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COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA

FACTORS ASSOCIATED WITH INFECTION PREVENTION AND CONTROL KNOWLEDGE AND PRACTICE AMONG HEALTHCARE WORKERS, KENEMA GOVERNMENT HOSPITAL, SIERRA LEONE

BY

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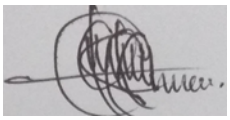
THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF THE MASTER OF PHILOSOPHY (M.PHIL.) DEGREE.

OCTOBER, 2020

DECLARATION

I, Kassim Kamara, hereby declare that this research is my own work apart from the references made to other people's work which have been duly acknowledged. This work was done under close supervision and that this work has neither in whole nor part been presented to the University nor elsewhere for another degree.



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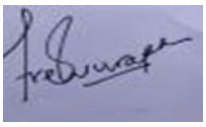

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DEDICATION

I dedicate this work to my mum, Fatmata Turay (Late), and Dad, Mr. Patrick Momoh Kamara for their support, love, and care, and discipline which they instilled in me. This work is also dedicated to the staff at Kenema government hospital healthcare workers and administration.

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ABSTRACT

Introduction: Infection prevention and control (IPC) is a hands-on discipline aimed at preventing the transmission of infections in healthcare settings. It is a critical component of the healthcare system. The main objectives of IPC include; the prevention of the incidence of infections in healthcare workers (HCW) and their patients, and other persons related with healthcare facilities; getting healthcare facilities in readiness for early detection, and response to disease outbreaks, and to ensure timely coordination and response to control community-acquired infectious diseases; it also gears to prevent and control antimicrobial resistance and the spread of resistant microorganisms. It is estimated that about 5% - 10% of patients are infected by one or more healthcare associated infection (HAI), and 15% - 40% of patients admitted to critical care are believed to be affected. This study assessed the factors associated with IPC knowledge and practice among healthcare workers, and the availability of IPC materials for practice at Kenema government hospital (KGH) in Sierra Leone.

Methods: This was a facility-based cross sectional study that recruited 219 HCWs at KGH. Selection of HCWs to participate into the study was done through simple random sampling using a lottery method. Face-to-face structured questionnaires, and observational checklists were used for data collection. We used logistic regression analysis to assess the associations between knowledge, and practice, and the independent variables such as age, sex, profession, current working unit/ward, working shift, availability of IPC supplies in working area, level of education, training on IPC, work experience, awareness of IPC committee, and access to IPC guidelines. The level of significance was set at 0.05.

Results: There was generally good knowledge (77.2%), and poor practice (53.3%) on IPC among the HCWs. Almost all the clinical areas had IPC supplies, although some basic PPEs such as gloves

were lacking in some. After conducting multiple logistic regression, tertiary level of education, (OR: 9.6, 95%CI: 2.8, 33.2, P= <0.001), five or more years work experience, (OR: 2.8, 95%CI: 1.2, 6.2, P= 0.013) were found to be significantly associated with knowledge on IPC, while working in the afternoon shift was significantly associated with good practice on hand hygiene (OR: 9.6, 95%CI: 1.2, 74.9, P=0.031), and reusable equipment (OR: 21, 95%CI: 1.2, 391, P=0.040).

Conclusions: Although there was overall good knowledge among HCWs on IPC, there are still gaps in knowledge on use of protective gloves, moments of hand hygiene, and waste segregation. The poor practice observed overall, knowledge gaps, and lack of some basic PPEs could lead to the transmission of HAIs at KGH. There is, therefore, an urgent need for the KGH administration and Ministry of the Health and Sanitation (MoHS) to intensify monitoring and supervision, mentorship, as well as conduct refresher trains for HCWs with less than five years of work experience.

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LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
CDC	Centers for Disease Control and Prevention
HAI	Healthcare Associated Infection
HCW	Healthcare Worker
HIV	Human Immunodeficiency Virus
IPC	Infection Prevention and Control
MoHS	Ministry of Health and Sanitation
OPD	Outpatient Department
PPE	Personal Protective Equipment
SOP	Standard Operating Procedures
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background

Infection prevention and control is the practical discipline concerned with preventing healthcare-associated infection. IPC is a critical part of the health care system with its purpose as follows; to prevent the occurrence of healthcare-associated infections in patients, health-care workers, visitors, and other persons associated with health-care settings, to prepare health-care facilities for the early detection and management of epidemics and to organize a prompt and effective response, to contribute to a coordinated response to control community-acquired infectious diseases, endemic or epidemic, to contribute to preventing the emergence of antimicrobial resistance and/or dissemination of resistant strains of microorganisms, and to minimize the environmental impact of these infections or their management (Ulrich & Wesarg, 2001).

Healthcare workers, for decades, have been known to be at risk of acquiring a variety of blood borne pathogen infections, most notably hepatitis B, as a result of job-related exposure. It is estimated that about 5% -10% of patients are infected by one or more HAI and 15% - 40% of patients admitted to critical care believed to be affected (Memoire, 2007). The detection of HIV&AIDS infection in the early 1980s and the identification of the first cases due occupational HIV infection triggered increased regulatory attention on improving healthcare workplace safety. Universal precautions guidelines, later expanded to incorporate the concepts associated with standard precautions (SP) were first implemented in 1996 (Garner, 1996). As indicated in these guidelines, primary prevention of job-related exposures remains the cornerstone of protecting healthcare workers from infection with blood borne pathogens. However, a significant number of

infections among healthcare workers continue to occur in the healthcare setting, despite the implementation of these guidelines (Reda, Fisseha, Mengistie, & Vandeweerd, 2010).

SP is a document that guides HCW to practice frequent hand hygiene, use personal protective equipment (PPE) such as gloves, masks, eye protection, face shield, and gowns when contact with mucus membranes, blood and body fluids of patients is expected. It also guides on the appropriate disposal of clinical wastes including sharps and tissues. Since patients infected with different microorganisms are usually difficult to determine by medical history through physical examination, recommendations that standard precautions are used on all patients, irrespective of knowledge about their infection status (Siegel et al., 2007).

Estimates from the World Health Organization (WHO) indicates that hundreds of millions of patients are affected by healthcare-associated infection (HAI) worldwide each year, contributing to significant mortality and financial losses for health systems, although precise data of the global burden are not available (Allegranzi, Nejad, & Pittet, 2017). For every 100 patients hospitalized at any given time, 6 to 7 will acquire at least one healthcare-associated infection (HAI) in developed countries and 10 in developing countries. HAI frequency in low- and middle-income countries, especially in high-risk patients, is at least two to three times higher than in high-income countries (Allegranzi et al., 2017).

Additionally, the risk of getting infected in health care facilities (HCF) in developing countries is 2 to 20 times higher than in developed countries; it is 19 times higher for device-associated infection (WHO, 2015).

Studies have documented that SPs are effective in preventing both work-related exposure incidents and associated infections. Implementing SP, however, has been a major challenge for HCWs

especially those in developing countries thus compromising their safety and increasing their exposure to infectious diseases in healthcare settings. Factors such as shortage or lack of supplies, sub-optimal safety practices, poor training, and poor awareness about the consequences of unsafe infection control practices, and limited organizational support for safe practice contribute to most of the infections in healthcare settings (Timilshina, Ansari, & Dayal, 2011).

It is evident from all indications that HAIs continue to pose a serious threat to the health of patients and healthcare workers globally, and in Sub Sharan Africa (SSA). Studies and interventions on how HAIs can be minimized particularly in SSA should be encouraged and given the needed attention.

1.2 Problem statement

In Sierra Leone, IPC knowledge and practice among HCWs has not been systematically tracked or studied. There is, however, a consensus informed by the 2014 Ebola outbreak that HAIs constitute a real public health threat to patients and healthcare workers' safety (MoHS, 2015b). With a reported 3,854 cumulative laboratory-confirmed cases of Ebola by the end of October 2014, about 5% (199) were among healthcare workers (Kanu et al., 2019).

About 13%, the highest of Ebola confirmed cases among healthcare workers in Sierra Leone occurred in Kenema district, mostly from Kenema government hospital (Kilmarx et al., 2014). The 4th quarter national IPC assessment report in 2018 showed that Kenema government hospital was among the poorly performing hospitals in the country with a 60.3% score on compliance which is below the >85% target for hospitals (National Infection, Prevention and Control Report, 2018). This pointed to limited or poor knowledge and practice on IPC among HCWs in the hospital.

Factors influencing knowledge and practice on infection prevention like years of work experience, level of education, availability of infection prevention materials, availability of infection prevention guidelines, training on IPC, etc. have been documented in some studies, (Gulilat, (2014), Geberemariyam, Donka, & Wordofa, (2018). In Sierra Leone, however, there has been no documented evidence on IPC knowledge and practice and their associated factors among HCWs. Hence the importance to assess the knowledge and practice of HCWs regarding IPC and their associated factors. In late 2014, the ministry of health and Sanitation (MoHS) in partnership with other organizations and cascaded national IPC training to over 4200 HCWs in Sierra Leone. This was followed by the development of IPC guidelines in 2015. The guidelines contained standards for safe, high-quality patient care for the safety of HCWs during routine healthcare delivery (Kanu et al., 2019).

Studies have indicated that failure to address poor IPC knowledge and practice could lead to increased risk of infection with blood borne pathogens among HCWs, patients, and the community (Al-mahdali, 2015).

This study will, therefore, assess the knowledge, practice, and associated factors as well as the availability of materials for IPC practice at Kenema government hospital.

1.3 Conceptual Framework

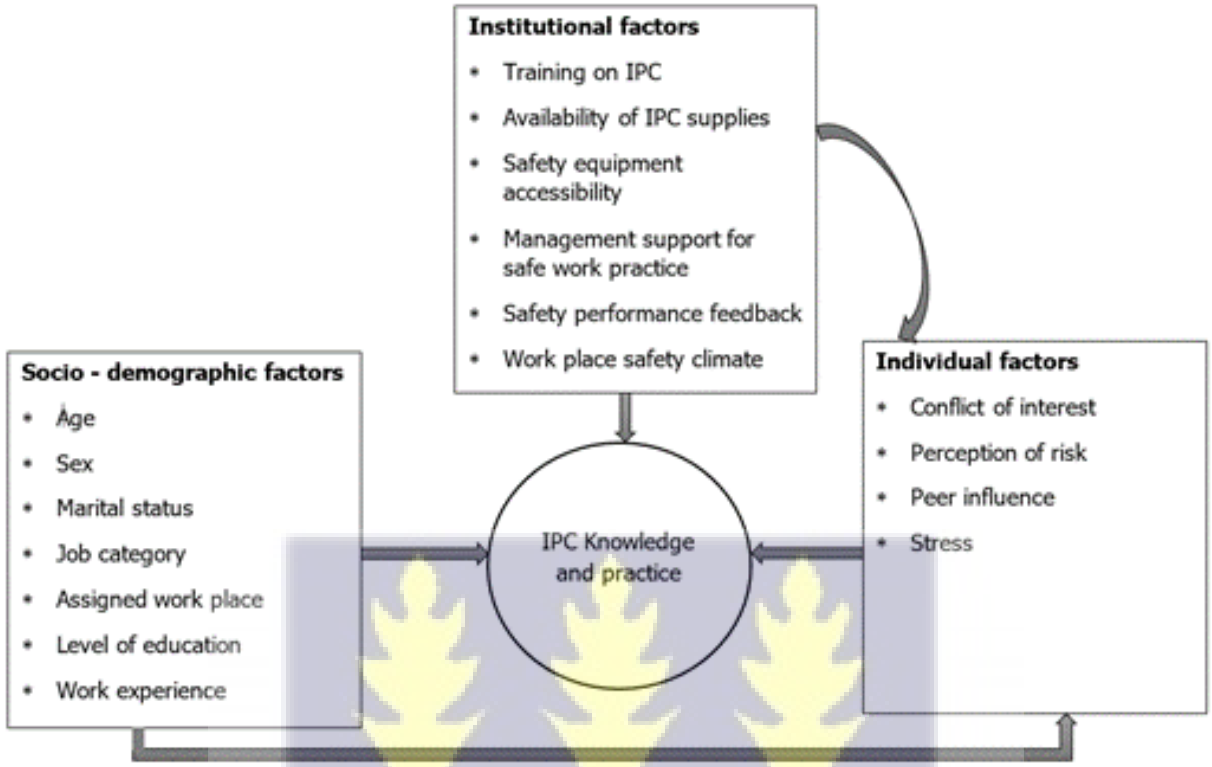

Figure 1: Conceptual framework for IPC knowledge and practice

The above conceptual framework is the knowledge translational model designed to suit the current study. We categorized the factors mainly into socio-demographic, institutional, and individual factors.

Socio-demographic factors: factors such as the age, job category, assigned work place, and level of education of HCWs are predictors of IPC knowledge and practice in healthcare settings. For example, studies have shown that increasing age of HCWs is positively associated with good IPC knowledge practice due to the fact that as HCWs get older, they become more knowledgeable and experienced which they in turn put into practice. Also, job category and assigned place of work are predictors of IPC knowledge and practice, for example, HCWs involved in surgeries or those assigned to work in high risk of HAIs transmission such as in surgical wards tend to have good

IPC knowledge and practice than other clinical areas. Furthermore, the HCWs level of education influences their knowledge and practice on IPC. For example, studies show that HCWs with higher level of education have greater odds of having good IPC knowledge and practice compared to those with lower level of education. This is because HCWs with tertiary level of education are believed to have acquired more knowledge during their training period as well as their ability to grasp IPC concepts better than those with lower level of education.

Institutional factors: institutional factors such as training on IPC, availability of IPC supplies, work place safety among others influence HCWs knowledge and practice on IPC in healthcare settings. For example, HCWs trained on IPC often have good IPC practice because the knowledge and skills acquired from the training are usually put into practice. Also, the availability of IPC supplies and the safety of the work environment could also influence the practice of HCWs on IPC.

Individual factors: factors such as risk perception, stress, and peer influence among others also influence HCWs practice on IPC. Studies show that HCWs risk perception, and stress among HCWs could influence good IPC knowledge and practice.

1.4 Research questions

1. What is the knowledge level and socio-demographic factors associated with IPC among healthcare workers at Kenema government hospital?
2. What is the knowledge level and institutional factors associated with IPC among healthcare workers at Kenema government hospital?
3. Are IPC materials available at Kenema government hospital?

4. What is the level of IPC practice, and the socio-demographic and institutional factors associated with practice among healthcare workers at Kenema government hospital?

1.5 Objectives

1.5.1 Main objective:

To assess HCWs knowledge, practice levels on IPC and socio-demographic and institutional factors associated with knowledge and practice, and availability of materials for infection prevention and control, among healthcare workers at Kenema government hospital.

1.5.2 Specific objectives

1. To assess the socio-demographic factors associated with healthcare workers knowledge on IPC in Kenema Government Hospital
2. To assess institutional factors associated with healthcare workers knowledge on IPC in Kenema Government Hospital
3. To assess the availability of infection prevention and control materials at Kenema Government Hospital
4. To assess the socio-demographic factors associated with IPC practice among healthcare workers at Kenema Government Hospital

1.6 Justification

Good knowledge and effective practice on IPC is vital to the protection against HAIs for all categories of HCWs, patients/clients, and communities.

This study is relevant because Kenema government hospital was one of the poorly performing hospitals in the country with regards to IPC in Sierra Leone according to the 4th quarter national

IPC assessment report with 60.3% compliance which is below the target of >85% (National Infection, Prevention and Control Report, 2018). Studies have indicated that poor IPC practices lead to increased risk of infection with blood borne pathogens among HCWs, patients, and the community (Al-mahdali, 2015).

This study aims to assess the knowledge of HCWs on IPC and its associated factors, availability of materials for IPC, and the level of IPC practice and its associated factors among HCWs at Kenema government hospital. The outcome of this study would help the KGH administration, IPC program, and MoHS with information on the extent of IPC knowledge and practice among HCWs at the hospital. This may enable stakeholders to take appropriate public health actions required on risk reduction geared towards the protection of HCWs, patients, and the community.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Infection prevention and control (IPC), according to WHO, is a scientific approach and practical solution aimed at preventing harm caused by infection to patients and HCWs. It occupies a critical position in the aspect of patient safety and quality universal health coverage since it is pertinent to health workers and patients at every single healthcare interaction. It addresses factors related to the spread of infections within healthcare settings (Storr et al., 2017).

IPC is a part of public health practice, carried out within the healthcare delivery system rather than at society level as a whole. It addresses factors related with the transmission of infectious microorganisms within healthcare settings, that is, from HCWs to patients or among HCWs.

The practice of IPC is critical if we are to ensure a healthy and safe healthcare delivery services in Sierra Leone. This review will cover a number of headings such as; sources of infection, the spread of pathogens, infection prevention and control, and factors associated with IPC knowledge and practice.

2.2 Sources of infection in hospitals

Microorganisms such as bacteria and viruses are naturally present in the environment, including the community, and in the hospital settings. However, the majority of these microorganisms are not pathogens and they play beneficial roles in human beings and the environment.

The natural environment also serves as a reservoir through which these microorganisms could be transmitted to susceptible individuals such as HCWs and their patients. Although there are many

reservoirs, the one from which infections arise is called the source (WHO, 2002). Identification of the right source is critical towards preventing of the spread of infections in healthcare settings.

The types of infection can be classified along the same lines of spread. Community-acquired infections can be spread other patients in healthcare settings through the respiratory tract, for example, in tuberculosis, infected blood as in viral hepatitis, faeces as in salmonella, Shigella, vibrio. Infections can also be spread through the air or skin scales such as in diseases including chickenpox, herpes, staphylococci, streptococci, and, infected discharges such as pus. These infections result from various sources, and are usually associated with invasive procedures carried out in wards, maternity units, outpatient departments, x-ray departments, operating theatres, and clinics. Healthcare workers including doctors, nurses, community health officers, laboratory personnel among others are at high risk of acquiring infections due to the role they play in healthcare delivery such as invasive procedures (WHO, 2002).

2.3 Spread of infections

Infection is the invasion and multiplication of microorganisms such as bacteria, viruses, and parasites that are not usually present within the body. The occurrence of infection is similar to a circular chain with each link representing a factor involved in the process, and this occurs if the link is present and in a proper sequence. These links include the causative agents sufficient enough to invade normal tissue, the reservoir in which the organism can thrive, and reproduce (for example; body tissues, animates and insects and contaminated food, water, and the environment). Additionally, the chain acts as a portal through which the pathogens exit the host's system such as through the respiratory and intestinal tracts (Storr et al., 2017).

Other modes through which infections can be spread from within persons or from the environment to persons include contaminated hands, air, vectors, and fomites. Other means through which

pathogens can enter the body of a susceptible host include open wounds, intestinal, and reproductive tract (MoHS, 2015b).

Microorganisms causing infection can spread in various ways such as; 1. Airborne: germs are carried by air such as the chickenpox virus, 2. Droplet spread: infectious droplets of moisture are coughed or breathed out during infection, for example, tuberculosis. These droplets settle on the surface and may be transferred to a susceptible person's eyes, 3. Direct Contact: by touching an infected person, such as Ebola and scabies, 4. Indirect Contact: through contact with contaminated equipment or other materials (Siegel et al., 2007).

Disease transmission chain

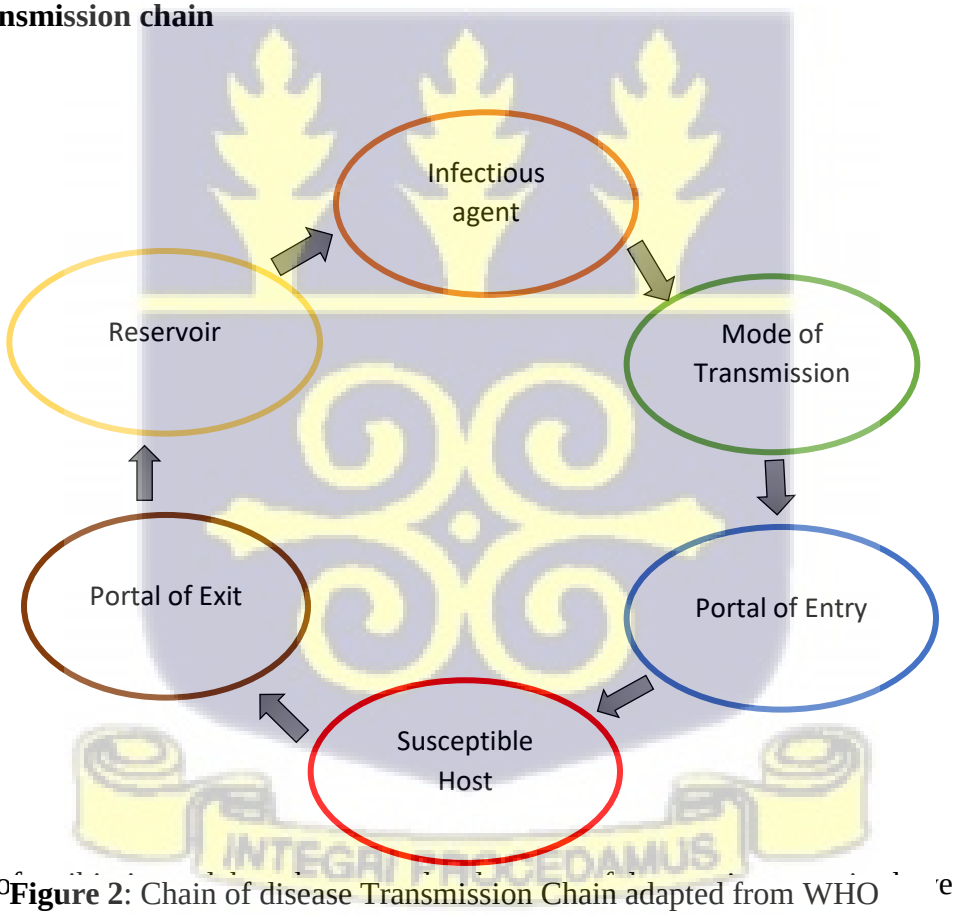

Figure 2: Chain of disease Transmission Chain adapted from WHO

The advent of [illegible] e introduced new types of pathogens which have been proved to be significantly dangerous to the health of humans (WHO, 2002).

New diseases continue to emerge as a result of changes in lifestyles and environment, making people more susceptible to these new public health threats, this has called for urgent actions to protect humans and animals (WHO, 2002). The continuous misuse of antibiotics has resulted in the emergence of many antibiotic-resistant bacteria, this suggests that newer antibiotics must continuously be developed to treat and contain infections in health care settings (Septimus, 2018).

2.4 Infection prevention and control

Infection prevention and control is very important with regards to patient safety and quality of care, as it is universally relevant to every healthcare worker and patient, at every health care interaction (Storr et al., 2017).

Infection prevention and control is an important element of practice for all healthcare professionals, this is not just to protect their health, but also to reduce nosocomial infections, hence improving the safety of patients.

Infection prevention and control address factors contributing to the spread of infections within healthcare settings, that is, whether it is between patients, patients to staff, staff to patients, or among healthcare workers. Additionally, it also takes into consideration preventive measures including; hand hygiene, use of personal protective equipment (PPE), respiratory hygiene and cough etiquette, injection and phlebotomy safety and sharps injury prevention, safe decontamination and sterilization of medical equipment, safe handling of Linen and laundry, environmental decontamination, and healthcare waste management (MoHS, 2015a).

Studies have shown that up to a third of hospital-acquired infection can be prevented effective Surveillance and control measures (Timilshina et al., 2011).

It is, however, ironic that healthcare facilities where people go to be healed may become a risky environment for the transmission of other infections. Hospitals are a reservoir for infection-causing microbes, but by ensuring good IPC practice, the risk of transmission can be minimized (Sahiledengle, Gebresilassie, Getahun, & Hiko, 2018). HCWs too can spread infections if they are not cautious about washing their hands and changing gloves whenever they come in contact with different patients, that is, moving from one patient to another. HAIs can also result from contaminated ventilation or water systems (Beltrami, M. Williams, T. Shapiro, Craig N. Chamberland, 2000).

2.5 Knowledge of Infection Prevention and Control

All HCWs, for example, physicians, midwives, community health officers, housekeepers, cleaners,' etc. should know about the importance of infection prevention. Knowledge of clinical infection, prevention, and control practices is continually growing and changing due to improving healthcare systems. Although the principles of infection, prevention, and control do not change, there are, however, specific clinical practices that may evolve as a result of new evidence (MoHS, 2015b).

Literature shows that there are differences in health practitioners' level of knowledge about IPC with higher knowledge recorded among practitioners especially in developed countries with a low burden of HAIs (Allegranzi et al., 2017), whereas inadequate knowledge on IPC has been recorded in developing countries including Sierra Leone (Al-mahdali, 2015).

A facility based cross-sectional study conducted in Ethiopia on knowledge attitudes and practice on IPC among HCWs revealed that majority of the study respondents 299 (84.2 %) were knowledgeable and 55 (15.8%) were not knowledgeable on the modes of transmission of HAIs in all health care facilities. With regards to prevention method of HAIs, the same study reported that

most the known prevention method mentioned was hand hygiene by 90.7% of the respondents, the least, also 58.2% mentioned patient isolation as a technique for infection prevention (Saleem, Khalid, Ishaque, & Zafar, 2010). In a similar study, (Sahiledengle et al., 2018), reported that 55.4% of HCWs had good knowledge in relation to infection prevention measures.

In Nigeria (Osaigbovo, 2018), in a study to assess knowledge and barriers to the practice of standard precautions among HCWs in a tertiary hospital showed an overall level of awareness of standard precautions was highest (98.4%) among nurses and lowest (6.7%) among ward attendants and this was statistically significant. In Ghana (Akagbo, Nortey, & Ackumey, 2017) in a study on knowledge of standard precautions and barriers to compliance among HCWs revealed that general knowledge on the basic concepts of standard precautions was low among HCWs. Only 37.0% of HCWs were aware that SP includes hand washing before and after any direct contact with the patient, 39.0% mentioned cough etiquettes, and 40.0% mentioned aseptic techniques which involve infection prevention strategies to minimize the risks of infection.

2.6 Infection Prevention and Control Practice

A facility-based cross-sectional study conducted by Sahiledengle et al., 2018 in Ethiopia among HCWs infection prevention practice revealed that 66.1% HCWs had good infection prevention practices. The study also showed that laboratory technicians and others (like anesthesiologists, dentists, and ophthalmologists) were 82% times less likely to have good infection prevention practices compared to doctors. The study also reveal that HCWs who were aware that infection prevention related standard operating procedures (SOP) or guidelines' availability in the healthcare facility were almost two times more likely to have good infection prevention practices compared to those who had no awareness on the availability of infection prevention related SOP.

A similar study in Ethiopia among HCWs with regards to IPC practice, Otovwe & Adidatimi, 2017, documented that 8.1% follow recommended guidelines for use of alcohol-based solutions and other antiseptics after lifting and moving a patient and 44.6% recaps needle after use. Also, 96.3% discard used needles and other wastes into their container and 17.3% of the participants of the study remove rings and bracelets, and watches before beginning hand hygiene, and also 96.3% dispose sharps separately from other wastes. Overall, 60.5% of HCWs had good practice towards infection prevention and control measures and the remaining 39.5% of HCWs had poor practice.

Geberemariyam, Donka, & Wordofa, 2018, in a cross-sectional study this study on the assessed the knowledge and practices of HCWs on infection prevention and associated factors in healthcare facilities found that HCWs who reported safe infection prevention practice was 36.3%. Furthermore, the study also reported that 69.4% of the healthcare workers frequently performed hand washing after caring for a patient, 64.2% after gloves removal, 63.6% before wound care, and 56.1% before caring for a patient.

2.7 Availability of Infection Prevention and Control

The availability of adequate materials has been found as one of the factors that promote IPC practice in healthcare facilities. Mukwato, Ngoma, & Maimbolwa, 2007, in a descriptive case study design, found that compliance with IPC practices was significantly high in departments such as the operating theatre where supplies of materials for IPC were adequate compared to the medical department where supplies were inadequate. In another study conducted at the same hospital, a significant association was found between the availability of IPC materials and compliance as all (100%) of those who highly complied with guidelines indicated that the materials for IPC were always or mostly available (Mukwato et al., 2007).

In a cross-sectional study by Hayeh Pauline Awusi, 2012, to assess Infection Prevention and Control Practices at the Ridge Regional Hospital in Accra found that the availability of materials for IPC practices and compliance with IPC guidelines were moderate.

2.8 Factors associated with IPC knowledge and practice

Socio-demographic factors

A facility-based cross-sectional study by Sahiledengle et al., (2018) in Ethiopia, profession, presence of IPC guidelines, and training on infection prevention were found as predictors for IPC practice. Also, when compared to nurses, midwives had almost 72% lesser odds of having good knowledge and practice on safe infection prevention (OR=0.28, 95% CI: 0.12-0.69). Furthermore, the study also found that physicians had 85% lesser odds of being knowledgeable on infection prevention when compared with nurses (OR=0.15, 95% CI: 0.05-0.45). Also, HCWs that had served for ten or more years had about three times greater odds of being knowledgeable on infection prevention when compared to other HCWs with less than five years of work experience (OR = 3.41, 95% CI: 1.22, 9.55). In another facility-based cross-sectional study in Ethiopia by Teshager, Engeda, & Worku, (2015a) found that male HCWs had 3.22 greater odds of being knowledgeable on surgical sites infection prevention when compared to females (OR=3.22, 95%CI: 2.09, 4.95). Also in the same study HCWs who had five or more years work experience had 1.81 greater odds of being knowledgeable on surgical sites infection prevention when compared to HCWs with lesser years of work experience (OR=1.81, 95%CI: 1.12, 2.94). Furthermore in the same study, females had 2.35 greater odds of having good surgical sites infection prevention practice when compared to males (OR=2.35, 95%CI: 1.58, 3.50), and HCWs aged 30 years or more had 1.79 greater odds greater odds of having good surgical sites infection prevention practice when compared to those with lesser age (OR=1.79, 95%CI: 1.08, 2.97). HCWs

with a diploma qualification had 2.25 greater odds of having good surgical sites infection prevention practice when compared to those with first degree and masters qualifications (OR=2.25, 95%CI: 1.08, 4.76) in the same study by Teshager et al., (2015a). A study in Ethiopia by Gulilat, (2014) also found that HCW who had worked for ten or more years had four times greater odds of having good practice infection prevention than with less than ten years work experience (OR =3.79, 95%CI: 2.33, 6.17).

Institutional factors

In a similar study in Ethiopia conducted by Sahiledengle et al., (2018), found that HCWs who had IPC guidelines available had about three greater odds of having safe practice on infection prevention when compared to those who did not have IPC guidelines for practice (OR=3.34, 95% CI: 1.65, 6.76). Furthermore in the same study, HCWs trained on infection prevention had about five times greater odds of having safe injection safety practice on infection prevention when compared to those who had not been rained on infection prevention (OR = 5.31, 95% CI: 2.42-11.63). Also, Teshager et al., (2015a) in a study in Ethiopia found that HCWs who were trained on infection prevention had 1.95 greater odds of being knowledgeable when compared to HCWs who had not being trained infection prevention, however, being trained on infection prevention was not a predictors for good infection prevention practice.

In another cross-sectional study by Gulilat, (2014) on the assessment of the knowledge, attitude, and practice of healthcare workers on infection prevention in health institutions, availability of personal protective equipment was found as a predictor for good IPC practice where HCWs who had PPEs available had 6.99 greater odds of having good infection prevention practice compared to HCWs who do not have (OR=6.99, 95%CI: 2.83, 17.27). In a similar study in a referral hospital in Ethiopia, Hussen SH, Estifanos WM, Melese ES, (2017) found that HCWs in the pediatric

department had 83% lesser odds of practicing good infection prevention measures compared to those in medical wards (OR=0.17, 95%CI: 0.06, 0.48).

A cross-sectional study conducted by Assefa & Diress, (2020) in Ethiopia found that HCWs that had infection prevention guidelines had 3.65 greater odds of having adequate knowledge on infection prevention when compared to those who did not have access to infection prevention guidelines. They study also found that HCWs in the laboratory had 2.56 greater odds of having adequate knowledge on infection prevention when compared to those who were working at the outpatient department. Furthermore, the study found that being trained on infection prevention, working in the laboratory were predictors of safe infection prevention practice.

CHAPTER THREE

METHODS

3.1 Study Design

This study adopted a facility-based cross-sectional survey design. Different groups of health practitioners including physicians, nurses, midwives, laboratory personnel, dentists, and anesthetists with varying characteristics such as age, sex, knowledge, work experience, practice among others were recruited, observed, and interviewed on IPC by trained research assistants using a semi-structured questionnaire and an observational checklist.

3.2 Study Area

This study was conducted at the Kenema Government Hospital (KGH) in the Eastern region of Sierra Leone. KGH is the regional hospital of the Eastern region located along Combema road in Kenema city, Kenema district. KGH being the regional referral hospital has a trained IPC focal coordinator and a unit that trains most of its staff on IPC practices. Being a regional hospital, KGH has a 350-bed capacity covering a catchment area of approximately 670, 000 people (MoHS, 2014). KGH has 467 staff and volunteers, this is based on an employee roster. KGH in the Eastern region of Sierra Leone mainly comprised of male, female, surgical, annex, Lassa fever, pediatric, maternity, neonatal wards as well as outpatient department among others. KGH in the eastern region of Sierra Leone also serves as the national referral center for Lassa fever, which is endemic in eastern Sierra Leone.

KGH staff strength is about 468 HCWs, comprising doctors, pharmacists, nurses, laboratory technicians, and other healthcare workers. The study was chosen in this hospital because it is the regional hospital and as well serves as the referral hospital for other health facilities within the

region and also for its low compliance in IPC practices compared to other hospitals (National Infection, Prevention and Control Report, 2018).

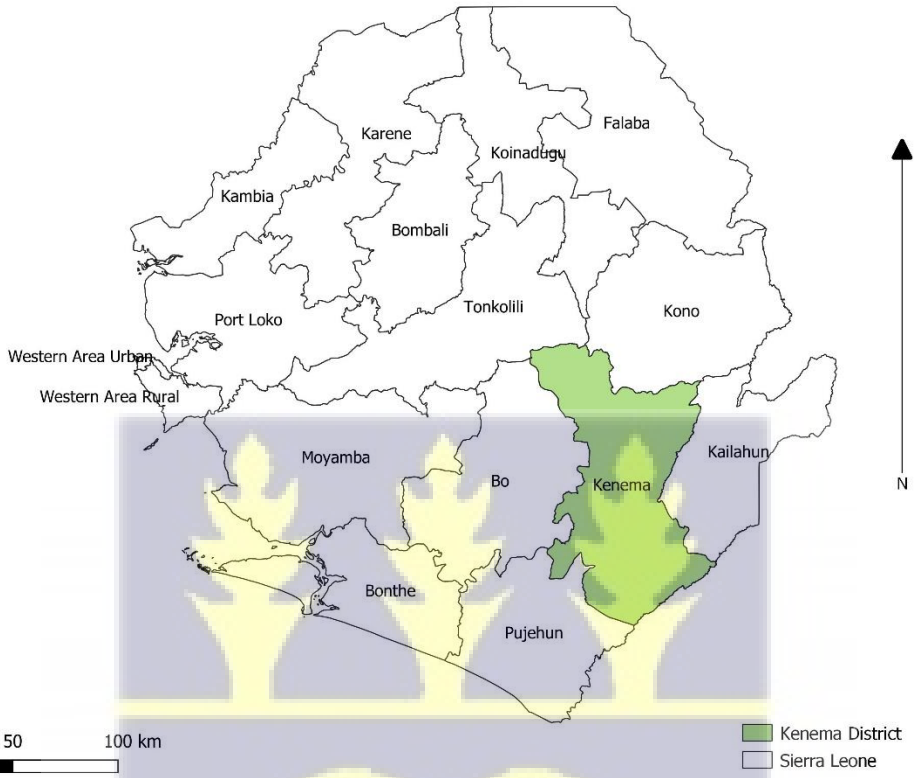

Figure 3: Map of Sierra Leone showing Kenema District

3.3. Study variables

The outcome variables studied were knowledge, practice of HCWs on IPC, and availability of IPC materials at the KGH. The independent variables are demographic characteristics including age, sex, profession, work experience, working shift, and availability of materials for IPC, awareness of IPC committee, availability of IPC supplies, availability of IPC guidelines in the working area.

Table 1: Operational Definition of the Socio-demographic characteristics and other variables

Variable	Operational definition	Measurement	Source of data
Age of HCW	HCWs age at last birthday	Continuous (years)	Interview
Sex	Sex of HCW	Categorical	Interview/Observation
Profession	Current designation of HCW	Categorical	Interview/observation
Religion	Religious belief of HCW	Categorical	Interview
Highest level of education	Highest level of education attained	Categorical	Interview
Years of work experience	HCW's years of work experience	Continuous	Interview
Current working in ward/unit	Clinical working area at the time of study	Categorical	Interview
Working shift	HCW's working shift at the time of study	Categorical	Observation
Availability of IPC supplies	Availability of IPC supplies in the clinical areas	Categorical	Observation

3.4 Sampling

3.4.1 Study Population

The study population include all healthcare workers at the Kenema government hospital

3.4.2 Sample size determination

A sample size of 233 was drawn from the study population. A confidence level of 95% (5% significance), a prevalence rate of 50.6% was used as reported in a study by (Jemal et al., 2019) on healthcare workers' knowledge, attitude and practice on infection prevention at Dubti referral hospital, Dubti, Ethiopia was used to determine the sample size for knowledge, and a 10% (21) non-response rate were used to obtain the sample size for estimating single population proportion using open epi software version 3 (n = [DEFF*Np(1-p)]/ [(d2/Z21-α/2*(N-1)+p*(1-p)]).

3.4.3 Unit of Analysis

The unit of analysis is an individual health worker at the hospital.

3.4.4 Sampling procedure

Simple random sampling was used to sample respondents for the study. This was achieved by obtaining a list of healthcare workers for each ward, unit, and department from the human resources unit to form the sampling frame. Healthcare workers at the top of the list was assigned number 1 and the one at the bottom assigned the number corresponding to the total staff in that care area. The numbers assigned to HCWs were thoroughly mixed in a sac before selection. And we selected those who participated in the study randomly using a lottery method. Healthcare workers who were selected but declined to participate in the study were replaced by putting their numbers in the sac and mixed again to select another respondent.

3.4.5 Inclusion criteria

Healthcare workers such as physicians, nurses, midwives, laboratory personnel, porters/cleaners, and other health professionals who were available at the Kenema government hospital at the time of data collection.

3.4.6 Exclusion criteria

Participants were excluded from the study if they are still undergoing training or internships in the health profession. Participants were also excluded from the study if they are not exposed to body fluids such as administrative staff.

3.5 Scope of study

Knowledge and infection prevention and control practice of HCWs were assessed on five main domains such as hand hygiene, use of protective gloves, injection or blood sampling safety,

disinfection of reusable equipment, and waste segregation. The WHO (Pittet & Donaldson, 2005), the WHO Regional Committee for Africa (WHO Regional Committee for Africa, 2008), and the Sierra Leone Ministry of Health and Sanitation (MoHS, 2015b) recognized these IPC domains as critical for patient safety.

3.6 Research Instrument

The questionnaire for this study was adapted from previous studies on IPC practices among HCWs by Hayeh Pauline Awusi, 2012 in relation to the current study. The standard observational guide for the assessment was adapted from MoHS Sierra Leone observational checklist and the CDC IPC checklists.

3.7 Data collection technique and tools

3.7.1 Data collection and quality control

The study recruited six research assistants who were final year students at the Eastern polytechnic pursuing health-related courses. They were trained for two days on the study protocol including data collection through face to face interviews, and observations using a structured questionnaire and observational guide as well as basic infection prevention principles. Observational guides were used to assess IPC practices among HCWs at the hospital. The research was supervised throughout the data collection period. This study was conducted for four weeks. We first conducted the observations in the first week of the study and then followed by the interviews in the remaining two weeks of the study. HCWs were observed for at least 45 minutes, and the interviews lasted between 30 – 45 minutes. To ensure quality of the data, we pre-tested the questionnaire in 5% of HCWs in the study area, but was not included in the actual study to assess the content and approach of the questionnaire and necessary corrections were made before actual data collection. Also, the

principal investigator examined the consistency, completeness, and accuracy of the collected data on daily basis.

3.7.2 Data processing and analysis

The raw data were inputted into Microsoft excel 2013. To minimize data entry errors, data validation rules were used. The data was cleaned, and imported into STATA software version 15 for statistical analysis. Categorical variables were presented as frequency and corresponding percentages. The results were presented using tables. Quantitative variables were analyzed using median and range. There were further analysis to determine the association of poor knowledge and practice with socio-demographic variables such as age, sex, clinical working area, working shift, profession, experience, and the availability of IPC materials. This was done using logistic regression analysis since the outcome variables are binary in nature. The tests were conducted at 95% confidence level which is the 0.05 level of significance to determine the association between the dependent and independent variables.

3.7.3 Ethical Consideration

The ethical principles concerning research on human participants were strictly followed, ensuring that the rights of the individual and the institutions are protected.

Clearance to conduct this study was sought for and granted by the Sierra Leone Ethics and Scientific and Review Committee. Approval to conduct this study was also given by the District Health Management Team (DHMT) and the Kenema Government Hospital Administration to use their data and staff for this study through issuing of letters that spelled out the research topic and the intentions of researchers to conduct this study within the facility. The objectives of the study were clearly explained to them to obtain permission for this study.

Consent to participate in this study was also obtained from the participants through the participant information sheet. They were also allowed to ask questions concerning this study for clarification. The study participants also had the right to decide whether to participate in this study or not without coercion since participating in this study was purely voluntary, as stated in the consent form. The study participants were, however, informed that they could leave questions unanswered if they find it discomforting, as well as having the right to withdraw from the study at any stage of this study without any coercion. Contacts of the researcher and supervisor were made available for respondents on the participant information form for further clarification.

Anonymity and privacy of the respondents were ensured by not requesting the names and addresses or any personal details which could reveal their identity when being interviewed. Telephone numbers were, however, informed they could follow up with respondents for any clarification. All completed questionnaires were kept in a sealed folder and inputted into a computer secured with a passcode for analysis.

3.7.4 Risks/Benefits

The study had no direct individual benefits in terms of compensations either in cash or in relation to the job position and this was clearly spelled out to participants through the participant information page which was given to them before they gave consent. Nonetheless, the benefits of the study to the facility as well as the community that benefits the participants indirectly include informing policymakers on necessary actions were spelled out to the participants on the information page. The participants were assured of no anticipated risks to be recorded physically or mentally for either participating in the study or not by the researcher aside the time involved in participating which has been spelled out in the information page and they still hold the right to withdraw and report to ethics committee immediately if they find that the study poses certain harm.

3.7.5 Conflict of Interest

There was no conflict of interest to the intended study.

3.8 Operational definition

Each correct response was scored one (1), and incorrect response scored zero (0) for knowledge and practice. The total score for practice in the five domains was used to determine the level of practice. To assess knowledge and practice a score of <70% was considered poor, and ≥70% was considered good for both knowledge and practice, adapted from a study in Ethiopia (Gezie, Leta, & Admasu, 2019).

CHAPTER FOUR

RESULTS

4.1 Socio-demographic characteristics of healthcare workers, Kenema government hospital, February, 2020.

Ninety-four percent (219/233) of the healthcare workers contacted to participate in the current study, hereafter referred to as study participants, agreed to enroll in the study. The 25 – 29 year age group had the highest percentage, with 28.8% (63/219) of the study participants. The median age of the study participants was 31 years, range 20 – 56 years. Seventy-four percent (162/219) of the study participants were females. Nearly half, 49.3% (108/219), of the study participants were married. The majority, 62.1% (136/219) of the study participants were Christians. The majority 90.4% (198/219) of the study participants had attained tertiary education level.

Most of the study participants were nurses and midwives 71.2% (156/219), followed by laboratory technicians, 14.6% (32/219). Slightly more than half, 52.5% (115/219) of the study participants had a cumulative working experience of five years and above. Most of the study participants were working at medical wards, 46.6% (102/219), followed by the outpatient department clinics (general OPD and specialized HIV and eye clinics) 21.5% (47/219) (see Table 2).

Table 2: Socio-demographic characteristics of study participants, Kenema government hospital, February 2020

Variable	Frequency (%) N = 219
Age (years)	
20 – 29	85(38.8)
30 – 39	87(39.7)
40 – 49	36(16.4)
≥50	11(5.0)
Sex	
Female	162(74.0)
Male	57(26.0)
Marital status	
Married	108(49.3)
Unmarried	111(50.7)
Religion	
Christian	136(62.1)
Muslim	83(37.9)
Highest level of education	
Up to secondary school	19(8.7)
Tertiary	200(91.3)
Profession	
Physicians & CHOs[1]	13(6.0)
Nurses & Midwives	156(71.2)
Laboratory technicians	32(14.6)
Others*	18(8.2)
Years of work experience	
<5	104(47.5)
≥5	115(52.5)
Currently working ward or unit	
Blood bank & Laboratory	29(13.2)
Lassa fever ward	8(3.6)
Maternity ward**	16(7.3)
Medical wards	102(46.6)
OPD, HIV & eye units	47(21.5)
Surgical ward	17(7.8)

OPD=Outpatient department, [1]CHO=Community health officer, HIV=Human immunodeficiency virus * Anesthetists, ophthalmologist & potters, ** Male, female, & pediatric wards.

4.2 Knowledge of healthcare workers on infection prevention and control in Kenema government hospital

In this study, 77.2% (169/219) of the study participants at KGH had good knowledge of infection prevention and control.

4.2.1 Hand hygiene

As shown in Table 3, 64.8% (142/219) of the study participant correctly mentioned all the five moments of hand hygiene. The majority (92.7%, 203/219) of the study participants mentioned that hand washing with soap and water or the use of alcohol hand rub decreases the risk of transmission of HAIs. About 85% (186/219) of the study participants were not aware that rubbing of hands with soap should last for about 20 seconds during hand washing. Approximately 77% (169/219) of the study participants were aware that the use of alcohol hand rub when hands are not visibly dirty can be as effective as using soap and water for hand hygiene.

4.2.2 Protective gloves

As shown in Table 3, about 90% (198/219) of the study participants were aware that single-use gloves should not be used for more than one patient during clinical care. About 80% (175/219) of the study participants were aware that wearing gloves does not eliminate the need for hand washing, and more than half 56.2% (123/219) mentioned that the use of sterile gloves is not the most effective method of preventing HAIs. Slightly above three fourth, 75.3% (165/219) of the study participants mentioned that it is necessary to remove gloves and decontaminate hands between patients during clinical care. Only about 22% (47/219) of the study participants mentioned that it is not acceptable to decontaminate gloves using soap and water or alcohol gel. About 93% (203/219) of the study participants were aware that gloves should be worn when handling potentially infectious materials or when coming into contact with contaminated items or surfaces

of patients. About 72% (158/219) of the study participants were aware that gloves should be worn when performing aseptic technique.

4.2.3 Injection safety

The majority, 92.2% (202/219) of the study participants were knowledgeable on the non-re-use of that needles and syringes and about 94% (206/219) mentioned that syringes cannot be reused even if they have not come in contact during clinical care. More than four-fifths, 82.2% (180/219) of the study participants were aware that the recapping of needles is not a good practice (see Table 3).

4.2.4 Waste segregation

More than three fourths, 76.3% (167/219) of the study participants understood that highly infectious waste should be deposited in a red container waste bin. About 82% (180/219) of the study participants mentioned that infectious or hazardous healthcare waste should be deposited in yellow waste bins. Similarly, about 82% (178/219) of the study participants correctly mentioned that black waste bins are the most appropriate to deposit non-infectious waste (see Table 3).

4.2.5 Reusable equipment

Between 87 to 90 % (190-197/219) of the study participants were aware that thermometers and stethoscopes should be disinfected after coming in contact with a patient. About 80% (176/219) of the study participants were aware that the use of boiling water to clean instruments is not the most effective means of sterilization of reusable instruments (see Table 3).

Table 3: Knowledge of healthcare workers on infection prevention and control in Kenema government hospital, February, 2020

Knowledge question	Response	Frequency (%) N=219
Name the moments of hand hygiene?	All 5 moments	142(64.8)
	<5 moments	77(35.2)
Washing hands with soap or use of alcohol based rub decreases the risk of transmission of HAIs	Agree	203(92.7)
	Disagree	16(7.31)
When using soap and water to clean hands, you should wet hands, apply soap, then rub hands together for at least **10 seconds**	Agree	186(84.9)
	Disagree	33(15.1)
Use of an alcohol hand rub for hand hygiene is as effective as soap and water if hands are not visibly dirty	Agree	169(77.2)
	Disagree	50(22.8)
Hand hygiene should be performed after examining a patient	Agree	187(85.3)
	Disagree	32(14.6)
Gloves can be used for more than one patient at the same time during clinical care	Agree	21(9.6)
	Disagree	198(90.4)
Wearing gloves eliminates the need to wash hands	Agree	44(20.1)
	Disagree	175(80.0)
Use of sterile gloves is the most effective method to prevent HAIs	Agree	96(43.84)
	Disagree	123(56.2)
It is necessary to remove gloves and decontaminate hands between different patients	Agree	165(75.3)
	Disagree	54(24.7)
It is acceptable to decontaminate gloves using soap and water or alcohol gel	Agree	172(78.5)
	Disagree	47(21.5)
Gloves should be worn when handling potentially infectious materials or when coming into contact with contaminated items or surfaces	Yes	203(92.7)
	No	16(7.3)
Gloves should be worn when there is a likelihood of coming into direct contact with a patient's blood, body fluids, moist body substances or saliva, mucous membranes and non-intact skin	Yes	186(84.9)
	No	33(15.1)

Gloves should be worn when performing aseptic technique	Yes	158(72.2)
	No	61(27.9)
Needles and syringes can be reprocessed during patient care	Agree	13(5.9)
	Disagree	206(94.1)
Syringes can be reused on more than one patient if they do not come into contact with the patient's body fluids	Agree	17(5.9)
	Disagree	202(92.2)
Recapping the needle after injecting a patient is a safe injection practice	Agree	39(17.8)
	Disagree	180(82.2)
Highly infectious waste should be deposited in red container waste bins	Agree	167(76.3)
	Disagree	52(23.7)
It is appropriate to deposit infectious or hazardous health-care waste in yellow waste bins	Agree	180(82.2)
	Disagree	39(17.81)
Black waste bins are the most appropriate to deposit non-infectious waste	Agree	178(81.3)
	Disagree	41(18.7)
It's not necessary to disinfect a thermometers after coming in contact with a patient	Agree	190(86.8)
	Disagree	29(13.2)
A stethoscope should always be disinfected after being in contact with a patient	Agree	197(90.0)
	Disagree	22(10.1)
Use of boiling water to clean reusable instruments and utensils is an effective means of sterilization	Agree	43(19.6)
	Disagree	176(80.4)

Table 4: Overall knowledge and practice levels of study participants in Kenema Government Hospital, February 2019

Variables	Frequency (%)
Knowledge	**N=219**
Good	169 (77.2)
Poor	50 (22.8)
Practice	**N=25**
Good	15 (60.0)
Poor	10 (40.0)

4.3 Bivariate analysis for socio-demographic and institutional factors associated with knowledge of infection prevention and control

4.3.1 Age

On bivariate analysis, when the different age groups (30-39, 40-49, ≥ 50) years were compared to the 20-19 age group, there is no statistically significant difference in their knowledge levels on IPC, all the P-values are more than 0.05 (see Table 5).

4.3.2 Sex

About seventy-four percent (162/219) were females (see Table 2). The results showed that being a female was associated with knowledge in IPC. Females had 2.4 times greater odds of being knowledgeable on IPC when compared to males (cOR=2.4, 95% CI: 1.2, 4.7). This association was found to be statistically significant at a 95% confidence level (P=0.012) (see Table 5).

4.3.3 Religion

About 62% (136/219) of the study participants were Christians. Religion was not a significant factor in this study. There was no association between Muslims and Christians with regards to knowledge of IPC (cOR=.1.0, 95% CI: 0.5, 1.9) (P=0.987) (see Table 5).

4.3.4 Marital status

As shown in Table 4, almost half, 49.3% (108/219) of the study participants were married, and the remaining were unmarried. Marital status was not found to be a significantly associated factor for knowledge on IPC, however, those who were unmarried were 1.3 times greater odds of being knowledgeable on IPC compared to those who were married (cOR=1.3, 95% CI: 0.7, 2.4) (P=0.451).

4.3.5 Highest level of education

Highest level of education of study participants was classified as either up to secondary school or tertiary level. The majority, 91.3% (200/219) of the study participants attained tertiary level of

education. Study participants who attained tertiary education level were 9.5 times greater odds of being knowledgeable on IPC when compared to those who attained up to secondary school education, (cOR=9.5, 95% CI: 3.4, 26.8) (Table 5). This finding is statistically significant at 95% confidence level (P=<0.001) (see Table 5).

4.3.6 Profession

About 71% (156/219) of the study participants were nurses and midwives combined, 14.6% (32/219) were laboratory technicians, and 6.0% (13/219) were physicians and community health officers combined. Even though profession was not a significant factor in this study, nurses and midwives combined had two times greater odds of being knowledgeable on IPC when compared to the other professions, (cOR=1.9, 95% CI: 0.56, 6.8), (P=0.294) (see Table 5).

4.3.7 Work experience

Slightly more than a half, 52.5% (115/219) of the study participants had five years or more work experience. The results revealed that healthcare workers who had five or more years of work experience had 2.7 times greater odds of being knowledgeable on IPC when compared with those with less than five years of work experience (cOR=2.7, 95% CI: 1.4, 5.2). This finding was statistically significant at 95% confidence level (P=0.003) (see Table 5).

4.3.8 Place of work

About 47% (102/219) of the study participants were working at medical wards, 13.2% (29/219) at the laboratory and blood bank combined. About 4% (8/219) at the Lassa fever ward, 7.3% (16/219) at maternity ward, 21.5% (47/219) at OPD, and specialized HIV and eye care units combined, and 7.8% (17/219) at the surgical department. The results showed that study participants who were working at medical wards had 2.6 times greater odds of being knowledgeable on IPC compared to

those working in other wards or units (cOR=2.6, 95% CI: 1.0, 6.8). This association was statistically significant at 95% confidence level (P=0.050) (see Table 5).

4.3.9 Training on IPC

The majority, 89.0% (195/219) of the study participants were trained in IPC. Training in IPC was a significant factor in this study. Healthcare workers trained in IPC had 5 times greater odds of being knowledgeable on IPC when compared to those who were not trained (cOR=5.0, 95% CI: 2.10, 12.2). This association was statistically significant at 95% confidence level (P=<0.001) (see Table 5).

4.3.10 Awareness of IPC committee in the hospital

The majority, 93.6% (205/219), were aware about the existence of a committee on IPC. Healthcare workers who were aware of the existence of an IPC committee had 10.6 times greater odds of being knowledgeable on IPC when compared to those who were not aware about the existence of IPC committee (cOR=10.6, 95% CI: 1.9, 60.0). This association was statistically significant at 95% confidence level (P=0.006) (see Table 5).

4.3.11 Access to IPC guidelines

The majority, 89.5% (196/219) of the study participants had access to the IPC guidelines in the health facility. Access to IPC guidelines was a significant factor for knowledge in IPC. Study participants who had access to IPC guidelines had 3.7 times greater odds of being knowledgeable on IPC when compared to those who did not have access to the guidelines (cOR=3.7, 95% CI: 1.5, 9.0). This was a statistically significant association at 95% confidence level (P=0.005) (see Table 5).

Table 5: Bivariate analysis for socio-demographic and institutional factors associated with healthcare workers infection prevention knowledge in Kenema government hospital, February 2020

Variables	Knowledge level		cOR(95%CI)	P value
	Good (n=169)	Poor (n=50)		
Age				
20 – 29	62	23	1	
30 – 39	70	17	1.5(0.8,3.1)	0.245
40 – 49	29	7	1.5(0.6,4.0)	0.377
≥50	8	3	1.0(0.2,4.0)	0.988
Sex				
Male	37	20	1	
Female	132	30	2.4(1.2,4.7)	**0.012**
Religion				
Christian	105	31	1	
Muslim	64	19	1.0(0.5,1.9)	0.987
Marital status				
Married	81	21	1	
Unmarried	88	23	1.3(0.7,2.4)	0.451
Highest level of education				
Up to secondary school	6	13	1	
Tertiary	163	37	9.5(3.4,26.8)	**<0.001**
Profession				
Physicians & CHOs	9	4	1	
Nurse & midwives	127	29	1.9(0.6,6.8)	0.294
Laboratory technician	25	7	1.6(0.4,6.7)	0.531
Others	8	10	0.4(0.1,1.6)	0.177
Work experience				
<5 years	71	33	1	
≥5	98	17	2.7(1.4,5.2)	**0.003**
Place of work				
Blood bank & Laboratory	20	9	1	
Lassa fever ward	7	1	3.2(0.3,29.5)	0.315
Maternity ward	12	4	1.4(0.3,5.4)	0.670
Medical wards	87	15	2.6(1.0,6.8)	**0.050**
OPD, HIV & eye units	27	20	0.6(0.2,1.6)	0.317
Surgical ward	16	1	7.2(0.8,62.9)	0.074
Training on IPC				
Yes	158	37	5.0(2.1,12.2)	**<0.001**
No	11	13	1	

Awareness of IPC committee				
Yes	166	39	10.6(1.9,56.9)	**0.006**
No	2	5	1	
Don't know	1	6	0.4(0.0,6.1)	0.522
Access of IPC guidelines				
Yes	157	39	3.7(1.5,9.0)	**0.005**
No	12	11	1	

*****cOR= crude odds ratio

4.4 Multivariate analysis for socio-demographic and institutional factors associated with healthcare workers infection prevention knowledge in Kenema government hospital, February, 2020.

Multiple logistic regression analysis for variables that were statistically significant at 95% CI and $P \leq 0.05$ at the bivariate level analysis was conducted. The factors that were statistically significant at 95% CI and $P \leq 0.05$ at the bivariate level analysis and therefore applied in the multiple logistic regression analysis include sex, level of education, years of work experience, place of work, training on IPC, awareness of IPC committee, and access to IPC guidelines. On multiple logistic regression, only level of education and years of work experience were statistically significantly associated with good knowledge on IPC ($P \leq 0.05$) (see Table 6). After adjusting for other factors in the model, healthcare workers who attained tertiary education were 9.6 times more knowledgeable on IPC compared to their counterparts and the difference was statistically significant (aOR=.9.6, 95% CI: 2.8, 33.2) (P=<0.001). Likewise, healthcare workers who had five or more years work experience had 2.8 times greater odds of being knowledgeable on IPC compared to those with less than five years of work experience, the difference was also statistically significant (aOR=2.8, 95% CI: 1.2, 6.2) (P=0.013) (see Table 6).

Table 6: Multivariate analysis for socio-demographic and institutional factors associated with healthcare workers knowledge on infection prevention in Kenema government hospital, February 2020

Variables	Level of knowledge		aOR(95%CI)	P value
	Good (n=169)	Poor (n=50)		
Sex				
Male	37	20	1	
Female	132	30	2.3(0.9,5.9)	0.089
Highest level of education				
Up to secondary school	6	13	1	
Tertiary	163	37	9.6(2.8,33.2)	**<0.001**
Work experience				
<5 years	71	33	1	
≥5 years	98	17	2.8(1.2,6.2)	**0.013**
Place of work				
Blood bank & Laboratory	20	9	1	
Lassa fever ward	7	1	1.0(0.1,12.8)	0.972
Maternity ward	12	4	2.2(0.3,17.8)	0.474
Medical wards	87	15	0.8(0.2,3.1)	0.753
OPD, HIV & eye units	27	20	0.4(0.1,1.5)	0.186
Surgical ward	16	1	2.1(0.2,22.0)	0.537
Training on IPC				
Yes	158	37	1.9(0.5,7.2)	0.339
No	11	13	1	
Awareness of IPC committee				
Yes	166	39	4.8(0.6,42.0)	0.156
No	2	5	1	
Don't know	1	6	0.3(0.0,5.9)	0.407
Access of IPC guidelines				
Yes	157	39	3.2(0.8,11.8)	0.088
No	12	11	1	

***aOR= adjusted odds ratio

4.5 Observation of healthcare workers on infection prevention and control practice at Kenema government hospital, February 2020

We observed healthcare workers for IPC practice on five components of IPC indicated in table 7.

4.5.1 Hand hygiene

Forty percent (10/25) of the HCWs observed for hand hygiene (HH) washed their hands before touching a patient or environment, 12% (3/25) used alcohol hand rub, and 48% (12/25) missed the opportunity to perform hand hygiene before touching a patient or their environment. More than half, 56% (14/25) of the healthcare workers observed washed their hands before an aseptic/clean procedure, 20% (5/25) used alcohol hand run, and 24% (6/25) missed the opportunity to perform hand hygiene when required. Forty-eight percent (12/25) washed their hands after blood or fluids exposure, 44% (11/25) used alcohol hand rub and 32% (8/25) missed the opportunity. Forty-four percent (11/25) washed their hands, 24% (6/25) used alcohol hand rub, and 32% (8/25) missed the opportunity after touching a patient or their environment (see Table 7).

4.5.2 Injection safety

Fifteen healthcare workers were observed for this component. About two-thirds, 66.7% (10/15) of those observed performed hygiene before preparing and administering medication, 87% (13/15) prepared injections using aseptic technique and in a clean area free from contamination, and 86.7% used one needle and syringe per patient. About 73% (11/15) of the disinfected the rubber septum on the medication vial was with alcohol before piercing, and 80% (12/15) of the used a new needle and syringe when obtaining additional doses of medication vials for the same patient. Sixty percent (9/15) of the HCWs observed used connectors and tubing for only one patient at the time of observation during administering medication (see Table 7).

4.5.3 Protective gloves

Fifteen healthcare workers were also observed in the use of protective gloves. Sixty percent (9/15) used new gloves for each patient they came in contact with at the time of observation. After using gloves in general, 60% (9/15) did not wash their hands or use alcohol hand rub between patients.

Before contact with a patient's blood, body fluids, mucous membranes, non-intact skin of patients or contaminated equipment, about 87% (13/15) of the healthcare workers observed wore gloves. Sixty percent (9/15) discarded used gloves into a waste bin after coming in contact with patient's blood, body fluids, mucous membranes, non-intact skin, or contaminated equipment (see Table 7).

4.5.4 Reusable equipment

Fifteen healthcare workers were observed on IPC for reusable equipment. Slightly above half, 53.3% (8/15) did not disinfect the stethoscope between patients. About 73% (11/15) of the disinfected the thermometer using alcohol or bleach between patients (see Table 7).

4.5.5 Waste segregation

The majority, 80% (16/20) deposited the syringe into the required container after taking a patient's blood sample or administering an injection a patient. Ninety percent (18/20) of them deposited the needle into a sharps box or provided container after administering an injection or taking a blood sample from a patient. More than half, 55% (13/20) of those observed segregated swabs, gauzes, and other infectious waste into the appropriate bin liner after an injection or taking blood sample. However, two thirds (15/20) of those observed did not segregate used gloves, swabs, gauzes, and other infectious waste into the appropriate bin liner after a medical examination of patients. (See Table 7).

Table 7: Infection prevention practice of healthcare workers in Kenema government hospital, February, 2020

Practice items	Observation	Frequency (%)
Hand hygiene		**N=25**
Hand hygiene before touching patient or environment	Wash hands	10(40.0)
	Used alcohol hand rub	3(12.0)
	Missed	12(48.0)

Hand hygiene before aseptic/clean procedure	Wash hands	14(56.0)
	Used alcohol hand rub	5(20.0)
	Missed	6(24.0)
Hand hygiene after blood or blood fluids exposure	Wash hands	12(48.0)
	Used alcohol hand rub	11(44.0)
	Missed	2(8.0)
Hand hygiene after touching patient or environment	Wash hands	11(44.0)
	Used alcohol hand rub	6(24.0)
	Missed	8(32.0)
Injection safety		**N=15**
Hand hygiene performed by HCW prior to preparing and administering medication	Yes	10(66.7)
	No	5(33.3)
Injections were prepared using aseptic technique and in a clean area free from contamination	Yes	13(86.7)
	No	2(13.3)
Needles and syringes were used for only one patient	Yes	13(86.7)
	No	2(13.3)
The rubber septum on the medication vial was disinfected with alcohol prior to piercing	Yes	11(73.3)
	No	4(26.7)
Medication vials were entered with a new needle and a new syringe even when obtaining additional doses for the same patient	Yes	12(80.0)
	No	3(20.0)
Medication administration tubing and connectors are used for only one patient	Yes	9(60.0)
	No	6(40.0)
Protective gloves		**N=15**
HCW used new gloves for each patient if gloves were used	Yes	9(60.0)
	No	6(40.0)
HCW washed his/her hand with soap or used alcohol hand rub after using gloves for each patient	Yes	6(40.0)
	No	9(60.0)

Before contact with blood, body fluids, mucous membranes, non-intact skin, or contaminated equipment, HCW wore gloves	Yes	13(86.7)
	No	2(13.3)
After contact with blood, body fluids, mucous membranes, non-intact skin, or contaminated equipment, HCW discarded the gloves into a waste bin	Yes	9(60.0)
	No	6(40.0)
Reusable equipment		**N=15**
Before or after patient contact the stethoscope, the HCW disinfected the stethoscope using rubbing alcohol or bleach	Yes	7(46.7)
	No	8(53.3)
Before or after patient contact the thermometer, the HCW disinfected the thermometer using rubbing alcohol or bleach	Yes	11(73.3)
	No	4(26.7)
Waste segregation		**N=20**
The HCW segregated the syringe into a leak-proof container, after an injection or taking blood sample	Yes	16(80.0)
	No	4(20.0)
The HCW segregated the needle into a leak-proof, puncture resistant sharps container after an injection or taking blood sample	Yes	18(90.0)
	No	2(10.0)
The HCW segregated swabs, gauzes, and other infectious waste into the appropriate bin liner after an injection or taking blood sample	Yes	13(55.0)
	No	7(35.0)
The HCW segregated used gloves, swabs, gauzes, and other infectious waste into the appropriate bin liner after a medical examination	Yes	5(25.0)
	No	15(75.0)

4.6 Bivariate analysis for socio-demographic and institutional factors associated with practice of infection prevention and control

4.6.1 Hand hygiene

Twelve percent (3/25) of the HCWs observed were working at the laboratory and maternity wards. Forty-four percent (11/25) of the HCWs observed were working at the male and pediatric wards, 20% (5/20) at the OPD, specialized HIV and eye care units, and 12% (3/25) at the surgical ward. Place of work was not a significant factor for infection prevention and control practice. The result

revealed that healthcare workers at OPD, specialized HIV and eye units had 70% lesser odds of having good hand hygiene practice when compared to their counterparts in other wards.

Forty percent (10/25) of HCWs observed were physicians and CHOs, 28% (7/25) were nurses, 20% (5/25) were laboratory technicians. The results showed that physicians and CHOs had 6 times greater odds of having good hand hygiene practice when compared to other cadres; (cOR=6.0; 95% CI: 0.5, 70.). This finding was not statistically significant at 95% confidence level (P=0.152) (see Table 8).

More than half, 56% (14/25) of those observed were females. We found that females had 6.4 times greater odds of having good hand hygiene practice when compared to males (cOR=6.4, 95% CI: 1.09, 37.7). This was a statistically significant association at 95% confidence level (P=0.040) (see Table 8).

More than half, 52% (12/25) observed worked during the afternoon shift. The result revealed that HCWs who worked in the afternoon shift had 11 times greater odds of having good hand hygiene practice when compared to those who worked in the morning shift (cOR=11, 95% CI: 1.60, 75.5). This finding was statistically significant at 95% confidence level (P=0.015) (see Table 8).

Hand washing buckets were not available in the care area for 60% (15/25) of HCWs observed during the time of observation. We found no association for care areas that had hand washing buckets compared to those who did not have (cOR=1, 95% CI: 0.1, 7.4) (P=1.0). Forty percent (10/25) had hand washing supplies available in care areas. We found that HCWs working in care areas where hand washing supplies were available had 40% lesser odds of having good hand hygiene practice when compared to their counterparts. This was, however, not a significant association at 95% confidence level (cOR=0.6, 95% CI: 0.1, 3.5) (P=0.611) (see Table 8).

Sixty percent (15/25) of the HCWs observed did not have hand hygiene promotion signs displayed in the care area. The results revealed that HCWs who had hand hygiene promotion signs displayed in their care areas had 30% lesser odds of having good hand hygiene practice when compared to those who did not have (cOR=0.7, 95% CI: 0.1, 4.7). This association was not statistically significant at 95% confidence level (P=0.703). We also observed that only 40% (10/25) of HCWs had alcohol hand rubs in their care areas. The result revealed that HCWs who had alcohol hand rubs in their care areas had 40% lesser odds of having good hand hygiene practice when compared to those who did not have alcohol hand rubs in their care area (cOR=0.6, 95% CI: 0.12, 3.53). This association was not statistically significant at 95% confidence level (P=0.611) (see Table 8).

4.6.2 Injection safety

Forty percent (6/15) were working at the female and pediatric wards, 20% (3/15) each were working at the outpatient department, maternity, and surgical wards. The result revealed that HCWs at the maternity ward had 2 times greater odds of having good injection safety practice when compared to their counterparts in other care areas (cOR=2.0, 95% CI: 0.1, 35.8). This association was not statistically significant at 95% confidence level (P=0.638) (see Table 8).

Forty percent (6/15) of those observed were nurses, 13% (2/15) were laboratory technicians, and about 27% (4/15) were community health officers. The results revealed that anesthetists had 4 times greater odds of practicing good practice injection safety measures when compared to other professions (cOR=4.0, 95% CI: 0.2, 75.7). This association was not statistically significant at 95% confidence level (P=0.355) (See Table 8).

More than half, 53% (8/15) were male. We found that females had 90% lesser odds of practicing good injection safety procedures when compared to males (cOR=0.1, 95% CI: 0.0, 0.8). This was a statistically significant association at 95% confidence level (P=0.033) (see Table 7).

More than half, 53% (8/15) were observed during the morning shift. HCWs in the afternoon shift had 7.5 times greater odds of practicing good injection safety measures when compared to those in the morning shift. This was not a statistically significant association at 95% confidence level (P=0.085) (see Table 8).

We also observed that only 40% (6/15) of HCWs had sharps containers/boxes available in their care area. The result showed that HCWs who had sharp containers/boxes in their care areas had 60% lesser odds of practicing good injection safety measures when compared to their counterparts. This association was not statistically significant at 95% confidence level (P=0.448) (see Table 8).

Forty percent (6/15) of HCWs observed had properly secured and not full sharp boxes/containers. The results showed that HCWs who had properly secured and not full sharp boxes/containers had 1.3 times greater odds of practicing good injection safety measures when compared to their counterparts (cOR=1.3, 95% CI: 0.2, 9.9). This was not a statistically significant association at 95% confidence level (P=0.833) (see Table 8).

Sixty percent (9/15) of HCWs observed had well-positioned and labeled sharp boxes/containers in their care area. However, the results showed that HCWs who had well-positioned and labeled sharp boxes/containers in their care area had 20% lesser odds of practicing good injection safety measures when compared to their counterparts (cOR=0.8, 95% CI: 0.10, 6.35). This association was not statistically significant at 95% confidence level (P=0.833) (see Table 8).

4.6.3 Reusable equipment

A total of 15 HCWs were observed for IPC practice with regards to reusable equipment. Slightly above two thirds, 67% (10/15) of those observed were working at the female and male wards. The result revealed that HCWs at the male and pediatric wards had 4 times greater odds of having good

practice on reusable equipment when compared to those in the pediatric ward (cOR=4.0, 95% CI: 0.3, 49.6). This result was not statistically significant at 95% confidence level (P=0.280) (see Table 8).

About 53% (8/15) of those observed were nurses while the remaining were physicians and CHOs. We found that nurses had 4 times greater odds of practicing good reusable equipment procedures when compared to physicians and CHOs (cOR=4.0, 95% CI: 0.5, 35.8). This was not a statistically significant association at 95% confidence level (P=0.215). Sixty percent (9/15) of HCWs observed were males. The result revealed that females had 70% lesser odds of practicing good reusable equipment procedures when compared to males (cOR=0.3, 95% CI: 0.0, 3.1). This finding was not statistically significant at 95% confidence level (P=0.280). More than half, 53% (8/15) of the HCWs were observed in the morning. The result revealed that HCWs working in the morning had 17.5 times greater odds of practicing good reusable equipment procedures when compared to those who worked in the afternoon (cOR=17.5, 95% CI: 1.2, 250). This was a statistically significant association at 95% confidence level (P=0.035) (see Table 8).

4.6.4 Protective gloves

A total of 15 HCWs were observed on protective gloves. About 33% (5/15) were working at the laboratory, about 46% (7/15) working at male and pediatric wards, and about 20% (3/15) were working at the outpatient department. We found that HCWs at the male and pediatric wards had 1.7 times greater odds practicing good protective gloves measures when compared to HCWs in the laboratory and outpatient department. This association was not statistically significant at 95% confidence level (P=0.680). Forty-six percent (7/15) were physicians and CHOs, about 27% (4/15) were laboratory technicians, and 27% (4/15) were nurses. The results revealed that physicians and CHOs had 60% lesser odds of practicing good protective gloves measures when compared to

nurses and laboratory technicians (cOR=0.4, 95%CI: 0.2, 6.7). This association was not statistically significant at 95% confidence level (P=0.588). About 53% (8/15) of HCWs observed were females. Females had 30% lesser odds of practicing good protective gloves measures when compared to males (cOR=0.7, 95% CI: 0.1, 5.9). This result was not statistically significant at 95% confidence level (P=0.715). About 53% (8/15) of HCWs observed worked during morning shifts. The results showed that HCWs during the afternoon shift had 2.3 times greater odds of practicing good protective gloves procedures when compared to those who were working during the morning shift (cOR=2.3, 95%CI: 0.3, 20.1). This association was not statistically significant at 95% confidence level (P=0.468). Slightly above two-thirds, 67% (10/15) of the staff observed had gloves available in their care area. HCWs who had gloves in their care areas had 36 times greater odds of practicing measures on protective gloves when compared to those who did not have gloves in their wards. This association was statistically significant at 95% confidence level (P=0.020) (see Table 8).

4.6.5 Waste segregation

A total of 20 HCWs were observed for IPC with regards to waste segregation. More than half, 60% (12/20) were working at the laboratory while the remaining were working at the male and pediatric wards. The result revealed that laboratory workers had 21 times greater odds of practicing good waste segregation measures when compared to those who worked at the male and pediatric wards (cOR=21, 95%CI: 1.8, 248). This was a statistically significant association at 95% confidence level (P=0.016).

Forty percent (8/20) were nurses while physicians and CHOs, and laboratory technicians each accounted for 30% (7/20). We found no association for profession in this domain for this study (cOR=1.0, 95%CI: 0.1, 8.3). The majority, 70% (14/20) observed were males. The result showed

that females had 2.7 times greater odds of having good practice on waste segregation when compared to males. This association was however not statistically significant at 95% confidence level (P=0.337). More than half, 55% (11/20) of those observed worked in the morning shift. The result revealed that those who worked in the afternoon shift had 97% lesser odds of practicing good waste segregation when compared to those who worked in the morning shift (cOR=0.03, 95%CI: 0.0, 0.4). This association was statistically significant at 95% confidence level (P=0.007).

Sixty percent (12/20) of the HCWs observed had the waste management SOP available in their care areas. The result showed that HCWs who had waste management SOP in the care areas had 6 times greater odds of practicing good waste segregation when compared to those who did not have (cOR=6.0, 95%CI: 0.8, 44.4). This finding was not statistically significant at 95% confidence level (P=0.079).

Sixty percent (12/20) of HCWs observed had at least one waste container in their care area. HCWs who had at least one waste container in their ward had 96% lesser odds of practicing good waste segregation when compared to those who did not have (cOR=0.04, 95% CI: 0.0, 0.6). This finding was statistically significant at 95% confidence level (P=0.016). Sixty percent (12/20) of the HCWs observed had at least one infectious (non-sharps) waste container in their care area. The result revealed that HCWs who had at least one infectious (non-sharps) waste container in the ward had 3.9 times greater odds of practicing good waste segregation when compared to HCWs who did not have (cOR=3.9, 95% CI: 0.3, 45.6). This finding was not statistically significant at 95% confidence level (P=0.284). More than half, 60% (12/60) of HCWs observed had waste bins not clearly marked to indicate the waste type to be disposed. The result revealed that HCWs who had waste bins clearly marked to indicate the type of waste had 80% lesser odds of practicing good waste segregation when compared to their counterparts (cOR=0.2, 95% CI: 0.0, 1.2). This finding is not

statistically significant at 95% confidence level (P=0.079). Sixty percent (12/20) of the HCWs observed had sharps container(s) in the ward less than three fourth full. The result showed that HCWs who had sharps container(s) in the ward less than three fourth full had 96% lesser odds of practicing good waste segregation when compared to their counterparts (cOR=0.04, 95% CI: 0.0, 0.6). This association was statistically significant at 95% confidence level (P=0.016) (see Table 8).

Table 8: Bivariate analysis for socio-demographic and institutional factors associated with infection prevention practice of healthcare workers in Kenema government hospital, February, 2020

Variables	Infection Prevention and control practice		cOR (95% CI)	Fishers exact
	Good	Poor		
Hand hygiene	**n=15**	**n=10**		
Place of work				
Laboratory	2	1	1	
Maternity ward	2	1	1.0(0.3,29.8)	1.000
Male & pediatric wards	7	4	0.9(0.1,12.9)	0.923
OPD & eye unit	2	3	0.3(0.0,6.7)	0.472
Surgical ward	2	1	1.0(0.0,29.8)	1.000
Profession				
Physician & CHO	5	5	1	
Nurse	6	1	6.0(0.5,69.8)	0.152
Laboratory technician	2	3	0.7(0.1,5.88)	0.715
Anesthetist	2	1	2.0(0.1,29.8)	0.615
Sex				
Male	4	7	1	
Female	11	3	6.4(1.1,37.7)	**0.040**
Time of observation				
Morning	4	8	1	
Afternoon	11	2	11(1.6,75.5)	**0.015**
Availability of functioning hand washing buckets				
Yes	8	2	1.0(0.1,7.4)	1.000
No	12	3	1	
Availability of hand washing supplies				

Yes	7	3	0.6(0.1,3.5)	0.611
No	9	6	1	
Display of hand hygiene promotion signs				
Yes	8	2	0.7(0.1,4.7)	0.703
No	11	4	1	
Availability of alcohol hand rubs				
Yes	7	3	0.6(0.1,3.5)	0.611
No	9	6	1	
Injection safety	**n=7**	**n=8**		
Place of work				
Female & pediatric wards	3	3	1	
Maternity ward	2	1	2.0(0.1,35.8)	0.638
Outpatient department	1	2	0.5(0.0,9.0)	0.638
Surgical ward	1	2	0.5(0.0,9.0)	0.638
Profession				
Nurse	2	4	1	
Laboratory technician	1	1	2.0(0.1,51.6)	0.676
CHO	2	2	2.0(0.2,26.7)	0.600
Anesthetist	2	1	4.0(0.2,75.7)	0.355
Sex				
Male	6	2	1	
Female	1	6	0.1(0.0,0.8)	**0.033**
Time of observation				
Morning	2	6	1	
Afternoon	5	2	7.5(0.8,74.2)	0.085
Availability of sharp containers/boxes				
Yes	2	1	0.4(0.0,5.1)	0.448
No	5	7	1	
Sharp boxes properly secured and not full				
Yes	3	3	1.3(0.2,9.9)	0.833
No	4	5	1	
Sharps boxes/containers well positioned and correctly labelled				
Yes	4	5	0.8(0.1,6.4)	0.833
No	3	3	1	
Protective gloves	**n=10**	**n=5**		
Place of work				
Laboratory	3	2	1	
Male & pediatric wards	5	2	1.7(0.2,18.9)	0.680

Outpatient	2	1	1.3(0.1,26.6)	0.851
Profession				
Laboratory	3	1	1	0.764
Physician & CHO	4	3	0.4(0.2,6.7)	0.588
Nurse	3	1	1.0(0.0,24.5)	1.000
Sex				
Male	5	2	1	
Female	5	3	0.7(0.1,5.9)	0.715
Time of observation				
Morning	4	3	1	
Afternoon	6	2	2.3(0.3,20.1)	0.468
Availability of gloves				
Yes	9	1	36(1.8,732)	**0.020**
No	1	4	1	
Reusable equipment	**n=6**	**n=9**		
Place of work				
Pediatric ward	1	4	1	
Female & male wards	5	5	4.0(0.3,49.6)	0.280
Profession				
Nurse	2	6	1	
Physician & CHO	4	3	4.0(0.5,35.8)	0.215
Sex				
Male	2	7	1	
Female	4	2	0.3(0.0,3.1)	0.280
Time of observation				
Morning	1	7	1	
Afternoon	5	2	17.5(1.2,250)	**0.035**
Waste segregation	**n=10**	**n=10**		
Place of work				
Male & pediatric wards	7	1	1	
Laboratory	3	9	21(1.8,248)	**0.016**
Profession				
Laboratory technician	3	3	1	
Nurse	4	4	1.0(0.1,8.3)	1.000
Physician & CHO	3	3	1.0(0.1,9.6)	1.000
Sex				
Male	6	8	1	
Female	4	2	2.7(0.4,19.7)	0.337
Time of observation				

Morning	8	1	1	
Afternoon	2	9	0.03(0.0,0.4)	**0.007**
Availability of waste management SOP				
Yes	8	4	6.0(0.8,44.4)	0.079
No	2	6	1	
Availability of at least one waste container in the ward				
Yes	3	9	0.04(0.0,0.6)	**0.016**
No	7	1		
Availability of at least one infectious (non-sharps) waste container in the ward				
Yes	9	7	3.9(0.3,45.6)	0.284
No	1	3	1	
All waste bins clearly marked to indicate the waste type				
Yes	2	6	0.2(0.0,1.2)	0.079
No	8	4	1	
Sharps container(s) in the ward less than ¾ full				
Yes	3	9	0.04(0.0,0.6)	**0.016**
No	7	1	1	
Waste bin(s) in the ward less than ¾ full				
Yes	8	4	6.0(0.81,44.4)	0.079
No	6	2	1	
Are there sharps on the floor at the time of observation				
Yes	7	1	21(1.8,248)	**0.016**
No	9	3	1	
Sharps safety posters displayed in the clinical area where sharps are disposed				
Yes	9	7	3.9(0.3,45.6)	0.284
No	1	3	1	
Duty allocation roster (for cleaners/transporters) is up to date				
Yes	9	3	0.04(0.0,0.6)	**0.016**
No	7	1	1	

*cOR= crude odds ratio, P-value (used fishers exact test)

4.7 Multivariate analysis for factors associated with infection prevention practice of healthcare workers in Kenema government hospital, February, 2020.

We conducted multiple logistic regression on all factors that were statistically significant at 95% confidence interval and P-value ≤ 0.05 at the bivariate level for all the five domains. These factors include; hand hygiene: sex, time of observation, injection safety: sex, time of observation,

Reusable equipment: sex, time of observation, waste segregation: the place of work, time of observation, availability of waste management SOP.

Out of the two factors that were significantly associated with hand hygiene at the bivariate analysis, only time of observation was statistically significant and strongly associated with IPC practice at the multiple logistic regression analysis level. Afternoon shift HCWs had 9.6 times greater odds of practicing good hand hygiene when compared to those who worked in the morning (aOR=9.6, 95% CI: 1.2, 74.9) (P=0.031). No factor was statistically significant at the multiple logistic analysis level for the injection safety domain. For reusable equipment, only time of observation was statistically significant and associated with IPC practice under this domain. HCWs in the afternoon shift had 21 times greater odds of practicing good reusable equipment procedures when compared to those who worked in the morning shift (aOR=21, 95% CI: 1.2, 391). There was no significant association at the multivariate level in the waste segregation domain. Variables including; availability of at least one waste container in the ward, sharps container(s) in the ward less than three fourth full, sharps on the floor at the time of observation, and duty allocation roster (for cleaners/transporters) is up to date in the waste segregation domain that were statistically significant at the bivariate analysis were omitted after running with multiple logistic regression in STATA and this may be due to collinearity between the independent variables. They were therefore not considered in the model (see Table 9).

Table 9: Multivariate analysis for socio-demographic and institutional factors associated with infection prevention practice of healthcare workers in Kenema government hospital, February, 2020.

Variables	Infection Prevention and control practice		aOR (95%CI)	Fishers Exact
	Good	Poor		
Hand hygiene	**n=15**	**n=10**		
Sex				
Male	4	7	1	
Female	11	3	5.4(0.7,40.3)	0.103
Time of observation				
Morning	4	8	1	
Afternoon	11	2	9.6(1.2,74.9)	**0.031**
Injection safety	**n=7**	**n=8**		
Sex				
Male	6	2	1	
Female	1	6	0.1(0.0,1.1)	0.062
Time of observation				
Morning	2	6	1	
Afternoon	5	2	5.8(0.4,90.9)	0.210
Reusable equipment	**n=6**	**n=9**		
Sex				
Male	1	7	1	
Female	5	2	0.2(0.0,4.1)	0.277
Time of observation				
Morning	5	5	1	
Afternoon	1	4	21(1.2,391)	**0.040**
Waste segregation	**n=10**	**n=10**		
Place of work				
Male & pediatric wards	7	1	1	
Laboratory	3	9	2.1(0.0,102)	0.706
Time of observation				
Morning	8	1	1	
Afternoon	2	9	0.1(0.0,1.1	0.055
Availability of waste management SOP				
Yes	8	4	3.1(0.1,86.9)	0.508
No	2	6	1	

*aOR= adjusted odds ratio P-value (used fishers exact test)

4.8 Observation for the Availability of Infection Prevention and Control materials in wards, Kenema government hospital, February, 2020.

We observed eight wards for the availability of IPC materials at the time of visit as indicated in table 10. These were the wards that were accessible for observation at the time of the study.

We found that two-thirds (6/8) of the wards had gloves readily available while about 63% (5/8) had waste management policy or SOP upon request. We also found that at least one general waste container and one infectious (non-sharps) waste containers were available in about 88% (7/8) of the wards observed. Three fourth, (6/8) of the wards observed had waste bins clearly marked to indicate the waste type (e.g. color coding or labeling to indicate general or infectious waste).

Three fourth, (6/8) of the wards observed had sharp containers less than three-fourths full, and about 63% of wards had waste bin(s) less than three-fourths full. Half (4/8) of the wards had sharps on the floor at the time of observation. Three-fourths (6/8) of the wards observed had no sharps safety posters displayed in the sharps disposal area. Duty allocation roster (for cleaners/transporters) and the waste collection and transport tracker were up to date in about 88% (7/8) of the wards observed. Also three fourth (6/8) of the wards had functioning hand washing buckets readily accessible in the patient care area.

Handwashing supplies, including soap and paper towels, were available in about 63% (5/8) of the wards/units observed, and signs promoting hand hygiene were displayed in about 63% (5/8) of the observed wards. Alcohol hand rubs were available in half (4/4) of the wards observed while 75% (6/8) of the wards had sharps container(s) available. At the time of observation, half (4/4) of the wards' sharps containers were properly secured and not full. All sharp boxes were well positioned and correctly labeled in about 63% (5/8) of the wards observed (see Table 10).

Table 10: Observation for Availability of Infection Prevention and Control materials in wards, Kenema government hospital, February, 2020.

Question	Observation	Frequency (%) N=8
Are gloves readily available in each patient ward?	Yes	6(75.0)
	No	2(25.0)
Is a waste management policy or SOP available upon request?	Yes	5(62.5)
	No	3(37.5)
Is at least one general waste container available in the ward?	Yes	7(87.5)
	No	1(12.5)
Is at least one infectious (non-sharps) waste container available in the ward?	Yes	7(87.5)
	No	1(12.5)
Are all waste bins clearly marked to indicate the waste type (e.g color coding or labelling to indicate general or infectious waste)?	Yes	6(75.0)
	No	2(25.0)
Is every sharps container on the ward less than ¾ full?	Yes	6(75.0)
	No	2(25.0)
Is every waste bin on the ward less than ¾ full?	Yes	5(62.5)
	No	3(37.5)
Is it accurate to say that there are no sharps on the floor at the time of observation?	Yes	4(50.0)
	No	4(50.0)
Are sharps safety posters displayed in the clinical area where sharps are prepared/disposed?	Yes	2(25.0)
	No	6(75.0)
Are both the duty allocation roster (for cleaners/transporters) and the waste collection and transport tracker (written log) updated daily?	Yes	7(87.5)
	No	1(12.5)
Are functioning hand washing buckets readily accessible in the patient care area?	Yes	6(75.0)
	No	2(25.0)
Are all handwashing supplies, such as soap and paper towels, available?	Yes	5(62.5)
	No	3(37.5)
Are signs promoting hand hygiene displayed in the area?	Yes	5(62.5)
	No	3(37.5)
Are alcohol based rubs readily available?	Yes	4(50.0)
	No	4(50.0)
Are sharps containers available?	Yes	6(75.0)
	No	2(25.0)
Are sharps containers properly secured and not full?	Yes	4(50.0)
	No	4(50.0)
Are sharps boxes well positioned and correctly labelled?	Yes	5(62.5)

	No	3(37.5)

4.8 Compliance with IPC guidelines and protocols at the Kenema government hospital, February, 2020.

The majority, 89.0% (195/219) of the study participants were trained on IPC. About 94% (205/219) of the study participants were aware of the existence of the IPC committee in the hospital. Also, about 90% (196/219) of the study participants had access to the IPC guidelines in the hospital (see Table 11).

Table 11: Compliance with IPC guidelines and protocols at the Kenema government hospital, February, 2020

Question	Response	Frequency (%)
Have you been trained on IPC?	Yes	195(89.0)
	No	24(11.0)
Are you aware of an IPC committee in the hospital?	Yes	205(93.6)
	No	7(3.2)
	Don't know	7(3.2)
Do you have access to IPC guidelines in the hospital?	Yes	196(89.5)
	No	23(10.5)

CHAPTER FIVE

DISCUSSION

In the absence of adequate IPC and patient safety measures, HCWs, and patients are at greater risk of acquiring bacterial and viral infections some of which are very serious and fatal such as HIV, hepatitis B virus (HVB), hepatitis C virus (HCV), and tuberculosis, as well as fungal and protozoal infections among others (Teshager et al., 2015a). Since the early 2000s, the WHO has explicitly stated that reducing the risk of HAIs through IPC is within the control of HCWs (WHO, 2002). Studies have also established that for HCWs to effectively apply IPC practices, they need appropriate up-to-date scientific information and knowledge on IPC (Kalantarzadeh, Mohammadnejad, Ehsani, & Tamizi, 2014). Studies show that majority of the HAIs can be reduced by 70% if appropriate and consistent application of IPC practices are implemented (Hosseinialhashemi, Sadeghipour Kermani, Palenik, Pourasghari, & Askarian, 2015).

5.1 Knowledge of IPC among healthcare workers

The finding by the current study that 77.2% of the HCWs interviewed (study participants) had good knowledge of IPC in general, that is, they scored 70% or above is consistent with other studies conducted elsewhere in Africa (Assefa & Diress, 2020). In the current study, the grading of study participants scores on knowledge questions on IPC preventive measures into good or poor was determined based on a study conducted in Ethiopia were 70% or above was considered good and <70% score poor (Gezie et al., 2019). Just like the current study, Assefa & Diress, (2020) in a cross-sectional study conducted among healthcare providers in a primary healthcare unit in Wogdie District, Northeast Ethiopia found that 70.8% were knowledgeable on IPC. Similarly, Desta et al., (2018), in Ethiopia found that 84.6% of the study participants were knowledgeable on IPC. Likewise, a study conducted by Mukwato et al., (2007) in Zambia found that 74.4% of the

healthcare workers were knowledgeable on IPC, and Gulilat, (2014) in Ethiopia found that 84.2% of the health workers were knowledgeable on IPC.

However, in the literature there are studies conducted elsewhere that have found low knowledge levels among HCWs on IPC, for example 20.3% in Trinidad and Tobago (Unakal et al., 2017) , 25.9% in Iran (Kalantarzadeh et al., 2014), and 50.6% in Ethiopia (Jemal et al., 2019). The variation in knowledge levels on IPC among healthcare workers in the different studies could be attributed to a lack of or inadequate in-service training (leading to low knowledge levels), time gap amongst the studies (there are improvements in knowledge base and access to knowledge resources over time), socio-demographic (for example, participants with more work experience have high knowledge levels), and sample size (influence the accuracy of the estimations), observations also noted by other researchers such as Gulilat, (2014) and (Assefa & Diress, 2020).

The finding that a high percentage of the study participants in the current study had good knowledge is a good indicator for the prevention and control of HAIs in KGH as good knowledge on IPC among HCWs has been associated with good IPC practices (Sahiledengle et al., 2018). The high score on knowledge among the HCWs on IPC in KGH could be attributed to multiple donor supported in-service trainings, workshops, and supportive supervision on IPC that followed the 2014 – 2016 Ebola outbreak (MoHS, 2015b). Also, the high knowledge levels on IPC among HCWs in the current study could be due to their long working experience since more than a half (52.5 %) of the study participants reported having worked for five or more years. Similar to the current study, Desta et al., (2018), in a study conducted at a regional referral hospital in Ethiopia found that 84.7% of the healthcare with long years of work experience and training on IPC had adequate knowledge on IPC.

Although the majority of the study participants in the current study had good knowledge on IPC, 22.8% of them had poor knowledge on IPC which raises serious public health concerns regarding the proper implementation of IPC practices at KGH. The lack of or poor knowledge of HCWs on IPC among other factors hinder efforts in the prevention and control of HAIs which exposes HCWs, patients, and the community at risk of acquiring HAIs (Unakal et al., 2017). Since adequate knowledge on IPC has been found to be a precursor for HCWs to effectively implement IPC measures (Allegranzi et al., 2011), there is need for the MoHS to plan for and train all HCWs at KGH on IPC. Such training could be conducted on-site or virtually via electronic platforms such as Zoom.us to bring down costs associated with on-site training.

Also, the finding by the current study that 81.0% of the participants had good knowledge on hand hygiene including moments of hand hygiene is encouraging since this could contribute to the reduction of the transmission of HAIs. The good knowledge score on hand hygiene among HCWs is consistent with a study conducted in Nigeria by Tobin, Asogun, Odia, & Ehidiamhen, (2013) who found 94.3% of HCWs were knowledgeable on hand hygiene IPC measures. Disturbing though is that the current study found that 93.7% of the study participants were not aware that rubbing of hands with soap during hand washing should last for at least 20 seconds. The finding that the majority of participants in the present study were unaware of the adequate duration needed for hand rubbing with soap is disturbing because inadequacies in the duration of hand rubbing with soap are associated HAIs (Abdella et al., 2014). The low knowledge about the duration of hand rubbing with soap found by the current study could be a recipe for transmission of HAIs amongst HCWs and their patients in the hospital. The low levels of knowledge about the adequate duration for hand rubbing in the current call for the continued training and mentorship of HCWs on hand hygiene in KGH since hands play a major role in the transmission of HAIs (Jemal et al., 2019).

The current study found that tertiary level of education of the study participants was significantly associated with good knowledge on IPC (OR=9.6, 95% CI: 2.76, 33.2) (P=<0.001), a finding consistent with other studies, for example Desta et al., (2018) in their study in Ethiopia found that higher level of education of HCWs was a predictor for good knowledge on IPC. The significant association between tertiary education level and knowledge on IPC could be due to the fact that HCWs with a higher level of education could have acquired information on IPC during their studies- which have a longer duration. In addition, health care workers who attain tertiary level of education are more likely to read and understand IPC concepts better than those with lower levels of education, a preposition also alluded to by Desta et al., (2018).

The finding by the current study that participants who had five or more years of work experience was almost three times more likely to have good knowledge on IPC when compared to those with less experience is in line with a study conducted by Desta et al., (2018) who found that HCWs who had more than ten years of work experience had better knowledge on IPC when compared to those with less working experience. The positive association between the number of years of work experience of HCWs and their knowledge on IPC could be explained by prolonged periods of continuous exposure to IPC resources and capacity building programs such as training and mentorship, an observation also mentioned by Al-mahdali, (2015). One could therefore reasonably argue that the knowledge of HCWs on IPC could improve with increasing number of years of service. The KGH management could prioritize providing IPC training and mentorship opportunities to newly recruited HCWs and volunteers as the current study has shown that they have less knowledge on IPC when compared to those with more years of work experience. Other studies in other countries have also found that the number of years of work experience of HCWs

is positively associated with good knowledge on IPC (Geberemariyam et al., 2018, Gulilat, 2014, Fashafsheh, 2015, Kalantarzadeh et al., 2014).

Although 89.0% of the current study participants were trained on IPC which is very impressive, training on IPC was not statistically significantly associated with good knowledge on IPC. This finding is contrary to other studies that found that training of HCWs on IPC is statistically significantly associated with good knowledge on IPC (Teshager, Engeda, & Worku, 2015b, and Geberemariyam et al., 2018).

The finding that there was no statistically significant difference between the age of the study participants and their knowledge on IPC in the present study is inconsistent with other studies (Teshager et al., 2015, Fashafsheh, 2015, and Geberemariyam et al., 2018) that found a significantly positive association between age of HCWs and their knowledge on IPC. Also, there was no statistically significant difference between the sex of the study participants and their knowledge on IPC in the current study, a finding that is inconsistent with a study by (Teshager et al., 2015a). Similarly, the knowledge of the study participants on IPC was not statistically different by profession in the current study. The current finding that HCWs knowledge was not significantly different by profession is inconsistent with a study conducted by Geberemariyam et al., (2018). As also reported by Desta et al., (2018), the current study found that the study participants knowledge on IPC was not significantly different by religion.

The 70.1% knowledge level of study participants on protective gloves by the current study is a good indicator that the spread of HAIs at could be reduced at KGH. The finding that a good percentage of HCWs were knowledgeable on protective gloves is consistent with a study by Flores & Pevalin, (2006) in London who found that 83% of HCWs were knowledgeable on the use of gloves.

Misconceptions about the use of gloves as an IPC measure has been associated with increased HAIs (Flores & Pevalin, 2006, and Hosseinialhashemi et al., 2015). Therefore, the finding by the present study that 43.8% of the study participants had misconceptions about the use of gloves as an effective preventive method for HAIs exposes HCWs and patients at KGH to serious health risk of acquiring HAIs. Given these misconceptions about the use of gloves as an effective IPC measure, there is an urgent need to intensify mentorship and coaching of HCWs at KGH on the importance and proper use of gloves for the prevention of HAIs.

The finding by the current study that 89.5% of the study participants were knowledgeable on injection safety is encouraging since this could greatly contribute to the reduction of the transmission of HAIs at KGH, and also given that in 2013 Onyemocho, Anekoson, & Pius, (2013) found that knowledge about safe injection practices in developing countries to be suboptimal. The high knowledge score on injection safety in the present study is consistent with a study conducted in Nigeria by Onyemocho et al., (2013) who found that only 54.3% of the HCWs interviewed were knowledgeable on injection safety. The variation in the knowledge levels on safe injection practices among the participants in the current study and the previous studies could be attributed to the time gap amongst the studies and the IPC capacity building interventions in Sierra Leone that followed the 2014-2016 Ebola outbreak in West Africa. However, the finding that only 18% of the study participants in the present study understood that recapping a needle after injecting a patient is safe practice raises serious public health concerns regarding the safety of HCWs as well their patients since recapping of needles increases the risk of pricks and thus HAIs transmission in healthcare facilities (Allegranzi et al., 2011).

The finding by the current study that 85.2% of the study participants were knowledgeable about decontamination of reusable equipment such as the thermometer and stethoscope is good indicator

that transmission of HAIs through thermometers and stethoscopes could greatly be reduced. The finding that majority of the study participants in the current study had good knowledge on IPC is inconsistent with a study conducted in Zambia by Mukwato, Ngoma, & Maimbolwa, (2009) who reported only 19.6% of the HCWs were knowledgeable on disinfection of medical instruments in healthcare facilities. The high levels of knowledge on the importance of decontamination of reusable equipment as an effective IPC measure could be harnessed to promote the prevention of HAIs through decontamination of all reusable equipment.

Because waste segregation is essential in the prevention of HAIs (Olaifa et al., 2018), the finding that 81.7% of the study participants by the current study were knowledgeable about waste segregation in general is beneficial for IPC practice. However, the finding by the current study that 24% of the participants were not aware that highly infectious waste should be deposited in red waste bins spells doom as studies have demonstrated poor waste management practices to significantly increase the risk of HAIs among HCWs and their patients (Olaifa et al., 2018). Therefore, there is an urgent need for the management of KGH to prioritize the training of their health care workers on proper waste management.

5.2 Observation of healthcare workers on IPC practice

The finding by the current study that 53.3% of the observed study participants had overall poor practice on IPC is discouraging, since a good percentage, 46.6% of the study participants had poor IPC practice which is alarming as this could lead to transmission of HAIs among HCWs and their patients at KGH. The current finding that a good percentage of the study participants had poor IPC practice is consistent with studies conducted elsewhere. For example, a study conducted in Ethiopia by Jemal et al., (2019) found that only 48.4% of HCWs had good IPC practice, 54.2% by Geberemariyam et al., (2018), although the sample sizes and data collection methods are different

from the current study. Other studies have, however, found good IPC practice scores among HCWs (Desta et al., 2018, and Gulilat, 2014). The variation in the findings could be attributed to differences in sample sizes, socio-demographics, and lack of in-service training. Differences in the knowledge of the study participants regarding IPC could also be another factor for this dissimilarity. The finding that a good percentage of the study participants had poor IPC practice is not encouraging since it puts the lives of the HCWs and patients at risk for the transmission of HAIs.

5.2.1 Practice on Hand Hygiene

The finding by the current study that 60.0% of the HCWs had overall good practice is not too encouraging since 40% of the study participants put their lives and their patients of contracting HAIs because of their poor IPC practice. The present study on overall IPC practice is higher than other studies conducted elsewhere, for example Hosseinialhashemi et al., (2015) in Iran found that 32.1% of HCWs had good practice on hand hygiene, and Powell-jackson et al., (2020) in Tanzania, found that <14% of the HCWs that participated in their study had good practice on hand hygiene, although the studies in Iran and Tanzania were conducted in more than one hospital with larger sample sizes. It is encouraging to know that prevention is given higher attention among HCWs at KGH in this study which indicates that if more effort and priority is given to this area, there could be great improvement in the hospital's IPC status. This finding, however, contradicts a study conducted by Abdella et al., (2014) at Gondar University Hospital.

The highest rate, 56.0% of hand hygiene practice was before aseptic/clean procedure, a finding which indicates that transmission of HAIs before such a procedure could be reduced. This high rate of hand hygiene practice before aseptic/clean procedure is dissimilar to a study in Ethiopia, (Gulilat, 2014) who reported the highest rate of practice after completing their procedures and

removal of gloves. Furthermore, nearly half of the current study participants observed missed the opportunity to perform hand hygiene before touching a patient or their environment, an alarming observation that may result in HAIs transmission at KGH. It is therefore necessary that KGH administration take urgent actions to address this low compliance to perform hand hygiene before touching a patient or their environment at the hospital. The current finding that nearly half of the current study participants observed missed the opportunity to perform hand hygiene before touching a patient or their environment is consistent with a study conducted by (Gulilat, 2014) in Ethiopia.

5.2.2 Practice on Injection safety

The finding by the current study that almost half (46.7%) of the study participants practiced poor injection safety measures is worrisome as the poor handling of injections exposes them and their patients to HAIs. The current finding that almost half (46.7%) of the study participants practiced poor injection safety is inconsistent with a study conducted in Tanzania by Powell-jackson et al., (2020) who found that more than 95% of the HCWs that participated in their study had good practice on injection safety, although this study was conducted in more than one health facility, and secondary data was used. Similarly in Nigeria, Onyemocho et al., (2013) found that 100% of the HCWs had good injection safety practice. The variation in findings could be attributed to differences in the knowledge level of the study participants, methods of data collection, and socio-demographic variables among others. The finding that only 86.7% of the study participants by the present study reported using one needle and syringe for only one patient is very disturbing as it implies that the rest, 13.3 % of them use the same needle and syringe for different patients. The use of the same needle and syringe for more than one patient is associated with increased risk of HAIs (Abdo, 2017). The increased risk of transmission of HAIs due to sharing of needles and

syringes amongst patients needs to be addressed urgently by the management of KGH through the provision of adequate supplies, training, and mentorship of healthcare workers on the policy of non-reusable needles and syringes.

The finding by the current study that 75 % of the HCWs correctly performed hand hygiene prior to preparing and administering medication is encouraging as it could help in reducing the spread of HAIs at KGH. Studies have shown a positive relationship between proper hand hygiene before preparing and administering medication and reduced spread of HAIs (Sax et al., 2009). The finding by the current study of proper hand hygiene prior to preparing and administering medication among HCWs is higher in the current study than 63.1% found HCWs in a study conducted in Vietnam (Abdo, 2017) and 13.7% by a study conducted in Nigeria (Abubakar, Usman, Idris, & Muhammad, 1996).

Although the current study found no statistically significant association between clinic area, sex, working shift and practice on injection safety, a study conducted in Vietnam by Abdo, (2017) found that working in the afternoon shift was significantly associated with safe injection practice.

5.2.3 Practice on Protective Gloves

The finding that 33.3% of the participants in the current study did not use protective gloves when needed implies that they could infect themselves or their patients while conducting medical procedures. However, practice on use of gloves before contact with blood, body fluids, mucous membranes, non-intact skin, or contaminated equipment was good. With this high compliance of glove use before contact with blood, body fluids, mucous membranes, non-intact skin, or contaminated equipment among HCWs could minimize the transmission of HAIs. The KGH administration should commend this good practice and encourage its continuity while also addressing the other areas. The finding that HCWs had good IPC practice on use of gloves before

contact with blood, body fluids, mucous membranes, non-intact skin, or contaminated equipment is consistent with a study in Kenya (Gertrude, 2013), but better than a study in Zambia, (Mukwato et al., 2007) and Tanzania, (Powell-jackson et al., 2020). The current finding that HCWs had good IPC practice on the use of gloves before contact with blood, body fluids, mucous membranes, non-intact skin, or contaminated equipment is lower than a study conducted in Nigeria, (Franklin Okechukwu Emeka, M.E. Chauke, 2009), and in Ethiopia, (Gulilat, 2014). Although there was no statistically significantly associated factor with practice on protective gloves in the current study, Geberemariyam et al., (2018) in a study in Ethiopia found that, training on IPC, availability of IPC guidelines, and profession as significantly associated factors with IPC practice including use of gloves. The variation in the findings could be attributed to the differences in training and scoring for good or poor practice amongst the two studies. Furthermore, variation in profession of the study participants could also be another factor the differences in the findings.

5.2.4 Practice on Reusable equipment

The overall finding that only 40% of the study participants disinfected either a thermometer or stethoscope between patients indicates that the majority of the HCWs observed had poor practice regarding disinfection of thermometers and stethoscopes. This raises serious concerns because non-disinfection of reusable instruments in healthcare facilities has been associated with the transmission of HAIs (Allegranzi et al., 2011) There is an urgent need by the KGH administration to engage hospital clinicians on disinfection of reusable equipment to minimize the risk of transmission of HAIs in the hospital. The current finding that only 40% of the study participants disinfected either a thermometer or stethoscope between patients is better than similar studies conducted in Tanzania, (Powell-jackson et al., 2020), and the Philippines, (Suarez, Oducado, & Josue, 2019), but lower than a study conducted in Ethiopia by Sahiledengle, (2019b). The variation

in findings could be due to methods of data collection, number of observed study participants and time gap. The current study also found that working in the afternoon shift among HCWs is significantly associated with good practice on reusable equipment. This indicates that the KGH administration should strengthen monitoring and sensitization of HCWs, especially to those working during the morning shifts. The current finding that working in the afternoon shift among HCWs is inconsistent with a study conducted by Sahiledengle, (2019b) in Ethiopia, who found other factors such as being a physician, awareness about infection prevention guidelines as significant factors associated with decontamination of stethoscope among HCWs.

5.2.5 Practice on waste segregation

The finding by the current study that only a half of the study participants observed had good IPC practice regarding waste segregation is alarming since this indicates that half of the study participants' poor waste segregation practice could result in the transmission of HAIs amongst HCWs and their patients at KGH. There is an urgent need for the KGH administration to prioritize monitoring, mentorship, and supervision on waste segregation in the hospital. The current finding that only half of the study participants observed had good IPC practice regarding waste segregation at KGH is consistent with a study by Sahiledengle, (2019a) in Ethiopia, who found 53.8% of healthcare workers observed had good practice regarding waste segregation. This current finding that only half of the study participants observed had good IPC practice regarding waste segregation is, however, slightly better than a similar study done in Tanzania among HCWs, 43.3% (Powell-jackson et al., 2020) regarding practice on waste management. The variation in the findings could be attributed to the number of observed health workers, experience level, study setting, and socio-demographic variables.

Although the current study found no factor statistically significant factor associated with IPC practice on waste segregation, a study by Powell-jackson et al., (2020) found that laboratory staff were less likely to comply with waste management practices compared to assistant medical and clinical officers. Also a similar study conducted in Ethiopia by Sahiledengle, (2019a) found that gender, age, years of service, standard precaution practice, and presence of on-site waste segregation containers were significantly associated with good waste segregation practice. The variation in the findings could be attributed to the differences in data collection methods, the number of study participants, study site, IPC domains studied, and socio-demographic variables.

5.3 Observation for availability of IPC materials

The finding by the present study that gloves, basic PPEs, were not available in the blood bank and eye clinic is an indicator to the possibility of transmission of HAIs among HCWs and patients. Indeed, studies have demonstrated that the lack of basic PPEs such as gloves is a predictor of poor compliance to IPC practices and positively correlates with HAIs among healthcare workers and patients (Storr et al., 2017, Tobin et al., 2013, Mukwato et al., (2009), and Al-mahdali, 2015).

There is an urgent need for KGH management to prioritize the timely procurement of basic PPEs such as gloves for all clinical areas in the hospital. The lack of basic PPEs such as gloves is widespread in resource limited settings for example Mukwato et al., (2009) in a study in Zambia found that 60 percent of the medical wards lacked basic PPEs. This lack of basic PPEs in resource limited setting could undo the gains made in the global fight against antimicrobial resistance as HAIs can easily spread in communities.

The lack of SOPs on waste management in three of the eight clinical care areas observed is also of great concern as it may lead to poor waste management practices. The availability of SOPs on

waste management promotes compliance to good waste management practices (Sahiledengle, 2019a). The finding by the present study that sharps were lying on the floor in four of the eight clinical care areas is particularly disturbing as studies have consistently demonstrated that poor disposal of sharps carries the highest risk to HAIs for both patients and the healthcare workers (Sahiledengle, 2019a). Also, the finding by the current study that only two of the eight clinical care areas had posters on waste management displayed for HCWs to reference in between procedures is disturbing as the availability of reference materials in form of posters during work has been found to improve adherence to good IPC practices among healthcare workers Mukwato et al., (2009). The KGH administration therefore needs to procure and distribute SOPs on waste management to guide healthcare providers on the safe disposal of medical waste.

Also the finding by the current study that three of the five care areas lacked hand washing supplies and reference materials such as posters to promote good compliance to hand hygiene practices requires the urgent attention of the KGH administration. Studies have indeed demonstrated a positive relationship between good compliance to hand hygiene practices and the presence of hand washing facilities (Huang & Stewardson, 2014). The finding by the present study is consistent with the national IPC assessment findings conducted by the national IPC program in hospitals and selected peripheral health units in Sierra Leone in 2018, which found KGH as the worst performing hospital regarding IPC with compliance score of 60.3% (National Infection, Prevention and Control Report, 2018). The lack of IPC equipment such as hand washing facilities in some of the clinical areas in KGH is an indication that the government of Sierra Leone needs to do more work in providing IPC materials to healthcare facilities in the country.

It is encouraging to know that majority of the study participants have been trained on IPC and had access to its guidelines for practice. This indicates that monitoring, supervision, in-service training, among others should be strengthened at KGH.

5.4 Limitations of the present study

This study, though with limitations too, which aimed at contributing to our understanding of the factors associated with IPC practices in KGH in Sierra Leone, requires a careful generalization of its findings to other healthcare facilities.

Data was collected from only one hospital in the Eastern province of Sierra Leone, which may present district and regional bias as the different regions of the country vary with socio-economic factors such as the opportunity for IPC training and the capacity and practices of the HCWs.

Furthermore, the current findings are restricted to the views and experiences of the study participants with limited observations of clinical practice, which may limit its implications in actual practice. However, the interviews and observation of practice allowed for triangulation of the findings, which could have mitigated this limitation. Moreover, the difference in experience levels of the groups of study participants such as physicians, midwives, nurses, community health officers, laboratory technicians, midwives, and anesthetists shed light on a broad range of knowledge and practice of the HCWs in contributing to the understanding of this subject area. However, the current study has provided valuable baseline information for comparison with future research notwithstanding its inability to completely generalize its results.

A major limitation of the current study, just like any survey, is related to social desirability bias, a situation in which the true perceptions of study participants might not be disclosed because of the feeling that they have to give socially or culturally correct answers. Such bias occurs when study

participants are unwilling to make negative views of services, especially while they are at the service site. HCWs in this study, for example, could have felt that it was inappropriate for them to mention that they were not knowledgeable on how to perform a given task, even though most of them have been providing these services. Other biases could have also have occurred, from the format of the questions, wording, and order.

Finally, factors associated with IPC practice could not be thoroughly assessed since the current study observed a small number of HCWs and few variables to assess HCWs IPC practice.

The current study, however, mitigated the effects of these biases in several ways, such as making the participants feel relaxed and giving assurance on their privacy and confidentiality hence producing stronger confirmation of the results.

Although this study has provided us with crucial information on the knowledge and practice levels on IPC among HCWs in KGH, an inherent limitation of cross-sectional studies such as the current study is that a causal relationship cannot be established (Gordis, 2014).

Despite the limitations of the current study, it has given understanding in important ways, and helped to identify knowledge, practice, and availability of IPC supplies based on the findings of this study. This study has proposed recommendations relevant to program managers of MoHS at all levels including the national, district, and health facility levels, policymakers, healthcare workers, and researchers.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

In general, the current study has found that HCWs at KGH have good knowledge on IPC. However, the current study found knowledge gaps among HCWs in KGH in specific areas of IPC such as when to use of gloves, moments of hand hygiene, and waste segregation. Identified by the current study also is that factors such as level of education and years of work experience were independent predictors of HCW's knowledge on IPC with HCWs with tertiary level of education and those with five or more years of work experience having good knowledge on IPC when compared to other categories.

The current study found that HCW's practice on IPC was generally poor. The study found that working shift of the HCW was an independent predictor of HCW's IPC practice with those HCWs working in the afternoon shift having good IPC practice on hand hygiene and the use of reusable equipment in comparison to others.

The current study found that IPC supplies were available in almost all the observed clinical areas, although basic PPEs such as gloves, alcohol hand rub, and waste bins were lacking in a few clinical areas.

6.2 Recommendations to improve knowledge, practice, and availability of IPC supplies

- Since the current study found knowledge gaps among HCWs on IPC, there is an urgent need for the IPC program at the MoHS to implement continuing in-service educational programs such as on-site and off-site training and mentorship.

- Since the accessibility of reference materials by HCWs is a documented method of improving their knowledge levels on different medical subjects, another way to improve the HCWs' knowledge on IPC is for the KGH administration to work with the national IPC program to make available information, education, and communication (IEC) materials and job aids on IPC.

- The KGH administration should prioritize IPC educational interventions to HCWs with less education and those with fewer years of work experience as this study found that HCWs with tertiary level of education and those with five or more years of work experience were more knowledgeable on IPC.

- The KGH administration should focus IPC-related activities of supervision and monitoring on HCWs working during the morning shift as the current study found that the afternoon shift was associated with good IPC practice.

- The KGH administration should procure IPC supplies and make them available to HCWs in all clinical areas of the hospital as this study found that some clinical areas at the hospital lacked basic PPEs such as gloves.

REFERENCES

Abdella, N. M., Tefera, M. A., Eredie, A. E., Landers, T. F., Malefia, Y. D., & Alene, K. A. (2014). Hand hygiene compliance and associated factors among health care providers in Gondar University Hospital, Gondar, North West Ethiopia. *BMC Public Health*, *14*(1). https://doi.org/10.1186/1471-2458-14-96

Abdo, A. H. (2017). Assessment of injection safety in Ha Dong General Hospital , Hanoi , in 2012 [version 4 ; referees : 2 approved , 1 approved with reservations] Referee Status :, 1–18. https://doi.org/10.12688/f1000research.11399.1

Abubakar, S., Usman, R. H., Idris, A., & Muhammad, I. (1996). Knowledge and practice of injection safety among healthcare workers in a Nigerian secondary healthcare facility, 1–8. https://doi.org/10.3396/IJIC.v15i1.004.19

Akagbo, S. E., Nortey, P., & Ackumey, M. M. (2017). Knowledge of standard precautions and barriers to compliance among healthcare workers in the Lower Manya Krobo District , Ghana. *BMC Research Notes*, 1–9. https://doi.org/10.1186/s13104-017-2748-9

Al-mahdali, G. (2015). A literature review of healthcare workers compliance to , and knowledge of standard / universal precautions, *2*(5), 156–166. https://doi.org/10.15406/mojph.2015.02.00040

Allegranzi, B., Nejad, S. B., Combescure, C., Graafmans, W., Attar, H., Donaldson, L., & Pittet, D. (2011). Burden of endemic health-care-associated infection in developing countries : systematic review and meta-analysis. *The Lancet*, *377*(9761), 228–241. https://doi.org/10.1016/S0140-6736(10)61458-4

Allegranzi, B., Nejad, S. B., & Pittet, D. (2017). The Burden of Infection, 1–7.

Assefa, J., & Diress, G. (2020). Infection prevention knowledge , practice , and its associated factors among healthcare providers in primary healthcare unit of Wogdie District , Northeast Ethiopia , 2019 : a cross-sectional study, 1–9.

Beltrami, M. Williams, T. Shapiro, Craig N. Chamberland, M. E. (2000). Risk and Management of Blodd-borne Infections in Health Care Workers. Clinical Microbiology Review., *13*(3), 2000.

Desta, M., Ayenew, T., Sitotaw, N., Tegegne, N., Dires, M., & Getie, M. (2018). Knowledge, practice and associated factors of infection prevention among healthcare workers in Debre Markos referral hospital, Northwest Ethiopia. *BMC Health Services Research*, *18*(1), 1–10. https://doi.org/10.1186/s12913-018-3277-5

Fashafsheh, I. (2015). Knowledge and Practice of Nursing Staff towards Infection Control Measures in the Palestinian Hospitals, *6*(4), 79–91.

Flores, A., & Pevalin, D. J. (2006). Healthcare workers' knowledge and attitudes to glove use. *British Journal of Infection Control*, *7*(5), 18–22. https://doi.org/10.1177/14690446060070050601

Franklin Okechukwu Emeka, M.E. Chauke, B. L. D. (2009). THE KNOWLEDGE AND

PRACTICE OF STANDARD PRECAUTIONS AMONG, (November).

Garner, J. S. (1996). Guideline for Isolation Precautions in Hospitals. *Infection Control & Hospital Epidemiology*, *17*(1), 54–80. https://doi.org/10.1017/s0195941700006123

Geberemariyam, B. S., Donka, G. M., & Wordofa, B. (2018). Assessment of knowledge and practices of healthcare workers towards infection prevention and associated factors in healthcare facilities of West Arsi District , Southeast Ethiopia : a facility-based cross-sectional study, 1–11.

Gertrude, M. (2013). PREVENTION STANDARD PRECAUTIONS AMONG NURSES.

Gezie, H., Leta, E., & Admasu, F. (2019). Health care workers knowledge , attitude and practice towards hospital acquired infection prevention at Dessie referral hospital , Northeast Ethiopia, 59–63.

Gordis, L. (2014). *Student Consult Register and activate this title today at studentconsult . com*.

Gulilat, K. (2014). Assessment of Knowledge, Attitude And Practice of Health Care Workers on Infection Prevention in Health Institution Bahir Dar City Administration. *Science Journal of Public Health*, *2*(5), 384. https://doi.org/10.11648/j.sjph.20140205.13

Hayeh Pauline Awusi, R. K. E. (2012). University of Ghana http://ugspace.ug.edu.gh, (10362714).

Hosseinialhashemi, M., Sadeghipour Kermani, F., Palenik, C. J., Pourasghari, H., & Askarian, M. (2015). Knowledge, attitudes, and practices of health care personnel concerning hand hygiene in Shiraz University of Medical Sciences hospitals, 2013-2014. *American Journal of Infection Control*, *43*(9), 1009–1011. https://doi.org/10.1016/j.ajic.2015.05.002

Huang, G. K. L., & Stewardson, A. J. (2014). Back to basics : hand hygiene and isolation. https://doi.org/10.1097/QCO.0000000000000080

Hussen SH, Estifanos WM, Melese ES, and M. F. (2017). Knowledge , Attitude and Practice of Infection Prevention Measures among Health Care Workers in Wolaitta Sodo Otona Teaching and Referral Hospital, *6*(4), 1–7. https://doi.org/10.4172/2167-1168.1000416

Jemal, S., Zeleke, M., Tezera, S., Hailu, S., Abdosh, A., Biya, M., & Abduljelil, S. (2019). Health care workers' knowledge, attitude and practice towards infection prevention in Dubti referral hospital, Dubti, North East Ethiopia. *International Journal of Advanced Community Medicine*, *2*(1), 30–36. https://doi.org/10.33545/comed.2019.v2.i1a.07

Kalantarzadeh, M., Mohammadnejad, E., Ehsani, S. R., & Tamizi, Z. (2014). Knowledge and practice of nurses about the control and prevention of nosocomial infections in emergency departments. *Archives of Clinical Infectious Diseases*, *9*(4), 0–4. https://doi.org/10.5812/archcid.18278

Kanu, H., Wilson, K., Sesay-kamara, N., Bennett, S., Mehtar, S., Storr, J., … Kolwaite, A. (2019). Creation of a national infection prevention and control programme in, 1–6. https://doi.org/10.1136/bmjgh-2019-001504

Kilmarx, P. H., Clarke, K. R., Dietz, P. M., Hamel, M. J., Husain, F., & Mcfadden, J. D. (2014).

Ebola Virus Disease in Health Care Workers — Sierra Leone , 2014, *63*(49), 1168–1171.

MoHS. (2014). Update : Ebola Virus Disease Outbreak — West Africa , October 2014, *63*(43), 978–981.

MoHS. (2015a). Government of Sierra Leone Ministry of Health and Sanitation Health Sector Annual Performance Report.

MoHS. (2015b). National Infection Prevention and Control Guidelines.

Mukwato, K. P., Ngoma, C. M., & Maimbolwa, M. (2007). Compliance With Infection Prevention Guidelines By Health Care Workers At Ronald Ross General Hospital Mufulira District, *35*(3).

Mukwato, Ngoma, C., & Maimbolwa, M. (2009). Compliance With Infection Prevention Guidelines By Health Care Workers at Ronald Ross General Hospital Mufulira District. *Medical Journal of Zambia*, *35*(3). https://doi.org/10.4314/mjz.v35i3.46530

National Infection, Prevention and Control Report, 2018. (2018). Ministry of Health and Sanitation Directorate of Health Security and Emergencies National Infection Prevention and Control Unit 2018 Fourth Quarter (Q4) Health Facilities Assessment Report.

Olaifa, A., Govender, R. D., Ross, A. J., Olaifa, A., Govender, R. D., & Knowledge, A. J. R. (2018). Knowledge , attitudes and practices of healthcare workers about healthcare waste management at a district hospital in KwaZulu-Natal Knowledge , attitudes and practices of healthcare workers about healthcare waste management at a district hospital in KwaZu. *South African Family Practice*, *6190*, 1–8. https://doi.org/10.1080/20786190.2018.1432137

Onyemocho, A., Anekoson, J. I., & Pius, E. O. (2013). Knowledge and Practice of Injection Safety among Workers of Nigerian Prison Service Health Facilities in Kaduna State, *1*(7), 171–176. https://doi.org/10.12691/ajphr-1-7-5

Osaigbovo, I. (2018). ASSESSMENT OF KNOWLEDGE AND BARRIERS TO THE PRACTICE OF STANDARD PRECAUTIONS AMONG HEALTHCARE WORKERS IN A NIGERIAN Original Article ASSESSMENT OF KNOWLEDGE AND BARRIERS TO THE PRACTICE OF STANDARD PRECAUTIONS AMONG HEALTHCARE WORKERS IN A NIGERIAN TERTIA, (December).

Otovwe, A., & Adidatimi, P. O. (2017). Knowledge , Attitude and Practice of standard precaution among Health Care Workers in Federal Medical Centre Yenagoa , *12*(4), 79–86. https://doi.org/10.9790/3008-1204037986

Pittet, D., & Donaldson, L. (2005). Clean Care is Safer Care: The first global challenge of the WHO World Alliance for Patient Safety. *American Journal of Infection Control*, *33*(8), 476–479. https://doi.org/10.1016/j.ajic.2005.08.001

Powell-jackson, T., King, J. J. C., Makungu, C., Spieker, N., Woodd, S., Risha, P., & Goodman, C. (2020). Articles Infection prevention and control compliance in Tanzanian outpatient facilities : a cross-sectional study with implications for the control of COVID-19. *The Lancet Global Health*, (20), 1–10. https://doi.org/10.1016/S2214-109X(20)30222-9

Reda, A. A., Fisseha, S., Mengistie, B., & Vandeweerd, J. (2010). Standard Precautions :

Occupational Exposure and Behavior of Health Care Workers in Ethiopia, *5*(12), 1–6. https://doi.org/10.1371/journal.pone.0014420

Sahiledengle, B. (2019a). Self-reported healthcare waste segregation practice and its correlate among healthcare workers in hospitals of Southeast Ethiopia, *9*, 1–11.

Sahiledengle, B. (2019b). Stethoscope disinfection is rarely done in Ethiopia : What are the associated factors ?, 1–15. https://doi.org/10.5061/dryad.jc3mk77.Funding

Sahiledengle, B., Gebresilassie, A., Getahun, T., & Hiko, D. (2018). Infection prevention practices and associated factors among healthcare workers in governmental healthcare facilities in Addis Ababa. *Ethiopian Journal of Health Sciences*, *28*(2), 177. https://doi.org/10.4314/ejhs.v28i2.9

Saleem, T., Khalid, U., Ishaque, S., & Zafar, A. (2010). Knowledge, attitudes and practices of medical students regarding needle stick injuries. *Journal of the Pakistan Medical Association*, *60*(2), 151–156.

Sax, H., Allegranzi, B., Chraïti, M. N., Boyce, J., Larson, E., & Pittet, D. (2009). The World Health Organization hand hygiene observation method. *American Journal of Infection Control*, *37*(10), 827–834. https://doi.org/10.1016/j.ajic.2009.07.003

Septimus, E. J. (2018). Antimicrobial Resistance: An Antimicrobial/Diagnostic Stewardship and Infection Prevention Approach. *Medical Clinics of North America*, *102*(5), 819–829. https://doi.org/10.1016/j.mcna.2018.04.005

Siegel, J. D., Rhinehart, E., Cic, R. N. M. P. H., Jackson, M., Brennan, P. J., & Bell, M. (2007). 2007 Guideline for Isolation Precautions : Preventing Transmission of Infectious Agents in Healthcare Settings.

Storr, J., Twyman, A., Zingg, W., Damani, N., Kilpatrick, C., Reilly, J., … Guidelines, W. H. O. (2017). Core components for effective infection prevention and control programmes : new WHO evidence-based recommendations. *Antimicrobial Resistance & Infection Control*. https://doi.org/10.1186/s13756-016-0149-9

Suarez, Z. M. S., Oducado, R. M. F., & Josue, E. L. C. (2019). Infection Control Practice on Vital Signs Equipment : A Survey Among Senior Nursing Students in Iloilo City , Philippines, *7*(2), 56–62.

Teshager, F. A., Engeda, E. H., & Worku, W. Z. (2015a). Knowledge, Practice, and Associated Factors towards Prevention of Surgical Site Infection among Nurses Working in Amhara Regional State Referral Hospitals, Northwest Ethiopia. *Surgery Research and Practice*. https://doi.org/10.1155/2015/736175

Teshager, F. A., Engeda, E. H., & Worku, W. Z. (2015b). Knowledge, Practice, and Associated Factors towards Prevention of Surgical Site Infection among Nurses Working in Amhara Regional State Referral Hospitals, Northwest Ethiopia. *Surgery Research and Practice*, *2015*, 1–6. https://doi.org/10.1155/2015/736175

Timilshina, N., Ansari, M. A., & Dayal, V. (2011). Risk of infection among primary health workers in the Western Development Region, Nepal: Knowledge and compliance. *Journal of Infection in Developing Countries*, *5*(1), 18–22.

Tobin, E. A., Asogun, D. A., Odia, I., & Ehidiamhen, G. (2013). Knowledge and practice of infection control among health workers in a tertiary hospital in Edo state. *Nigeria Direct Research Journal of Health and Pharmacology (DRJHP)*, *1*(2), 20–27. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.407.5493&rep=rep1&type=pdf

Ulrich, J., & Wesarg, I. (2001). Improving Infection Prevention and Control At the Health Facility. *Pediatric Dermatology*, *18*(2), 163. https://doi.org/10.1046/j.1525-1470.2001.01894-2.x

Unakal, C. G., Nathaniel, A., Keagan, B., Alexandria, B., Lauralee, B., Varun, C., … Akpaka, P. E. (2017). Assessment of knowledge, attitudes, and practices towards infection prevention among healthcare workers in Trinidad and Tobago. *International Journal Of Community Medicine And Public Health*, *4*(7), 2240. https://doi.org/10.18203/2394-6040.ijcmph20172813

WHO. (2002). Guidelines on Prevention and Control of Hospital Associated Infections, (January).

WHO. (2015). Infection Prevention and Control Recovery Plans and Implementation : Guinea , Liberia , and Sierra Leone Inter-country Meeting.

WHO Regional Committee for Africa. (2008). Fiftieth session of the WHO Regional Committee for Africa Final report, (September). Retrieved from https://apps.who.int/iris/bitstream/handle/10665/92228/AFR- RC58-20 - Regional Committee Report.pdf [cited 2016 May 26]?sequence=1

APPENDICES

1. INFORMED CONSENT FORM

Thesis title: Factors associated with infection prevention and control practices among healthcare workers, Kenema government hospital, Sierra Leone.

Introduction: I am Kassim Kamara, Master of Philosophy Applied Epidemiology and Disease Control student from the University of Ghana, and this research's principal investigator.

Purpose of this study: the aim of this study is to assess IPC practices among health workers at the Kenema government hospital. The study objectives are to assess HCWs knowledge and practice on IPC and their associated factors, and assess the availability of IPC materials in the hospital.

Procedure: This study involves answering questions about IPC practices, performance, and observation by the researcher. Participation is voluntary and I would be grateful if could respond to this questionnaire as sincerely and independently as possible. This research is purely for academic purpose which forms part of the requirement for the award of a Master of Philosophy in Applied Epidemiology and Disease Control.

To participate in this study is voluntary and you can decide not to answer any question or all the questions. You may withdraw from the study at any time during the interview. Nevertheless, I will encourage you to participate fully in the study since your opinions are very important in helping to assess IPC practices at the facility.

Your answers will be treated as confidential information and will be used only for the purposes of this study; therefore, your total honesty in your replies will be extremely valuable to our purposes.

This interview will last between 30 – 45 minutes and we would appreciate your time and responses.

Compensation: there is no financial or material benefit for taking part in this study.

Contact information

Kassim Kamara: University of Ghana, email: kassim10915@gmail.com, Tel: +23277951706/+23278241391

Voluntary consent: The contents of the study information have been read carefully by me, explained in detail in my language and I have clearly understood the contents, information and purposes. I declare that my participation is fully voluntary and may not respond to questions which I don't know or I don't want to disclose the information being asked. I agree to voluntarily participate in this study.

Name of Participant…… Signature……

Telephone number……

Date……..

Name of interviewer…… Signature……

Telephone number……

Date……

2. SAMPLE QUESTIONNAIRE

Dear respondent, I am Kassim Kamara, a final year student pursuing Master of Philosophy degree from the University of Ghana. I am administering this questionnaire to solicit your response in order to help assist in establishing information on HCWs practices on IPC at the Kenema government hospital. The information given will be used strictly for academic purposes and all information given will be treated as confidential.

Section i: Personal information

1.0 Identification Information		
S/N	**Variable**	**Write response below**
1.1	Unique ID Number	
1.2	Tel. No. of respondent	
1.3	Tel. No. of interviewer	
1.4	Date of interview	

2.0 Socio-demographic characteristics			
S/N	**Variable**	**Response**	
2.1	Age in completed years	…….years	
			Circle one
2.2	Sex	Male	1
		Female	2
			Circle only one
2.3	Marital status	Single	1

		Married	2
		Divorced	3
		Widowed	4
		Separated	5
			Circle only one
2.4	Religion	Christian	1
		Muslim	2
		Others specify -write	3……..
			Circle only one
2.5	Highest level of education	No education	1
		Primary	2
		Secondary	3
		Tertiary	4
			Circle only one
2.6	Profession	Physician	1
		Nurse	2
		Midwife	3
		Lab technician	4
		Anesthetist	5
		CHO/CHA	6
		Others, specify	7……
2.7	Years of work experience		

Section ii: Knowledge of IPC among healthcare workers

We are also interested in knowing your level of knowledge in infection prevention and control

3.0 Knowledge of IPC among healthcare workers			
	Hand hygiene	**Correct responses**	**Tick if named**
3.1	Can you name the moments of hand hygiene?	Before touching the patient	☐
		Before a clean or aseptic procedure	☐
		After exposure to body fluids	☐
		After touching the patient	☐
		After contact with patient surroundings	☐
			Circle only one response 1 for Agree ; 2 for Disagree
3.2	Washing hands with soap or use of alcohol hand rub decreases the risk of transmission of healthcare acquired infections		1 2
	When using soap and water to clean your hands, you should wet your hands, apply soap, then rub your hands together for at least **10 seconds**		1 2
	Use of an alcohol hand rub for hand hygiene is as effective as soap and water if hands are not visibly dirty		1 2
	Protective gloves		
3.3	Gloves can be used for more than one patient at the same time during clinical care		1 2
3.4	Wearing gloves eliminates the need to wash hands		1 2
3.5	Gloves should be worn when handling potentially infectious materials or when coming into contact with contaminated items or surfaces		1 2
3.6	Use of sterile gloves is the most effective method to prevent HCAI		1 2
3.7	It is necessary to remove gloves and decontaminate hands between different patients		1 2
3.8	It is acceptable to decontaminate gloves using soap and water or alcohol gel		1 2
3.9	Gloves should be worn when performing aseptic technique		1 2
	Injection safety		**Circle only one response**

		1 for Agree ; 2 for Disagree
3.10	Needles and syringes can be reprocessed during patient care	1 2
3.11	Syringes can be reused on more than one patient if they do not come into contact with the patient's body fluids	1 2
3.12	Recapping the needle after injecting a patient is a safe injection practice	1 2
	Reusable equipment	**Circle only one response** **1 for Agree ; 2 for Disagree**
3.13	It's not necessary to disinfect a thermometers after coming in contact with a patient	1 2
3.14	A stethoscope should always be disinfected after being in contact with a patient	1 2
3.15	Use of boiling water to clean reusable instruments and utensils is an effective means of sterilization	1 2
	Waste segregation	**Circle only one response** **1 for Agree ; 2 for Disagree**
3.16	Highly infectious waste should be deposited in red container waste bins	1 2
3.17	It is appropriate to deposit infectious or hazardous health-care waste in yellow waste bins	1 2
3.18	Black waste bins are the most appropriate to deposit non-infectious waste	1 2

Section iii: Availability of materials for infection prevention and control practices

4.0 Availability of materials for infection prevention and control practices			
			Tick only one
4.1	How available are gloves in the word/department?	Always available	
		Not always available	
4.2	Do you always have PPEs for use on the ward for use?	Always available	
		Not always available	

4.3	Do you always have the items available for hand washing?	Always available	
		Not always available	
4.4	How is the availability of detergents for decontamination of used instruments	Always available	
		Not always available	
4.5	How often are safety boxes available for disposal of used syringes and needles	Always available	
		Not always available	

Section iv: Compliance with IPC guidelines and protocol

5.0 Compliance with IPC guidelines and protocol		
		Circle only one
5.1	Have you been trained on IPC?	Yes
		No
5.2	Is there an IPC committee in this hospital?	Yes
		No
		Don't know
5.3	Do you have access to the IPC guideline in this facility?	Yes
		No

Section v: observation for availability of Infection prevention and control supplies

I am also interested in observing some of the IPC practices in your ward. I will focus at your logistics, documentation and performances.

Indicator	**Observation**
	Circle one only
Protective gloves	
Are gloves readily available in each patient ward?	Yes No
Waste segregation	

Is a waste management policy or SOP available upon request	Yes No
Is at least one general waste container available in the ward?	Yes No
Is at least one infectious (non-sharps) waste container available in the ward	Yes No
Are all waste bins clearly marked to indicate the waste type (e.g color coding or labelling to indicate general or infectious waste)	Yes No
Is every sharps container on the ward less than ¾ full?	Yes No
Is every waste bin on the ward less than ¾ full?	Yes No
Is it accurate to say that there are no sharps on the floor at the time of observation?	Yes No
Are sharps safety posters displayed in the clinical area where sharps are prepared/disposed?	Yes No
Are both the duty allocation roster (for cleaners/transporters) and the waste collection and transport tracker (written log) updated daily?	Yes No
Hand hygiene	
Are functioning hand washing buckets readily accessible in the patient care area?	Yes No
Are all handwashing supplies, such as soap and paper towels, available?	Yes No
Are signs promoting hand hygiene displayed in the area?	Yes No
Are alcohol based rubs readily accessible?	Yes No
Injection safety	
Are sharps containers available?	Yes No
Are sharps containers properly secured and not full?	Yes No
Are sharps boxes well positioned and correctly labelled?	Yes No

Section v: **Observation form for HCWs infection prevention and control practices**

Hand Hygiene

Observer:	End Time:
Date (dd /mm/yyyy):	Form #:
Day of Week:	
Start Time:	Clinical area:

Healthcare Worker (HCW) Category code:

1 = Physician
2 = Nurse
3 = House officer
4 = Laboratory techs/assistant
5 = House officer
6 = Community health officer/Assistant
7 =Anesthetics
8 = other

Key:

W = Wash
A = Alcohol based hand rub
M = No hand hygiene
Missed opportunity

HCW Category code	Before						After						Other					
	Before initial P/R/C or P/R/C ENV contact			Before aseptic/clean procedure			After blood or body fluids exposure			After P/R/C or P/R/C ENV contact			Artificial Nails			Hand Jewelry (rings, bracelets, not watches)		
	W	A	M	W	A	M	W	A	M	W	A	M	W	A	M	W	A	M

Injection safety	**Practice performed**
Proper hand hygiene, using alcohol-based hand rub or soap and water, is performed prior to preparing and administering medications.	Yes No
Injections are prepared using aseptic technique in a clean area free from contamination or contact with blood, body fluids, or contaminated equipment.	Yes No
Needles and syringes are used for only one patient (this includes manufactured prefilled syringes and cartridge devices such as insulin pens).	Yes No
The rubber septum on a medication vial is disinfected with alcohol prior to piercing.	Yes No
Medication vials are entered with a new needle and a new syringe, even when obtaining additional doses for the same patient.	Yes No
Medication administration tubing and connectors are used for only one patient.	Yes No
Protective gloves	

After using gloves with a patient, health-care worker used new gloves for each patient if gloves were used	Yes No
After using gloves in general, health-care worker washed his or her hands with soap or used an alcohol-based hand rub for each patient seen	Yes No
Before contact with blood, body fluids, mucous membranes, non-intact skin or contaminated equipment, health-care worker wore gloves	Yes No
After contact with blood, body fluids, mucous membranes, non-intact skin or contaminated equipment, the health-care worker discarded the gloves into a waste bin	Yes No
Injection safety	
Before an injection or taking a blood sample, the health-care worker used a new needle	Yes No
Before an injection or taking a blood sample that required a syringe, the health-care worker used a new syringe	Yes No
Before potential contact with blood, body fluids, mucous membranes, non-intact skin or contaminated equipment, the health-care worker used clean swabs and alcohol-based solutions and did not use wet swabs from a multiuse container	Yes No
Do HCWs correctly dispose of needles (i.e. needles are discarded after single use and are not recapped, bent or broken prior to disposal in sharps container)?	Yes No
Reusable equipment	
Before or after patient contact (thermometer), The health-care worker disinfected the thermometer using rubbing alcohol or bleach	Yes No
Before or after patient contact (stethoscope), the health-care worker disinfected the stethoscope using rubbing alcohol or bleach	Yes No
Waste segregation of needles and syringes	Yes No
After an injection or taking a blood sample that required a syringe, the health-care worker segregated the syringe into a leak-proof, puncture-resistant sharps container	Yes No
After an injection or taking a blood sample in general, the health-care worker segregated the needle into a leak-proof, puncture-resistant sharps container	Yes No
Waste segregation, excluding needles and syringes	
After an injection or taking a blood sample during which infectious waste was produced, the health-care worker segregated swabs, gauzes and other infectious waste into a yellow or red bin with matching bag	Yes No

After a medical examination during which infectious waste was produced, the health-care worker segregated tongue depressors, swabs, gauzes and other infectious waste into a yellow or red bin with matching bag	Yes No