>54 (25%)</td>
<td>161 (75%)</td>
</tr>
<tr>
<td>Knowledge about Post-exposure Prophylaxis</td>
<td>186 (87%)</td>
<td>29 (13%)</td>
</tr>
</tbody>
</table>

**4.3 Compliance of Nurses with infection prevention and control practices**

Table 4.3 summarizes the level of compliance of nurses with various IPC practices. Out of the 215 nurses, majority (79.1%) reported compliance with IPC practices. Most of the nurses reported they always wash their hands with soap under running water (93.5%), on removal of gloves, they always wash their hands after contact with patient or body fluids (91.2%), disposable items are used once and discarded in their unit (95.3%), they wash hands before and after invasive procedure (93.5%), they discarded sharps in safety boxes (96.3%), they wear goggles and mask when performing invasive and body fluid procedures (53.0%), they cover wounds and cuts on skin before start of work (86.0%), they carry out disinfection often in the working area and ensures that all instruments are decontaminated after use (89.3%) and 90.7% of
them reported they don’t use the same waste bin for infectious and non-infectious waste.

Surprisingly, only 31.6% of the nurses reported they do not recap needles after use.

### Table 4.3: Compliance of nurses with various IPC practices

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>COMPLIANCE n (%)</th>
<th>NON-COMPLIANCE n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I always wash my hands with soap under running water in my unit</td>
<td>201 (93.5)</td>
<td>14 (6.5)</td>
</tr>
<tr>
<td>On removal of gloves, I always wash my hands after contact with a patient or body fluid</td>
<td>196 (91.2)</td>
<td>19 (8.8)</td>
</tr>
<tr>
<td>Disposable items such as gloves, masks etc. are used once and discarded in my unit</td>
<td>205 (95.3)</td>
<td>10 (4.7)</td>
</tr>
<tr>
<td>I wash my hands before and after invasive procedures</td>
<td>201 (93.5)</td>
<td>14 (6.5)</td>
</tr>
<tr>
<td>I discard sharp materials in safety boxes</td>
<td>207 (96.3)</td>
<td>8 (3.7)</td>
</tr>
<tr>
<td>I don’t recap needles before disposal</td>
<td>68 (31.6)</td>
<td>147 (68.4)</td>
</tr>
<tr>
<td>I wear goggles and mask when performing body fluid and invasive procedures</td>
<td>114 (53.0)</td>
<td>101 (47.0)</td>
</tr>
<tr>
<td>I cover wounds and cuts on my skin before I start work</td>
<td>185 (86.0)</td>
<td>30 (14.0)</td>
</tr>
<tr>
<td>I carry out disinfection often in the working area and ensures that all instruments are decontaminated after each use</td>
<td>192 (89.3)</td>
<td>23 (10.7)</td>
</tr>
<tr>
<td>I don’t use the same waste bin for non-infectious waste and infectious waste</td>
<td>195 (90.7)</td>
<td>20 (9.3)</td>
</tr>
</tbody>
</table>

In addition to the self-reported compliance, an observational checklist was used to observe 20 nurses as they went about their routine activities to make a comparison between the self-reported compliance and observed compliance. The findings are summarized in table 4.4 below. Some discrepancies were seen between what was reported and observed with regard to some of the IPC practices. Whilst 93.5% reported they always washed hands with soap under running water in
their unit, only 50% of nurses were observed washing hands frequently with soap under running water. Also 89.3% of them reported they carried out disinfection regularly in the working area and ensured that all instruments were decontaminated after use but only 35% were observed to do so. In general, compliance with avoidance of needle recapping (safe handling of sharps) as stipulated in the national IPC policy and guidelines was poor in both the self-reported (31.6%) and observed (30%).

Table 4.4: Comparison between self-reported and observed compliance with IPC practices

<table>
<thead>
<tr>
<th>Variable</th>
<th>Self-reported (N=215)</th>
<th>Observed (N=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I always wash my hands with soap under running water in my unit</td>
<td>201 (93.5)</td>
<td>10 (50)</td>
</tr>
<tr>
<td>I always wash my hands before and after contact with a patient or body fluid</td>
<td>196 (91.2)</td>
<td>8 (40)</td>
</tr>
<tr>
<td>I always wear gloves before contact with each patient</td>
<td>205 (95.3)</td>
<td>12 (60)</td>
</tr>
<tr>
<td>I don't recap needles before disposal</td>
<td>68 (31.6)</td>
<td>6 (30)</td>
</tr>
<tr>
<td>I carry out disinfection often in the working area and ensures that all instruments are decontaminated after each use</td>
<td>192 (89.3)</td>
<td>7 (35)</td>
</tr>
<tr>
<td>I don't use the same waste bin for infectious waste and non-infectious waste</td>
<td>195 (90.7)</td>
<td>18 (90)</td>
</tr>
</tbody>
</table>
Figure 4.2: A bar graph showing self-reported and observed Compliance with frequent hand washing and frequent disinfection and decontamination among nurses

4.4 Factors influencing compliance with infection prevention and control practices among nurses

The final objective of the study determined the factors that influence nurses’ compliance with IPC practices. The two set of factors measured were socio-demographic factors and how they influence compliance with IPC practices. The second set of factors were general institutional and individual factors such as availability of hand washing station with soap, running water and disposable tissue/towel, provision of in-service training on IPC, monitoring of IPC by management, consistent water supply, adequate supply of resources to work with, accessibility to PPE, existence of IPC policy and guidelines in institutions, accessibility to IPC guidelines and knowledge of its content, high work load and forgetfulness.
4.4.1 Bivariate analysis of Socio-demographic and institutional factors influencing Compliance of nurses with infection prevention and control practices

Table 4.5 gives a summary of the bivariate analysis of the association of socio-demographic factors with Compliance with IPC practices. Vaccination (p<0.001) and marital status (p=0.04) were found to be significantly associated with compliance with IPC practices at bivariate analysis using chi-square and Fisher’s exact test. The rest were not significant.
Table 4.5: Association of socio-demographic factors with compliance of nurses with IPC practices

<table>
<thead>
<tr>
<th>Socio-demographic factor</th>
<th>n (%)</th>
<th>X² (P-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaccination status</td>
<td></td>
<td>13.34 (&lt;0.001)*</td>
</tr>
<tr>
<td>Yes</td>
<td>171 (79.5)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>44 (20.5)</td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td>(0.039)*</td>
</tr>
<tr>
<td>Single</td>
<td>133 (61.9)</td>
<td></td>
</tr>
<tr>
<td>Married/Cohabiting</td>
<td>81 (37.6)</td>
<td></td>
</tr>
<tr>
<td>Divorced</td>
<td>1 (0.5)</td>
<td></td>
</tr>
<tr>
<td>Religion</td>
<td></td>
<td>(0.535)**</td>
</tr>
<tr>
<td>Christian</td>
<td>198 (92.1)</td>
<td></td>
</tr>
<tr>
<td>Moslem</td>
<td>17 (7.9)</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td>(0.792)**</td>
</tr>
<tr>
<td>Akan</td>
<td>117 (54.4)</td>
<td></td>
</tr>
<tr>
<td>Ewe</td>
<td>35 (16.3)</td>
<td></td>
</tr>
<tr>
<td>Ga/Adangme</td>
<td>40 (18.6)</td>
<td></td>
</tr>
<tr>
<td>Mole-Dagbani</td>
<td>9 (4.2)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>14 (6.5)</td>
<td></td>
</tr>
<tr>
<td>Education level</td>
<td></td>
<td>(0.814)**</td>
</tr>
<tr>
<td>Certificate</td>
<td>29 (13.5)</td>
<td></td>
</tr>
<tr>
<td>Diploma</td>
<td>123 (57.2)</td>
<td></td>
</tr>
<tr>
<td>First degree</td>
<td>54 (25.1)</td>
<td></td>
</tr>
<tr>
<td>Master’s degree</td>
<td>9 (4.2)</td>
<td></td>
</tr>
<tr>
<td>Work experience</td>
<td></td>
<td>(0.815)**</td>
</tr>
<tr>
<td>&lt;1 year</td>
<td>106 (49.3)</td>
<td></td>
</tr>
<tr>
<td>1-3 years</td>
<td>38 (17.7)</td>
<td></td>
</tr>
<tr>
<td>4-8 years</td>
<td>37 (17.2)</td>
<td></td>
</tr>
<tr>
<td>&gt;8 years</td>
<td>34 (15.8)</td>
<td></td>
</tr>
<tr>
<td>Age Category</td>
<td></td>
<td>(1.000)**</td>
</tr>
<tr>
<td>&lt;20 years</td>
<td>5 (2.3)</td>
<td></td>
</tr>
<tr>
<td>20-29 years</td>
<td>141 (65.6)</td>
<td></td>
</tr>
<tr>
<td>30-39 years</td>
<td>55 (25.6)</td>
<td></td>
</tr>
<tr>
<td>40-49 years</td>
<td>13 (6.1)</td>
<td></td>
</tr>
<tr>
<td>&gt;50 years</td>
<td>1 (0.5)</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td>(0.159)**</td>
</tr>
<tr>
<td>Female</td>
<td>194 (90.2)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>21 (9.8)</td>
<td></td>
</tr>
</tbody>
</table>

**: Fisher’s exact test  X²: Pearson’s chi-square  *: p<0.05 – statistically significant
However, all variables with p-value of 0.2 or less qualifies for entry into the multivariable analysis. Thus, with this threshold, socio-demographic characteristics such as sex, marital status and vaccination will be included in the multivariable logistics regression analysis.

Table 4.6 summarizes the association of institutional and individual factors with compliance with IPC practices at bivariate analysis using chi-square and Fisher’s exact test, where at least one of the expected frequencies was less than or equal to 5. The findings from the univariate analysis showed that most (87.4%) of the nurses reported having hand washing station with soap, running water and disposable tissue or towel, majority (50.2%) of the nurses said high workload influences their ability to comply with IPC practices and 10.2% of the nurses attributed their inability to comply with IPC practices to forgetfulness. Furthermore, majority of the nurses reported consistent water supply (60.5%), existence of IPC guidelines (91.2%), accessibility to IPC guidelines (64.7%), provision of in-service training (96.3%), monitoring of IPC (80.9%), provision of adequate supplies (71.2%) and accessibility to PPE (55.4%) in their facilities. The bivariate analysis showed a significant association of high workload (p=0.03) and accessibility to PPE (p=0.02) with compliance of nurses with IPC practices. There was no significant association between compliance with IPC practices and the other factors (P-values>0.05).
Table 4.6: Association of institutional and individual factors with compliance of nurses with IPC practices (N=215)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Compliance (n=170)</th>
<th>Chi-square ($X^2$)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of IPC</td>
<td>**</td>
<td></td>
<td>0.09</td>
</tr>
<tr>
<td>Good</td>
<td>180(83.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>22(10.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>13(6.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of Hand washing station</td>
<td>**</td>
<td></td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>188(87.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>27(12.6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consistent water supply</td>
<td></td>
<td>2.08</td>
<td>0.15</td>
</tr>
<tr>
<td>Yes</td>
<td>130(60.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>85(39.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existence of IPC guidelines</td>
<td>**</td>
<td></td>
<td>0.08</td>
</tr>
<tr>
<td>Yes</td>
<td>196(91.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>19(8.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessibility to IPC guidelines</td>
<td></td>
<td>3.19</td>
<td>0.07</td>
</tr>
<tr>
<td>Yes</td>
<td>139(64.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>76(35.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-service training</td>
<td>**</td>
<td></td>
<td>1.00</td>
</tr>
<tr>
<td>Yes</td>
<td>207(96.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>8(3.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitoring of IPC</td>
<td></td>
<td>1.07</td>
<td>0.30</td>
</tr>
<tr>
<td>Yes</td>
<td>174(80.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>41(19.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adequate supplies</td>
<td></td>
<td>0.14</td>
<td>0.71</td>
</tr>
<tr>
<td>Yes</td>
<td>153(71.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>62(28.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessibility to PPE</td>
<td></td>
<td>5.43</td>
<td><strong>0.02</strong></td>
</tr>
<tr>
<td>Yes</td>
<td>119(55.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>96(44.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High workload</td>
<td></td>
<td>4.60</td>
<td><strong>0.03</strong></td>
</tr>
<tr>
<td>Yes</td>
<td>108(50.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>107(49.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forgetfulness</td>
<td>**</td>
<td></td>
<td>0.79</td>
</tr>
<tr>
<td>Yes</td>
<td>22(10.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>193(89.8)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

%: column percentages  **: Fisher’s exact test  $X^2$: Pearson’s chi-square *p<0.05
4.4.2 Multivariable analysis of factors influencing compliance with IPC practices

As already indicated, only variables including socio-demographic factors and institutional and individual factors with p-value less than or equal to 0.2 from the bivariate analysis were included in the multivariable analysis. The variables were vaccination status, marital status, sex, knowledge of IPC, consistent water supply, existence of IPC guidelines, accessibility to IPC guidelines, accessibility to PPE and high workload. The multivariable logistics regression model was built using backward elimination stepwise regression method at a threshold of 0.1. Table 4.7 is a summary of the final model.

After adjusting for possible confounders, Vaccination and Accessibility to PPE were found to be significantly associated with compliance with IPC practices. The results showed that Nurses who have received some form of vaccination have about three times odds of complying with IPC practices as compared to those who have not been vaccinated [AOR= 3.46, 95% CI (1.64, 7.31)]. Also, nurses who are able to access personal protective equipment (PPE) had about two times odds of complying with IPC as compared with those who lack access to PPE [(AOR=2.13, 95% CI (1.06, 4.27)]. High workload reduces the odds of compliance with IPC practices by 52%, this was however not significant [(AOR=0.52, 95%CI (0.26, 1.06)].

Table 4.7: Factors influencing compliance with IPC practices among 215 nurses

<table>
<thead>
<tr>
<th>Factor</th>
<th>Crude odds ratio</th>
<th>p-value</th>
<th>95% Confidence interval</th>
<th>Adjusted Odds ratio</th>
<th>p-value</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaccination status</td>
<td>3.69</td>
<td>&lt;0.001</td>
<td>(1.78, 7.64)</td>
<td>3.46</td>
<td>0.001</td>
<td>(1.64, 7.31)</td>
</tr>
<tr>
<td>Accessibility to PPE</td>
<td>2.20</td>
<td>0.021</td>
<td>(1.12, 4.29)</td>
<td>2.13</td>
<td>0.034</td>
<td>(1.06, 4.27)</td>
</tr>
<tr>
<td>High workload</td>
<td>0.48</td>
<td>0.034</td>
<td>(0.24, 0.95)</td>
<td>0.52</td>
<td>0.070</td>
<td>(0.26, 1.06)</td>
</tr>
</tbody>
</table>
Table 4.8: Test for Multicollinearity

<table>
<thead>
<tr>
<th>Variable</th>
<th>Variance inflation factor (VIF)</th>
<th>Tolerance (1/VIF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>2.76</td>
<td>0.36</td>
</tr>
<tr>
<td>Work experience</td>
<td>2.48</td>
<td>0.40</td>
</tr>
<tr>
<td>Educational Level</td>
<td>1.18</td>
<td>0.84</td>
</tr>
<tr>
<td>Knowledge of IPC</td>
<td>1.12</td>
<td>0.89</td>
</tr>
<tr>
<td>Vaccination status</td>
<td>1.13</td>
<td>0.89</td>
</tr>
<tr>
<td>Religion</td>
<td>1.31</td>
<td>0.76</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>1.36</td>
<td>0.73</td>
</tr>
<tr>
<td>Marital status</td>
<td>1.44</td>
<td>0.69</td>
</tr>
<tr>
<td>Sex</td>
<td>1.10</td>
<td>0.91</td>
</tr>
<tr>
<td>Accessibility to PPE</td>
<td>1.50</td>
<td>0.66</td>
</tr>
<tr>
<td>In-service training on IPC</td>
<td>1.16</td>
<td>0.86</td>
</tr>
<tr>
<td>Monitoring of IPC</td>
<td>1.43</td>
<td>0.70</td>
</tr>
<tr>
<td>Availability of Handwashing station</td>
<td>1.22</td>
<td>0.82</td>
</tr>
<tr>
<td>Existence of IPC policy and guidelines</td>
<td>1.43</td>
<td>0.70</td>
</tr>
<tr>
<td>Accessibility to IPC guidelines</td>
<td>1.33</td>
<td>0.75</td>
</tr>
<tr>
<td>High workload</td>
<td>1.10</td>
<td>0.91</td>
</tr>
<tr>
<td>Forgetfulness</td>
<td>1.13</td>
<td>0.89</td>
</tr>
<tr>
<td>Adequate supply of resources</td>
<td>1.55</td>
<td>0.64</td>
</tr>
<tr>
<td>Consistent water supply</td>
<td>1.17</td>
<td>0.85</td>
</tr>
</tbody>
</table>

Table 4.8 above shows no existence of Multicollinearity as variance inflation factor of the variables and tolerance are less than 10 and greater than 0.10 respectively.
CHAPTER FIVE

DISCUSSION

5.0 Introduction

A good knowledge and compliance of nurses with infection prevention and control practices is crucial in avoiding nosocomial infections transmission at healthcare settings. The role of nurses is pivotal and are at the frontline of healthcare delivery as compared to other healthcare professionals. According to studies by Lui, Curtis & Crookes, (2014), nurses’ adherence to IPC practices forms part of their daily activities and this is relevant for protection of patients and staff from acquiring nosocomial infections. National guidelines and policy on IPC practices have been formulated by the Ministry of Health in Ghana with the aim to provide guidelines for the practice of the expected IPC at health facilities. The current study assessed knowledge of nurses on IPC, compliance and factors influencing compliance with IPC practices. In this chapter, discussions of the findings with reference to significant literature on the subject are presented according to each objective.

5.1 Level of knowledge of infection prevention and control practices among nurses

The findings from the study showed in general that most (83.7%) of the nurses had good knowledge on IPC. These findings can be ascribed to massive attention given by the various institutions in the provision of in-service training on IPC as majority of the nurses reported that their institution provide in-service training on IPC. Similar studies by Samson-Akpan and Bassey, (2015) also showed that majority (62.2%) of nurses had good knowledge on infection control. Also, a previous study by Abdullah and Idriz, (2017) reported a high level of knowledge (90%) of nurses in control and prevention of hospital acquired infections. Some studies however, reported low levels of knowledge of nurses on IPC practices (Kanwalpreet et al., 2013; Moyo,
These low levels of knowledge could be attributed to inadequate training on IPC as it is indicated that provision of in-service training increases the knowledge level of health professionals on IPC practices (Eskander, Morsy, & Elfeky, 2013). The level of knowledge varied with the various IPC measures in the current study. Majority of the nurses were knowledgeable about hand hygiene practices, use of PPE, proper waste management, disinfection and instrument decontamination and post-exposure prophylaxis. The results from the study however, revealed that most of the nurses were not knowledgeable (75%) about nosocomial infections despite institutions efforts in the provision of in-service training on IPC. Similar studies also reported poor knowledge (55%) of nosocomial infections among nurses (Osuala & Oluwatosin, 2017). Another finding worth mentioning is the poor knowledge about safe injection practices among most of the nurses. Recapping of needles is a dangerous practice which can result in needle stick injury and expose healthcare workers to infections with dangerous blood-borne pathogens. More than half of the nurses (57%) were not knowledgeable about the dangers associated with needle recapping and reported that “recapping of needles was safe and did not expose the nurse to danger”. This is consistent with previous studies by Alrubraiee et al., (2017), which showed that more than half of the nurses (67.1%) had poor knowledge on safe injection practices.

5.2 Compliance of Nurses with IPC practices

The second objective of the study assessed nurses’ compliance with IPC practices. It is a necessity for all health professionals including nurses to comply with IPC guidelines so as to minimize the burden of nosocomial infections in various health facilities. Findings from the study indicated high level (79.1%) of compliance as reported by the nurses. This is consistent with findings from a similar study which showed a high rate of self-reported compliance (Russell
et al., 2018). Majority of the nurses reported frequent hand washing with soap under running water and always washing their hands after contact with each patient. Also, most of the nurses reported that disposable items were used once and discarded in their unit, they washed hands before and after invasive procedures, they discarded sharps in safety boxes and wear goggles and mask when performing invasive procedures. Furthermore, majority of the nurses reported they covered cuts and wounds on skin prior to start of work, they carried out disinfection regularly in working area and decontaminate instruments after each use and they use separate bins for infectious and non-infectious waste. Over 50% of the nurses reported that they recap needles after use prior to disposal. The poor knowledge of the nurses on safe injection practices as indicated in the current study reflects the poor compliance reported with regards to needle recapping. Previous studies also reported that more than 50% of nurses recap needles prior to disposal (Shrestha & Thapa, 2018; Samson-Akpan & Bassey, 2015). This is a dangerous practice and it is imperative for health institutions to intensify training on IPC with particular emphasis on safe injection practices to educate nurses on the dangers associated with recapping of needles. Nurses were also observed whilst they went about their routine activities. The findings showed major discrepancies between the self-reported and observed compliance. There is a major gap between what nurses reported they do and what was observed by the principal investigator. 93.5% of the nurses reported they always wash hands with soap under running water in their unit but only 50% were observed to comply with frequent hand washing with soap under running water. Similar study also showed discrepancies in self-reported hand washing and observed hand washing (Samson-Akpan & Bassey, 2015). Additionally, majority of nurses reported carrying out disinfection regularly in the working area and ensuring that all instruments are decontaminated after each use, however less than 50% were observed carrying out disinfection
regularly in the working area and instrument decontamination after each use. Previous studies conducted comparing observed and self-reported practices, always showed variation indicating higher compliance of self-reported practice than observed (Seibert, Speroni, Oh, DeVoe, & Jacobsen, 2014). There is a possibility of exaggeration of self-reported compliance and this could be the reason for the discrepancies. Due to limited time for data collection, only few numbers of nurses were observed, however, the findings are very crucial as it will serve as a basis for recommendation for larger observational studies using solely an observational checklist to ascertain nurses’ compliance on practical basis. Another observation worth mentioning is the issue of recapping of needles. There was an agreement between the self-reported and observed practice. More than 50% were observed recapping needles as was self-reported. This is to reiterate the need for intensive training on safe injection practices.

5.3 Factors influencing compliance with infection prevention and control practices among nurses

The third objective of the study determined factors that influence compliance with IPC practices among nurses. Demographic as well as institutional factors were assessed to examine the association between the factors and self-reported compliance with IPC practices. Findings from univariate analysis of the various institutional factors saw majority of the nurses reporting availability of hand washing station, consistent water supply, existence of IPC guidelines, accessibility to IPC guidelines, provision of in-service training, monitoring of IPC by management, provision of adequate supplies and accessibility to PPE in their facilities. More than half of the nurses reported high workload as a factor influencing their compliance with IPC practices and barely 10% reported forgetfulness as a factor. Bivariate analysis of the factors
showed a significant association of marital status, vaccination status, high workload and accessibility to PPE with compliance with IPC practices. After adjusting for possible confounders in the multivariable analysis, accessibility to PPE and vaccination status were found to be strongly associated with IPC practice. Nurses’ perceptions of risk of exposure to blood-borne and other pathogens in the clinical setting were measured by determining vaccination status. Findings from the study revealed that most of the nurses had received vaccination for all or some of the recommended vaccines for health workers. Nurses who perceived higher risk of infection are more likely to comply with IPC practices than those with lower perception of risk (Russell D. et al., 2018). The current study showed that nurses who have received some form of vaccination, in other words, nurses who perceived a higher risk of infection as a result of the nature of their work are three times more likely to comply with IPC practices compared to those who have not been vaccinated. Vaccination is essential for nurses and all other health professionals who work directly with patients or handle materials capable of spreading infections. It provides self-protection and reduces nurses’ chances of acquiring or spreading vaccine-preventable diseases in the clinical settings. Self-protection may be a major driving force in compliance with IPC practices (Darawad, Al-Hussami, Almahairat & Al-Sutari, 2012; Borg M.A. et al., 2009).

Accessibility to PPE is another factor that was found to be strongly associated with compliance with IPC practices. This is consistent with findings from previous studies (Haile, Engeda & Abdo, 2016) which showed a significant association of accessibility to PPE and perception of infection risk with compliance with IPC practice. Other factors such as training on standard precautions, management support and sex were also found to be significant in the previous study. Results from the current study showed that nurses who are able to access personal protective
equipment are twice more likely to comply with IPC practices than those who lack access to personal protective equipment. PPE are key elements for achieving effective IPC practices and lack of accessibility to PPE will lead to high levels of non-compliance among nurses and other healthcare workers. Surprisingly, there was no significant association between level of knowledge and compliance with IPC practices. This finding is however, consistent with previous studies (Osuala & Oluwatossin 2017; Samson-Akpan & Bassey, 2015; Shrestha et al., 2018; Russell et al., 2018) which showed no significant association of level of IPC knowledge and compliance with IPC practices.

5.4 Limitation of the study

The limitation of the study was the self-reported nature of the data collected. The study was a facility-based study and only depended on reports by participants and results were based on self-reported cross-sectional study findings. Therefore, there was a possibility of reporting bias and social desirability bias. However, efforts were put in place to reduce the occurrence of this social desirability bias by assuring participants of strict confidentiality and anonymity of the data collected. Also due to time constraint in data collection, only few nurses were observed and hence results may not be generalizable, however, the findings are worth mentioning and this will serve as a basis for recommendation of larger observational studies using solely a checklist to ascertain compliance with IPC. The sampling method used to select the participants in the three facilities could have also introduced selection bias in the study. Exclusion of type of nursing profession in the analysis is another limitation of the study as this could be a possible confounder of compliance with IPC practices.
CHAPTER SIX
CONCLUSION AND RECOMMENDATION

6.0 Introduction
This chapter presents the conclusion of the study and recommendations for improving IPC practices in health settings.

6.1 Conclusion
The findings from the study showed in general high level of knowledge of nurses on IPC practices. High level of compliance was also reported in the study. However, there were some lapses in knowledge and compliance with respect to some of the IPC measures in health facilities. Majority of the nurses lack adequate knowledge about nosocomial infections and safe injection practices. Majority of the nurses reported that they recap needles after use. Self-reported compliance was higher than the observed compliance. Majority of the nurses reported availability of hand washing station, consistent water supply, existence of IPC guidelines, accessibility to IPC guidelines, provision of in-service training, monitoring of IPC by management, provision of adequate supplies and accessibility to PPE in their facilities. More than half of the nurses reported high workload as a factor influencing their compliance with IPC practices and only few reported forgetfulness as a factor. Vaccination status and accessibility to PPE were significant factors associated with nurses’ compliance with IPC practices.

6.2 Recommendations
The following recommendations are made based on findings from the current study.
6.2.1 Recommendations to Health Facilities for practice

The study identified some gaps in Compliance and the level of knowledge of some of the IPC measures. Nurses generally had inadequate knowledge about nosocomial infections and safe injection practices. Their compliance with safe injection practices was poor as most of the nurses practice needle recapping. It is therefore recommended that various health facilities should provide intensive education and training on safe injection practices with emphasis on the dangers associated with needle recapping. Health institutions should also intensify education on nosocomial infections and vaccination. This can be incorporated in the health institutions continuous professional development (CPD) programs. Vaccination should be mandatory for all nurses and other healthcare workers. Health institutions should provide the needed assistance and support staffs by paying for some, if not all the cost associated with vaccination. IPC guidelines and policy should be made accessible to nurses and other health professionals to constantly update them on the knowledge of its content. Finally, personal protective equipment should be readily accessible by nurses and other healthcare workers at all times in health institutions in addition to all the other requirements needed to promote IPC practices always.

6.2.2 Recommendations for Research

The findings from the study showed some discrepancies between self-reported compliance and observed compliance, although only few numbers of nurses were observed and therefore may not be generalizable. There is also a possibility of exaggeration of self-reported compliance due to the self-reported nature of the questionnaire. It is therefore recommended that larger observational studies should be conducted in the future using observational checklist to ascertain compliance with IPC practices among nurses.
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Shrestha, G.N., & Thapa, B. (2018). Knowledge and practice on infection prevention among nurses of Bir Hospital, Kathmandu

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APPENDICES

Appendix A

PARTICIPANTS INFORMATION SHEET

The Information Sheet provides information about the research for participants to make an informed decision of whether to participate in the study or not. It outlines the nature of the research, what the research involves, risks, benefits, compensation (if there is none, this should be stated).

Title of Study

Infection Prevention and control Practices among Nurses in Selected Health Facilities in Greater Accra Region of Ghana

Background and Purpose of research: The role of nurses has always been pivotal in healthcare delivery. They are in more contact with patients than other healthcare professionals are and hold the key to infection prevention and control challenges. The study aimed to assess the knowledge of nurses on infection prevention and control (IPC), their compliance with IPC practices and determine factors that influence compliance with IPC practices by nurses.

Nature of research: The study is about assessing IPC practices among nurses in selected healthcare facilities. At the end of the study, I hope to gain information about the knowledge of nurses on IPC practices, their compliance with IPC practices and factors influencing compliance with IPC practices. The findings of the study will help in filling the gap and also help develop strategies for successful infection prevention program and interventions. The study participants are nurses who will be selected from three Hospitals in the Greater Accra Region of Ghana and
these Hospitals are Ga West Municipal Hospital, Achimota Hospital and Tema General Hospital. A total of 237 nurses will be recruited for this study.

**Participant’s involvement**

**Duration /what is involved:** You would be required to complete a questionnaire consisting of about 46 sets of questions divided into four sections on the heading’s socio-demographic characteristics, knowledge of infection prevention and control practices, compliance with infection prevention and control practices and factors influencing compliance with infection prevention and control practices. Participants will be given a maximum of about one hour in a day at their own convenience and privacy to complete the questionnaire.

**Potential Risks:** There are no foreseen direct risks involved in your participation in this study except for your time and the need to provide some personal information which may be a form of inconvenience to you. However, this study is expected to provide data on the extent of infection prevention practices among nurses and the information gathered will assist in minimizing the burden of nosocomial infections and also help to develop strategies for successful infection prevention programs and interventions.

**Benefits:** The study has no direct individual benefits in terms of compensations either in cash or in relation to job position. Despite this, the study is expected to provide data on the extent of IPC practices among nurses and the information gathered will assist in minimizing the burden of nosocomial infections and also help policy makers to develop strategies for successful infection prevention and control programs and interventions. By participating in this study, participants can assess their level of knowledge about IPC practices and also be informed about the contents of infection prevention and control guidelines and the need to comply with them.
**Costs:** Participants are assured that no cost will be incurred by their participation in this study, however, should any cost be incurred, they will be borne by the principal investigator.

**Compensation:** There is no payment involved in this study but you will be compensated with snack for your time.

**Confidentiality:** Your response to the questions will be held confidential and will not be disclosed to any unauthorized persons. It will only be used for research purposes. Questionnaire has been anonymized as no names will be required on the questionnaires.

**Voluntary participation/withdrawal:** Participation is voluntary and you are free to withdraw from the study at any time without being penalized in any way.

**Outcome and Feedback:** The data collected will be analyzed and findings will be communicated to all nurses from the participating institutions with appropriate recommendations. Hard copies of questionnaires will be kept in a sealed cabinet that can only be accessed by the principal investigator. All data files will be stored on a personal computer and password protected.

**Funding information:** This research is solely funded by the principal investigator.

**Sharing of participants Information/Data:** The data collected will be for research purpose and will not be shared with any third party. It will solely be for the Principal investigator.

**Provision of Information and Consent for participants:** As the principal investigator, I humbly seek your consent to participate in this research by signing the participant’s consent form which will be given to you. All the information you need to know about the research and your
right as a participant have been provided in this information sheet. Copies of the information sheet and Consent forms will be given to you after they have been signed.

**Your rights as a participant:** If you have any question about your rights as a study participant, you may contact the Administrator of the GHS Ethics review committee through:

**Hannah Frimpong**

GHS-ERC Administrator

Office: +233 302 681109

Mobile: **233 (0) 243235225 or 0507041223**

Email: Hannah.Frimpong@ghsmail.org

You can also visit the Research and Development Division of the GHS Ethical review committee near Adabraka Polyclinic Hospital, Cathedral Square, Castle road, Accra-Ghana.
Appendix B

CONSENT FORM

STUDY TITLE: INFECTION PREVENTION AND CONTROL PRACTICES AMONG NURSES IN SELECTED HEALTH FACILITIES IN GREATER ACCRA REGION OF GHANA

PARTICIPANTS’ STATEMENT

I acknowledge that I have read the purpose and contents of the Participants’ Information Sheet and satisfactorily explained to me in a language I understand (English). I fully understand the contents and any potential implications as well as my right to change my mind (i.e. withdraw from the research) even after I have signed this form.

I voluntarily agree to be part of this research.

Name or Initials of Participant…………………………..   ID Code ……………………………..

Participants’ Signature …………………

Date…………………………..
INVESTIGATOR STATEMENT AND SIGNATURE

I certify that the participant has been given ample time to read and learn about the study. All questions and clarifications raised by the participant have been addressed.

Researcher’s name..................................................

Signature ..............................................................

Date........................................................................
Appendix C

RESEARCH INSTRUMENT

UNIVERSITY OF GHANA

SCHOOL OF PUBLIC HEALTH

DEPARTMENT OF EPIDEMIOLOGY AND DISEASE CONTROL

QUESTIONNAIRE

Title of Study: Infection Prevention and control Practices among Nurses in selected Health Facilities in Greater Accra Region of Ghana

The purpose of this research is to assess infection prevention practices among nurses in selected hospitals in Greater Accra region of Ghana. The principal investigator is a student of the School of Public Health, University of Ghana. Respondents are entreated to answer all questions. Respondents are also assured of confidentiality of response given.

SECTION A: SOCIO-DEMOGRAPHIC CHARACTERISTICS

1. Age at last birthday
2. Sex {0} Male {1} Female
3. Marital status {0} Single {1} Married {2} Cohabiting {3} Divorced
4. Religion {0} Christian {1} Muslim {2} Traditional {3} other, please specify
5. Ethnic group {0} Akan {1} Ga/Adangme {2} Ewe {3} Mole-Dagbani {4} others, please specify
6. Educational Level  
   0 Certificate  
   1 Diploma  
   2 BSc  
   3 MSc, MPhil, MPH or above

7. Work Experience  
   0 less than 1 year  
   1 1 to 3 years  
   2 4 to 8 years  
   3 More than 8 years

SECTION B: KNOWLEDGE OF INFECTION PREVENTION AND CONTROL PRACTICES

Please circle the appropriate answer for each

1. Are you aware of the existence of national policy and guidelines manual on infection prevention and control practices for healthcare workers in your institution?
   A. No
   B. Yes

2. Hospital acquired infections can be transmitted from………………
   A. staff to patients,
   B. patients to staff
   C. All the above
   D. None of the above

3. Nosocomial infections are infections that patients…………………
   A. Acquire from home before reporting to the hospital
   B. Acquire from the hospital
   C. Are not at risk of acquiring

4. Most nosocomial infections are caused by…………………
   A. Multi-drug resistant bacteria
   B. Multi-drug sensitive bacteria
C. Virus

5. The following are effective ways of preventing hospital acquired infections except……
   A. Frequent hand washing with soap under running water
   B. Using the same gloves for different patients
   C. Disinfection and sterilization
   D. Disposing used needles in sharp boxes

6. Do you know about World Health Organization’s 5 moments of hand hygiene?
   A. No
   B. Yes

7. When is it appropriate to wash your hands as a nurse?
   A. Before and after each procedure
   B. After documentation of patient information
   C. After talking to each patient

8. Standard precautions apply to all patients regardless of diagnosis
   A. True
   B. False

9. All staff and patients are considered potentially infectious
   A. True
   B. False

10. Body fluids can be handled with bare hands if gloves are not available
    A. True
    B. False
11. Decontaminating all instruments and surfaces, that have come in contact with body fluids or mucous membrane should be done for
   A. 10 minutes in a 0.5% chlorine solution
   B. 10 minutes in warm soapy water
   C. 10 minutes in hydrochloric acid

12. Sterilization process includes the following except
   A. Steam sterilization using autoclave
   B. Chemical sterilization using chemicals like glutaraldehyde
   C. Physical sterilization using distilled water

13. Personal protective equipment (PPE) does not create a barrier between virus, bacteria or fungi and healthcare workers
   A. True
   B. False

14. Sharps should be handled and disposed carefully
   A. using sharp boxes
   B. In the dust bin
   C. Burying it in the ground

15. Recapping of needles is safe and does not expose nurses to danger
   A. True
   B. False

16. The following are appropriate things to do in infection prevention practices except
   A. Reporting accidental exposure to blood and body fluids to authorities
B. Keeping needle stick injuries to oneself and not reporting because it is not necessary

C. Proper management of accidental injuries

17. The best way of managing a patient with highly contagious infection is

A. Putting him or her on the same ward with other patients

B. Failing to admit the patient

C. Admitting and isolating the patient from other patients

18. Soiled linen can be sent directly to the laundry without decontamination

A. True

B. False

19. Post-exposure prophylaxis is necessary following needle stick injury

A. True

B. False

20. Vaccination decreases hospital acquired infections. The following are common vaccines for health care personnel except

A. Influenza

B. Hepatitis B

C. Anaemia

D. Meningococcal
#### SECTION C: COMPLIANCE WITH INFECTION PREVENTION AND CONTROL PRACTICES

Please tick the appropriate box; where: 1=Yes 2= Sometimes 3 = No

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I always wash my hands with soap under running water in my unit</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2. On removal of gloves, I always wash my hands after contact with a patient or body fluid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Disposable items such as gloves, masks etc. are used once and discarded in my unit</td>
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<td></td>
</tr>
<tr>
<td>4. I wash hands before and after invasive procedures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I discard sharp materials in safety box</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I recap needles before disposal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I wear goggles and mask when performing invasive and body fluid procedures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I cover wounds and cuts on my skin before I start my work</td>
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<tr>
<td>9. I carry out disinfection often in the working area and ensures that all instruments are decontaminated after each use</td>
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<tr>
<td>10. I use the same waste bin for infectious waste and non-infectious waste</td>
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</tbody>
</table>
SECTION D: FACTORS INFLUENCING COMPLIANCE WITH INFECTION PREVENTION AND CONTROL PRACTICES

Please circle the appropriate answer for each question

1. There is a hand washing station with soap, running water and disposable towel/tissue
   A. No   B. Yes, always   C. Sometimes

2. Is water supply consistent on daily basis? A. No   B. Yes, always   C. Sometimes

3. Does the institution provide in-service training/workshop related to infection prevention and control for staff? A. No   B. Yes

4. Knowledge of infection prevention and control among staff are monitored in the hospital by management? A. No   B. Yes   C. Am not aware

5. Are there adequate supply of resources (sterile needles and syringes, gloves, sharp containers, disinfectants, hand sanitizers etc.) to work with in your department? A. No   B. Yes, always   C. Sometimes

6. Are Personal protective equipment always accessible? A. No   B. Yes, always   C. Sometimes

7. Are you aware of the existence of infection prevention and control guidelines in your institution? {0} No, am not aware {1} Yes, am aware

8. If yes, do you have access to the document and knowledge of its content? A. No   B. Yes

9. I am not able to follow standard precautions frequently due to; (please tick all that apply)
   A. High work load B. I don’t have enough time   C. Forgetfulness D. None applies to me

10. I am vaccinated for common pathogens e.g. Influenza virus, Hepatitis virus etc. A. No   B. Yes
11. If No, choose any of the following reasons below that applies to you

A. My facility has not provided us with any form of vaccination   B. My facility has provided the needed vaccinations for staff but I refused to be vaccinated because of fear of any harmful side effects   C. My religion does not permit me to be vaccinated   D. others, please specify…………………………………………
# OBSERVATIONAL CHECKLIST

<table>
<thead>
<tr>
<th>INJECTION PREVENTION AND CONTROL PRACTICES</th>
<th>DONE</th>
<th>NOT DONE</th>
</tr>
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<tbody>
<tr>
<td>1. Nurses wash hands before and after every procedures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Nurses wash hands with soap under running water</td>
<td></td>
<td></td>
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<tr>
<td>3. Protective clothings are worn by nurses in surgical, labor and</td>
<td></td>
<td></td>
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<tr>
<td>neonatal intensive care unit</td>
<td></td>
<td></td>
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<tr>
<td>4. Nurses wear gloves before attending to each patient</td>
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<tr>
<td>5. Sharps are handled aseptically and disposed appropriately into sharp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>boxes</td>
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<td></td>
</tr>
<tr>
<td>6. Nurses disinfect working area frequently</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Nurses separate infectious waste from non-infectious waste</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>