SCHOOL OF PUBLIC HEALTH
COLLEGE OF HEALTH SCIENCES
UNIVERSITY OF GHANA

PREVALENCE AND DETERMINANTS OF NOSOCOMIAL INFECTIONS AMONG HEALTH CARE WORKERS IN 37 MILITARY HOSPITAL

BY

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A DISSERTATION SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF SCIENCE IN OCCUPATIONAL HYGIENE

JULY, 2019

DECLARATION

I, Sena Kofi Kunawotor, hereby declare that apart from references to other people's works, which have been duly acknowledged, this proposal is as a result of my own independent work and has not been submitted for the award of any degree in any institution.

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Dr Prudence Tettey

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18/10/19

DEDICATION

This thesis is dedicated to my lovely wife, Mrs Charleen Kunawotor for her motivation, support and encouragement.

ACKNOWLEDGEMENT

I would like to express my heartfelt appreciation to my supervisor Prudence Tettey for the advice, guidance; support and encouragement, May the God Lord bless you. I thank my course mates for their support and all those who contributed to the success of this thesis in diverse ways.

I acknowledge the contributions of my research assistants; Mr. Dominic Edem Hotor of the University of Ghana and S/SGT Gautch of 37 Military Hospital, Selasie Kunawotor of University of Allied Health Studies, Ho. I acknowledge the Hospital Command, Heads of Departments and Wards and all staff of the 37 Military Hospital for their co-operation during the data collection.

To the lecturers of the Department of Biological, Environmental and Occupational Health, School of Public Health, I am so grateful for the knowledge imparted in me. May God bless you all.

Finally, I give Glory to the Most High God for bringing me this far, Glory be to His name.

ABSTRACT

Background of study: Hospital Acquired Infections (HAI's) also known as Nosocomial infections have been recognised as a serious public health problem in the last few years and are becoming increasingly common worldwide affecting both developed and developing countries. The increase in prevalence among developing countries is due to determinants such as poor adherence to existing HAI guidelines, ineffective national Infection Prevention and Control (IPC) policies and inadequate IPC personnel. In Ghana, health facilities have overly become the conduit through which health care workers get infections. Previous studies have been conducted on nosocomial infections in urban and rural settings in Ghana. These studies covered the prevalence and determinants of HAI's within district, regional and teaching hospitals. However, satisfactory progress has not been made in that space, therefore, drawing attention to this study on its prevalence, association with knowledge, attitudes and behaviours of health workers in the largest military hospital which also serves as the health facility for the National Disaster and Emergency Response in Ghana.

Objective: The main objective of this study is to investigate the prevalence and determinants of HAI's among health care providers in health facilities looking at a special case of 37 Military Hospital.

Methods: Participants of this cross-sectional study included 270 healthcare workers who were randomly selected from 9 professions (Doctors, Nurses, Laboratory professionals, Public Health staff, Dental Technicians, Radiology staff, Laundry staff, staff from the Central Sterile Services Department and Ward Assistants) from the strata of population at the 37 Military hospital. The duty roster of all the source population were collected and participants were assigned numbers. A random number generator was then employed to select participants. Data was collected in May 2019 using a five-part Questionnaire and

analysed via SPSS v25 software. Chi-square tests was run to analyse associations between socio-demographic or economic factors and HAIs.

Results: Overwhelmingly, almost 93.7% (262) of all the health workers interviewed indicated that they were very much aware of hospital-acquired infections in general. In relation to the common HAI's that affect staff easily at the hospital, almost half 49.3% (133) of respondents asserted to skin infections. This was followed by Surgical Site Infections 18.9% (51). Catheter-Associated Urinary Tract Infections and Ventilator-Associated Pneumonia infections also consisted of 28.1% (76) of total responses. The least common type of HAI's that affect staff at the hospital was the Central Line-Associated Bloodstream Infections 3.7% (10).

The study found out that nurses were the most susceptible staff to hospital-acquired infections. This was asserted by 70.0% (189) of the total population. Again, 27.4% (74) indicated having ever contracted nosocomial infections. However, 72.6% (196) indicated they have never contracted HAIs. Another 13.3% (35) of the respondents had infections on 3-5 instances while 10.7% (27) had recorded HAIs once. An overwhelming 78.1% (211) of respondents asserted to the fact that, proper hand washing and IPC measures were the most effective methods of preventing nosocomial infections.

Conclusion: Prevalence of nosocomial infections among staff at 37 Military Hospital was alluded to by respondents with skin infections being dominant. Knowledge on IPC measures among the staff was good. Determinants of nosocomial infections were explored from mainly individual behavioural aspects. Work place safety to curb the spread of HAIs among staff at the hospital has been put in place but not too satisfactory. A couple of respondents indicated having contracted infections from within the facility more than once.

KEY WORDS: Nosocomial Infections, Infection Prevention Control, Health Care Workers.

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LIST OF ACRONYMS

Acronym	Meaning
CAUTI	Catheter-Associated Urinary Tract Infections
CDC	Centre for Disease prevention and Control
CLABSI	Central Line-Associated Bloodstream Infections
CVD	Cardiovascular Disease
GHS	Ghana Health Service
HAI	Hospital Acquired Infection
HCW	Healthcare workers
HCW	Healthcare Workers
HH	Hand Hygiene
HSE	Health and Safety Executive
IPC	Infection Prevention and Control
MH	Masked Hypertension
NCD	Non-communicable disease
NCO	Non-Commissioned Officer
PEP	Post Exposure Prophylaxis
PPE	Personal Protective Equipment
SSA	Sub-Saharan Africa
SSI	Surgical Site Infections
VAP	Ventilator-Associated Pneumonia

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Hospital Acquired Infections (HAI's) also known as Nosocomial infections have been recognised as a serious public health problem in the last few years and are becoming increasingly common worldwide affecting both developed and developing countries. However, the prevalence is two to threefold higher in developing countries compared to Europe or the USA (Nejad et al., 2011). The increase in prevalence among developing countries is due to determinants such as poor adherence to existing HAI guidelines, ineffective national IPC policies and inadequate IPC personnel (Rothe et al., 2013). Nosocomial infections also affect the quality of health care provided in hospitals as they lead to significant morbidity and mortality as well as increased health care costs (Haley et al., 1985).

The World Health Organization defines nosocomial infection as, "an infection acquired in a health care facility by a patient who was admitted for a reason other than that infection. This include infections acquired in the hospital but appearing after discharge and also occupational infections among the staff of the facility." (WHO, 2002). They are frequently caused by microorganisms that are resistant to multiple antibiotics which make the treatment of nosocomial infections prolong. It is estimated that 5% to 10% of human patients admitted to hospitals develop Nosocomial Infections (Burke, 2003). Such infections may manifest during the period of stay of patients or staff within the hospital or develop after the patient has been discharged or the staff has left the facility.

According to the World Health Report, about 3 million out of 35.7 million health care workers experience percutaneous exposure to infectious diseases each year (Bhardwaj et

al., 2014). This places health care workers at direct high risk of infection with bloodborne pathogens and other communicable diseases.

Among the many nosocomial infections, four main groups of such infections have been identified and updated accordingly. These include Central Line-Associated Bloodstream Infections (CLABSI), Catheter-Associated Urinary Tract Infections (CAUTI), Surgical Site Infections (SSI) and Ventilator-Associated Pneumonia (VAP). These categories have within them unique characteristics which affect health workers who act as potential vectors for these causal agents (Kahn et al., 2017). The spread of these infections serves as a great source of concern for the managers and administrators in healthcare practice, particularly in developing countries where the health care systems are already pressured.

In Africa, the issue of hospital-acquired infections also dominates within the health care milieu. Generally, previous data implies that nosocomial infections are widespread in sub-Saharan Africa especially dominant with surgical sites. The prevalence rates of the infections as researched and reported was 2.1% in Cameroon (Kensah et al., 2013) and ranges between 1.6% - 11% in Gabon (Scherbaum et al., 2014; Mobashr, 2014). The rates varied between 2.5% - 14.8% in Burkina Faso and Tanzania. The reported rate in Senegal was 10.9% while the prevalence rate of Mali varied between 9.6% - 18.7% (WHO, 2011). The Democratic Republic of Congo and Burundi recorded prevalence rates of 1.7% and 10.4% respectively (Chu et al., 2015). Other countries such as Uganda and Ghana also recorded rates of 6.7% and 28% respectively (Newman, 2009; WHO, 2011). At the top of these reports are the findings of 5.7% - 45% in Nigeria and Ethiopia with the former having an incidence rate as high as 45.8% (Vergnano et al., 2005; Azeez-Akande, 2012).

The aforementioned statistics present a very disturbing picture of the prevalence of nosocomial infections on the continent. Infection prevention and control (IPC) refers to

measures aimed at preventing and controlling infections and transmission of infections within health care settings. The high rates of this HAI's persist due to inadequate and in some cases lack of national Infection Prevention and Control (IPC) policies together with their personnel and general poor adherence to existing nosocomial infection guidelines (Rothe et al., 2013). The vulnerability of acquiring such infections must be well examined and effective measures put in place to eliminate the incidence to a bare minimum.

In trying to provide total quality healthcare there are effective and low-cost prevention measures, however, the occupational health of health care workers has not been prioritized enough over the years (Abdeljalil, 2014). Thus, understanding the complex relationship of factors that contribute to nosocomial infection is a sine qua non to improving the outcomes of health workers who are exposed to such infections.

1.2 Problem statement

Health facilities in Ghana have overly become the conduit through which health care workers get infections. The spread of HAIs leads to the extension of patient's admissions, increased medical costs and heightened morbidity and mortality. Hence, an effective Infection Prevention and Control (IPC) practice is fundamental to ensure quality healthcare. The benefit of IPC in healthcare delivery reduces the risk of contracting infections and subsequently minimizes the overall costs of health care provision. In Ghana, there are laws to ensure the safety of workers outlined in Occupational Health and Safety Policy and Guidelines for Health Workers, however, despite the existence of these codified laws, efforts towards effective implementation and reduction in the incidence of HAIs have not yielded satisfactory results.

Previous studies have been conducted on HAIs in urban and rural settings in Ghana. These studies have covered prevalence and determinants of nosocomial infections within the Korle Bu, Komfo Anokye and Tamale Teaching Hospitals (Newman, 2009; Yawson & Hesse, 2013; Darkwah, 2015; Labi et al., 2018). Similarly, the Greater Accra, Central, Eastern, Brong Ahafo, Upper West and Volta Regional Hospitals (Tagoe et al., 2011; Tagoe & Desbordes, 2012; Hayeh &Esena, 2013; Labi et al., 2018) and the Ashaiman Poly Clinic (Essien-Baidoo et al., 2018) have also benefited from studies on HAI's.

The 37 Military Hospital has been chosen as it plays a key role in providing quality healthcare to service personnel and their families, civilian employees of the Ministry of Defence and their families and ex-service personnel as well as the general public. Moreover, the hospital serves as a teaching hospital and the health facility for the National Disaster and Emergency Response and also the United Nations Level IV Hospital in the West Africa Sub-region (Kommogldomo, 2016). The study seeks to examine the burden of such infections in this facility in a bid to chart a new path towards quality health care among the health staff therein.

The doctor-to-patient ratio in Ghana stands at 1:8000 patients, a situation that has fallen short of the World Health Organisation (WHO) recommended ratio of 1:1320 patients which contributes to pushing the medical staff to high workloads. These constraints the practice of stringent disinfection precautions in the 37 Military Hospital. Also, the non-compliance of hand hygiene by patients and health care workers as a whole is one of the major reasons attributed to the upsurge of HAIs generally. The development of effective alcohol-based hand rub solutions among others has addressed many of these concerns when it comes to hand hygiene (Boyce & Pittet, 2002).

Under-reporting and lack of documentation of HAIs is a major challenge because authorities are unable to quantify the impact for policy directives. Furthermore, there is inadequate education on the essence of disinfecting personal medical devices at the 37 Military hospital. It is very easy to ignore a problem where there is little or no data to prove the existence of the problem, and since these incidences are not documented, it poses as a silent health hazard with many repercussions (Sagoe Moses et al., 2001).

Beyond these studies, satisfactory progress has not been made in that space, therefore, drawing attention to this study on its prevalence, determinants and association with knowledge, attitudes and behaviours of health workers in the largest military hospital which also serves as the health facility for the National Disaster and Emergency Response in Ghana.

1.3 Research Questions

1. What are the knowledge levels of healthcare workers on HAI's and IPC within 37 Military Hospital?
2. What are the determinants for nosocomial infections at the 37 Military Hospital?
3. What is the frequency of nosocomial infections reported among healthcare workers at the 37 Military Hospital?
4. What is management's action in terms of logistics and other parameters to forestall the incidence of nosocomial infections among healthcare workers in the 37 Military Hospital?

1.4 General objective

The main objective of the study is to investigate the prevalence and determinants of Hospital Acquired Infections among healthcare providers at the 37 Military Hospital.

1.5 Research Objectives

5. To ascertain the knowledge level of healthcare providers on HAI's and infection prevention and control (IPC) measures.
6. To determine the factors responsible for HAI transmission and spread.
7. To determine the frequency of HAI's among healthcare providers
8. To evaluate the safety procedures on HAIs for staff.

1.5 Conceptual Framework

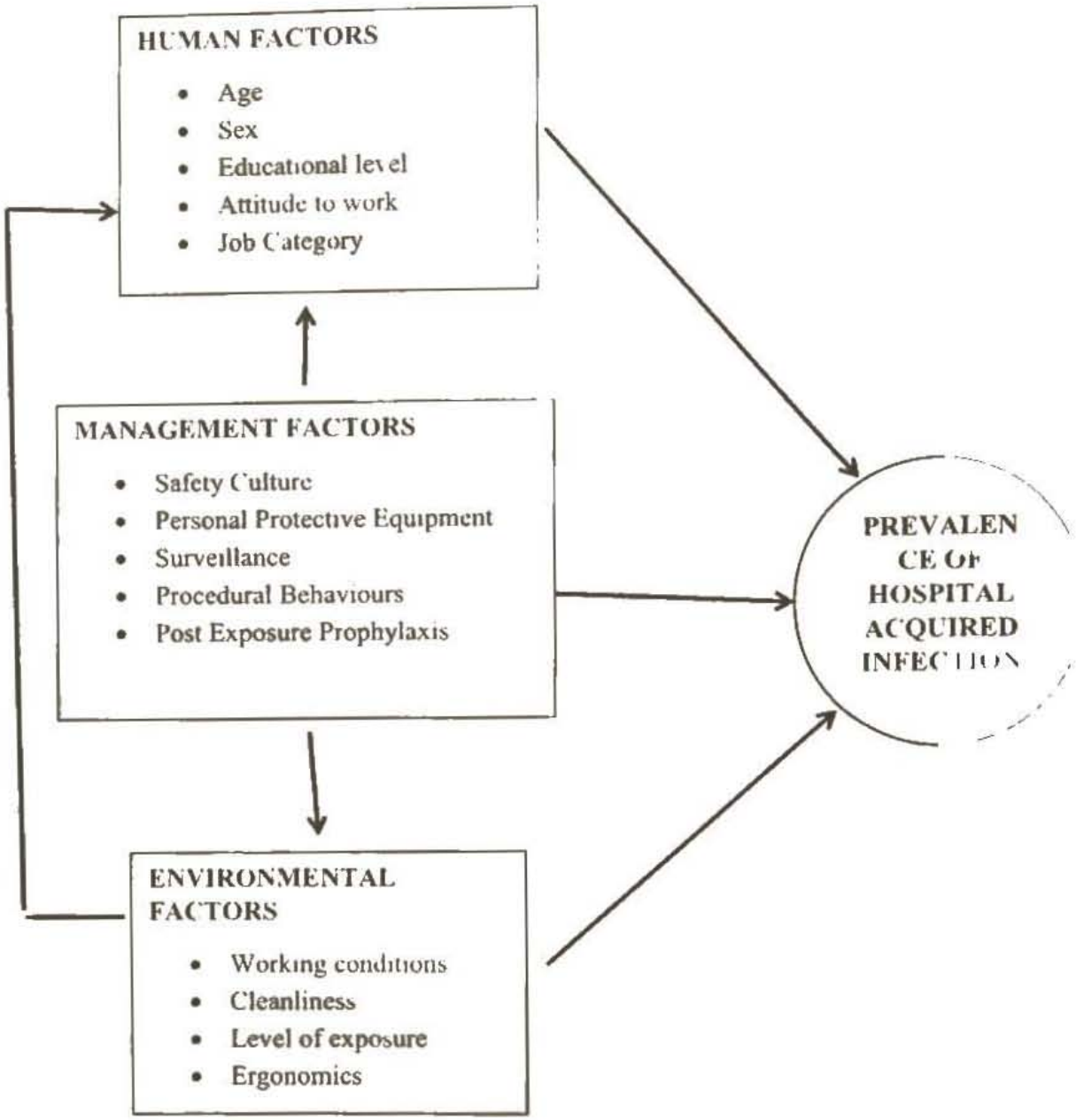

Figure 1.1: Framework for the Incidence of nosocomial infections among health workers

Source: Authors construct, 2019.

The diagram above shows the conceptual framework for the incidence of nosocomial infections among health workers. The main outcome variable is the occurrence of nosocomial infections. However, other factors contribute to a health worker contracting

these infections. The diagram depicts 3 broad categories that result in HAI's. Human and socio-demographic factors such as age, sex, educational level, as well as environmental factors such as the level of exposure, working conditions and ergonomics also influence the incidence of hospital-acquired infections. Finally, the role of management of healthcare facilities in ensuring safety culture, the use of personal protective equipment (PPE) and surveillance also goes a long way to determine the infection rate of health workers.

1.6 Significance of the Study

This study is of important value in the following ways.

The study will contribute to an updated picture of HAIs from the United Nations Level IV Hospital Facility. Results from this study will be used as a first-hand source of information regarding Hospital Acquired Infections among staff at the 37 Military Hospital. Findings will help health care providers and planners in the control and management of nosocomial infections in hospitals and other healthcare providing facilities.

Moreover, the recommendations emerging from this study will be useful for improving occupational health and safety in hospitals within the country.

CHAPTER TWO

REVIEW OF LITERATURE

2.0 Introduction

In this chapter, key terminologies are defined and a general overview of the existing literature regarding the epidemiology of nosocomial infections, aetiology and prevalence of nosocomial infections, mode of transmitting nosocomial pathogens, types of nosocomial infections and factors influencing the development of nosocomial infections. Infection prevention and control programmes and the impact and management of nosocomial infections are also brought to the fore. Also, empirical studies in the developing regions of the world including Ghana are reviewed accordingly. This is intended to help the researcher fully analyse and discuss the results of the study and juxtapose them with previous findings of other researchers.

2.1 Definition of nosocomial infections

Nosocomial infections emanate from "Nosocomial" originates from the Latin word for hospital known as "nosocomium" which refers to infections within the hospital setting that were not present nor incubating at the time of a patient's admission or a health worker's duty period at the hospital (Jenkins, 2017).

Hospital-acquired infections (HAI) or nosocomial infections are defined as an infection "acquired in the hospital by a patient who was admitted for a reason other than that infection. An infection occurring in a patient in a hospital or other healthcare facility in whom the infection was not present or incubating at the time of admission. This includes infections acquired in the hospital but appearing after discharge and also occupational infections among the staff of the facility" (World Health Organization, 2002). The focus of

this research relates to the latter part of the definition dealing with infections among staff that are acquired through patients within the hospital or from the hospital environment.

2.2 Epidemiology of nosocomial infections

Nosocomial infections affect a great number of patients worldwide. According to the WHO, approximately 15% of all hospitalized patients suffer from these infections. These infections are responsible for 4%-56% of all death causes in new-borns (neonates) with an incidence rate of 75% in Sub-Saharan Africa and South-East Asia. In resource-poor settings such as most countries in Africa including Ghana, rates of infection may exceed 20% (Pittet, 2005; WHO, 2008), but available data is scanty in specific country estimates.

The WHO, however, provides some guidance as to which types of nosocomial infections occur most frequently in developing countries. Surgical Site Infections, Urinary Tract Infections and Lower Respiratory (pneumonia) infections were the leading types reported.

The WHO study (2008) and others reveal that the highest prevalence of nosocomial infections occurs in intensive care units and in acute surgical and orthopaedic wards not surprisingly. Infection rates are higher among patients with increased susceptibility because of old age, underlying disease or chemotherapy. This position differs somewhat from studies reported in the United States for example, where urinary and respiratory tract infections are highest and followed by surgical site infections. Nosocomial infections may be considered either as endemic or epidemic. Epidemic infections occur during outbreaks when an unusual increase above the baseline of a specific infection or infecting organism occurs.

2.3 Aetiology of nosocomial infections

Studies have revealed that nosocomial pathogens come from contact with staff (cross-examination), from patients own body (endogenous flora) while others come from contaminated needles, the environment and interments (exogenous flora), (Jain et al., 2011; Sabra et al., 2012). According to the CDC, diagnosis of infection is made on the basis of a combination of clinical findings and the results of laboratory studies or another diagnostic testing.

Four main groups of nosocomial infections have been identified in recent times. These include Central Line-Associated Bloodstream Infections (CLABSI), Catheter-Associated Urinary Tract Infections (CAUTI), Surgical Site Infections (SSI) and Ventilator-Associated Pneumonia (VAP). These infectious agents vary among healthcare facilities and even within a single institution. Hence, knowledge of trends in the pathogens responsible for nosocomial infections is important in determining appropriate empirical therapy.

2.4 Central Line-Associated Bloodstream Infections (CLABSI).

A central line (also known as a central venous catheter) refers to a catheter (tube) that medical officers place in large veins in the neck, chest or groin to give medication or fluids or collect blood for medical testing (CDC, 2011). A central line bloodstream infection (CLABSI) occurs when bacteria or other germs come into contact with the patient's central line and then enter their bloodstream. These infections are serious but can often be successfully treated. This classification of nosocomial infections is a deadly infection with mortality rates of 12%–25%. Although there is a decrease in CLABSI over the years in United State hospitals, more cases of CLABSI are still reported especially in Intensive Care Unit (ICU) and acute facilities wards each year (CDC, 2016). Health care workers,

patients and families can play an active role in CLABSI prevention. The cost of these infections is the highest among nosocomial infections as the cost of intravascular device-related bloodstream infections have increased with the rise in cases caused by resistant bacteria. Most of these infections can be prevented with the correct insertion, cleaning, and care practice of a central line.

2.5 Catheter-Associated Urinary Tract Infections (CAUTI)

A urinary tract infection (UTI) denotes infections involving any part of the urinary system, including the urethra, ureters, bladder and kidney. UTIs are the most common type of healthcare-associated infections reported. Statistics have shown that 75% of UTI's acquired in hospitals are associated with a urinary catheter, which involves the insertion of a tube into the bladder through the urethra to drain urine (CDC, 2016). CAUTI's are caused by internal native flora of patients. These catheters serve as a medium of entry of bacteria when placed inside. CAUTI's can further develop to complications such as epididymitis, prostatitis and orchitis in males and cystitis, meningitis and pyelonephritis in box sexes (CDC, 2016).

2.6 Surgical Site Infections (SSI)

These are post-surgery infections that occur in the part of the body where the surgery took place. Surgical site infections can sometimes be superficial infections involving the skin only. They are a very common type of nosocomial infections mainly caused by Staphylococcus aureus resulting in prolonged hospitalization and risk of death. Other surgical site infections are more serious and can involve tissues under the skin, organs or implanted material. Also, the duration of the surgical procedure has been cited as the most important contributor to the development of SSI's in humans with rates almost doubling

with every hour the patient spends in surgery (Beal et al., 2000). SSI's can be further described as superficial incisional, deep incisional and organ or space infections (CDC, 2016). One study showed that mortality associated with SSI with S. aureus infection was higher for the elderly population than for younger people. Length of stay and actual costs were similarly elevated (McGarry et al., 2004).

2.7 Ventilator-Associated Pneumonia (VAP)

This is a type of hospital-acquired pneumonia that occurs more than 48 hours after endotracheal intubation. It is a lung infection that usually develops in persons who are on ventilators. A ventilator is a machine that is used to help a patient breathe by giving oxygen through a tube placed in a patient's mouth or nose, or through a hole in the front of the neck. Infections may occur if germs enter through the tube and get into the patient's lungs. With a high prevalence, 86% of nosocomial pneumonia is associated with ventilation (Craven & Hjalmarson, 2010). Approximately 25% to 60% of deaths for patients with nosocomial infection can be attributed to VAP. Also, the costs in terms of economics are the highest for nosocomial infections (Micek et al., 2007). Common symptoms of VAP include fever, bronchial sounds and leucopenia (Koenig &Truwit, 2006).

2.8 Determinants of HAI's

Risk factors determining hospital-acquired infections depends upon the condition of the environment in which health care is delivered, the susceptibility and condition of the patient and the lack of awareness of the prevailing infections among staff and health care providers.

2.9 Environment Susceptibility

Inadequate waste disposal and poor hygienic conditions within the health care settings put health care workers at risk of infection. Other risks pertain to prolonged stay in the intensive care unit and the health facility in general. Consideration must be given to the prevention of infection with environmental pathogens such as fungi (e.g. Aspergillus), bacteria (e.g. Legionella species), or viruses (e.g. Varicella). The CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC) has over the years revised the guidelines relating to environmental factors for infections. The report provides clear recommendations for infection control measures according to several environment-related categories, including air (normal ventilation and filtration, as well as handling during construction or repair), water, (water supply systems, ice machines, hydrotherapy tanks and pools) and environmental services such as laundry and housekeeping (Sehulster & Chinn, 2003).

2.10 Education

Improper use of infection techniques, inappropriate use of invasive devices (catheters), poor knowledge of basic infection control measures and inadequate control policies. These risk factors are associated with poverty, understaffed health care workers, inadequate healthcare facilities and supply of equipment and the lack of financial support in low-income countries.

2.11 Reservoirs and transmission

Healthcare workers are exposed to a variety of microorganisms during working periods in healthcare facilities. Traditionally, it has been believed that most nosocomial infections, with a few exceptions such as tuberculosis and aspergillus and viruses like respiratory

syncytial virus (RSV), influenza, rhinovirus and corona viruses, are not spread through the air. While a large percentage of HAIs are spread through surface contact (such as hands) or by catheters, intravenous (IV) lines or surgical incisions, many nosocomial infections can also spread through the air (Abdeljalil, 2014).

Bacteria belonging to the endogenous flora of patients can cause infections if they are transferred to tissue wound or surgical site. Transmission of pathogens occurs during the treatment through direct contacts with the patients body fluids, saliva, hands, etc. and by the staff through direct contact or other environmental sources (food, water, other water bodies).

The healthcare environment which contains food, water and equipment also can be a source of transmission for pathogens living within this setting.

2.12 Risk factors

The dominant factor for the acquisition of nosocomial infections has been documented as the length of stay within a hospital facility. These infections are boosted by numerous factors which may be intrinsic (factors inherent in persons such as age, disrupters of the natural barrier such as lesions/injury, other underlying diseases, chemotherapy) or extrinsic (factors which reside in the healthcare worker and practices of an individual caregiver), (Akingbade et al., 2013; Jose et al., 2014). Other prevailing conditions like the air conditioning systems, contaminated water systems, invasive devices as well as resistance to antimicrobial agents put health workers at risk (Samuel et al., 2010).

2.13 Infection prevention and control

In tackling nosocomial infections, prevention is the best approach to manage these infections. HAI's can thus be addressed by considering the interaction of pathogens and people within the context of clinical practice in the place where healthcare is delivered (Jenkins, 2017).

The benefit of IPC in health delivery and patient satisfaction ensures less expenditure on health care within any country. According to the WHO (2002), it is a policy for every country to achieve at least 70% compliance with IPC practices.

Unhygienic environment, where air, water and food can get contaminated and transmitted, serve as the best source for the pathogenic organism to prevail. Therefore, policies must be put in place to ensure the use of cleaning agents on floors, walls, windows, beds, toilets and baths among other medical devices. Airborne bacterial contamination can be eliminated with proper ventilation and regular filtering of air. When these ventilation systems are checked regularly in the general wards, operating theatres and ICUs and also maintained and documented, an infection can be minimized.

It is the duty of healthcare professionals to take a role in infection control. Adherence to personal hygiene and standard operating procedures (SOP's) is necessary for every staff to hold in earnest. Hand decontamination is required with proper hand disinfectants after being in contact with infected patients. Use of masks, gloves head covers or an appropriate uniform is necessary for healthcare delivery. Safe injection practices and sterilised equipment should be used (Ducel, 2002).

2.14 Bottlenecks in the management of nosocomial infections

Research has shown that an effective infection control programme is important in reducing morbidity, mortality and cost resulting from hospital-acquired infections. However, other factors inhibit infection control activities in developing countries. These factors rest on the inadequate infection programmes and in some cases, the burden of understaffing, enhanced by limited infrastructures such as quarantine rooms/laboratories for isolation and essential materials such as gloves, disinfectants and masks. Regular hand washing practice, which must be a norm in every health care facility, are not followed through in developing countries as basic amenities such as running water are not widespread which makes the hand washing policy a difficult programme to effect (Nejad et al., 2011).

Many bodies and agencies are responsible for the routine monitoring of hospital-acquired infections. Key among them is the National Nosocomial Infections Surveillance (NNIS) in the USA, the Centre for Disease Control and other local units and individual hospital infection control committees. In developing countries, the programmes of these bodies are poorly managed and to some extent, interventions are not carried out. The aforementioned defects in management and agencies may be a contributory factor to the increasing rate of nosocomial infections reported (Samuel et al., 2010).

2.14 Related Studies

Many studies have been conducted on nosocomial infections around the world. These have looked at the control and management in India (Ross & Vasntha, 2014), prevalence in USA (Weinstein, 1998), India (Nazir & Kadri, 2014), Iran (Farzianpour et al., 2014), determinants in Netherlands (Geubbels et al., 2005), Switzerland (Hugonnet et al., 2006), Italy (Auriti et al., 2010), Europe (Tabah et al., 2012), risk factors in China (Zhou et al., 2018) among other facets of hospital-acquired infections in varied locations.

Within the African space, these infections have also been rigorously studied as most of the disturbing prevalence rates emanate from this region. Studies such as Malangu & Legothoane (2013) in South Africa observed risk factors and prevalence of nosocomial infections which revealed staff nurses as the most infected. They were also mainly infected with tuberculosis and thus the study recommended that infection control measures should be implemented in a system-wide fashion rather than focussing on hospital wards and front-line healthcare workers, nursing and other medical staff members.

Mbim et al., (2016) on the other hand studied the incidence of nosocomial infections in 13 Sub Saharan African countries and their effects. Figures from the study depict endemic rates of the infections varying between 1.6% to 45.8% with worrying incidence densities. The frightening prevalence rates resulted in a 3.4% to 10.9% and is higher than that of hospital-associated infections which often result in mortality in the study sites.

Shannon (2016) studied the spread of the Ebola virus disease (EVD) infection among healthcare workers in Montserrado County, Liberia, where out of 378 cases, 192 deaths occurred among health workers representing 51% of total cases. Again, health authorities at all levels must ensure heightened vigilance and improved occupational safety measures, especially in the health facilities to prevent and manage not only EVD infection among health care workers.

All the aforementioned scenarios within the African milieu give credence to the fact that hospital-acquired infections have crept deeply into the dark parts of its health care sectors causing a lot more harm than the healthcare system can manage. It is thus fair to put more emphasis on the prevalence and determinants of such infections while stepping up the prevention control mechanisms to effectively manage this menace.

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CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Study Design

A hospital-based cross-sectional survey was carried out between May and June 2019 (2 months) among healthcare workers at 37 Military Hospital, Accra, Ghana.

3.2 Study Location

The 37 Military Hospital is a specialist military-based Hospital located in the South-Eastern part of Greater Accra Region of Ghana. It is located close to the Jubilee House, i.e. the seat of government, at the intersection of the Liberation road and Giffard road. It is the largest Military Hospital in Ghana supported by various Medical Reception Stations (MRSs) in the various military garrisons across the country. It serves as one of the major referral hospitals in Ghana. Initially constructed in 1941 and re-designed in 1956, the 37 Military Hospital has grown to become the second-largest medical facility in Accra.

The primary objective of the facility is to provide quality healthcare to service personnel and their families, civilian employees of the Ministry of Defence and their families and ex-service personnel as well as the general public. The hospital again serves as the National Disaster and Emergency Response health facility.

The hospital has 14 out-patient departments and 10 in-patient departments (wards and emergencies). It also has an estimated staff capacity of about 3,500 comprising both military and civilian employees. It has a bed capacity of about 500 beds, an estimated annual Outpatient attendance of about 26,486 visits and an annual Inpatient attendance of about 13,208. About 85% of the annual attendance is from the general public.

The 37 Military Hospital is also a Teaching Hospital and is made up of several departments including Dental, Surgical, Medical, Gynaecology, Paediatrics, Obstetrics, Pathology, Pharmacy, Physiotherapy, Public Health and Radiology. It also has training institutions such as the Nursing and Midwifery Training School (NMTC), School of Anaesthesia, Emergency Medical Technicians School and a Post Graduate Medical College.

The hospital is now a United Nations Level IV Military Medical facility which provides healthcare for UN soldiers and workers from conflict areas in the sub-region.

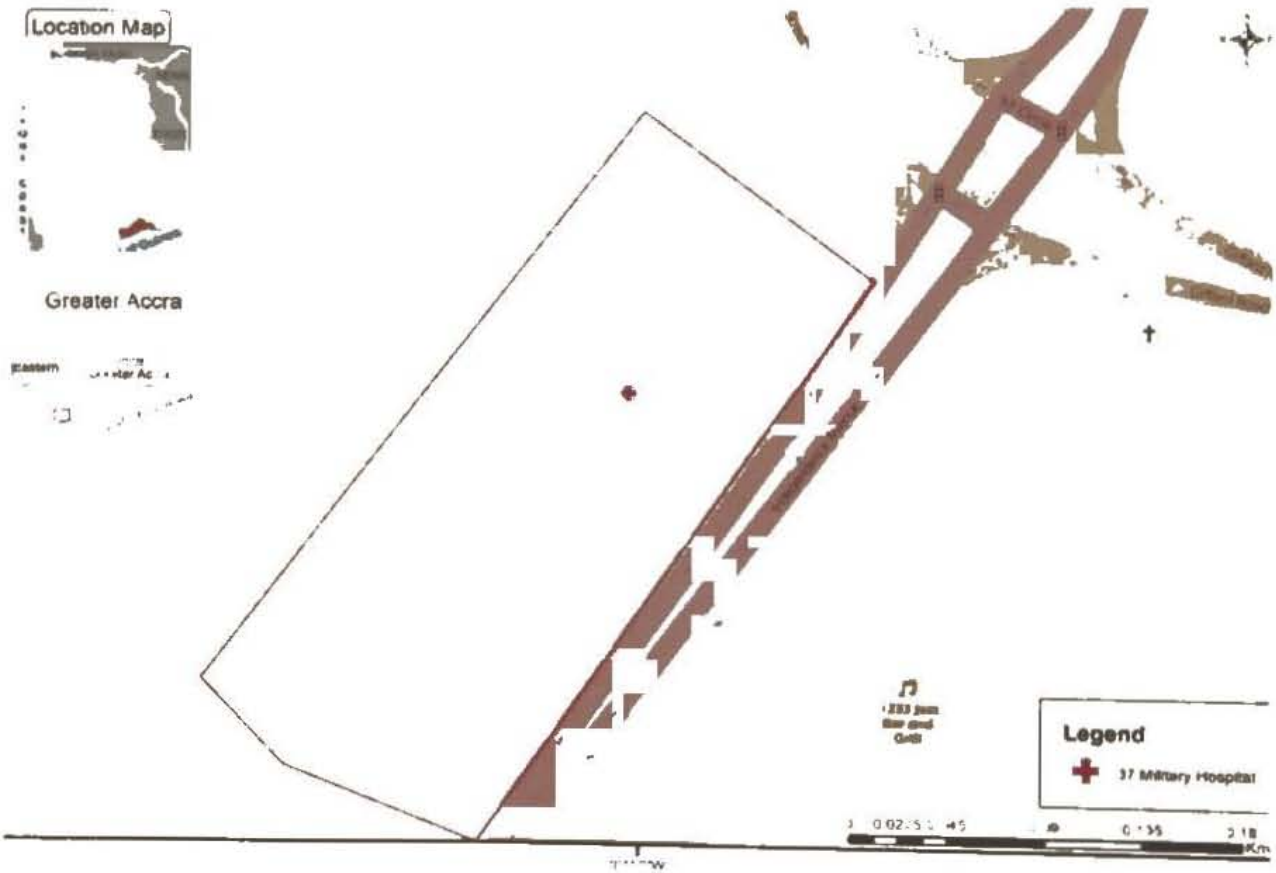

Figure 3.1: Map of Study Area
Source: (CERSGIS, 2019)

3.3 Study population

The study population consists of healthcare workers in various departments. These span across Doctors, Physician, Medical Assistants, Nurses, Ward Assistants, Laboratory staff, Radiology staff, Dental Technicians, Public Health staff, Laundry staff, the staff of the Central Sterilization Services Department (CSSD) and Pharmacy staff at the 37 Military Hospital who voluntarily took part in the study. The study also targeted both healthcare workers who work during the day and those who run the night shift to cover the entire sample. In this study, two hundred and seventy (270) healthcare workers were consented to take part in the study.

3.4 Sample

Due to the inability to cover a large number of populations, researchers normally draw a portion of it for their study.

3.4.1 Sample Size

A total sample size of two hundred and seventy (270) healthcare workers were randomly selected using a stratified random sampling technique. The total population of health workers at the facility was divided into different subgroups from which final respondents were randomly selected from each subgroup or strata. This sample size was calculated using the pi - face sample size calculator. Since the actual prevalence of nosocomial infections ranged between 15-25% (Scherbaum et al., 2014; Kahn et al., 2017) a median prevalence level of 20% was estimated and used in the study. This is because healthcare workers are knowledgeable and may be aware of the occurrences of HAI's and may adopt measures to minimize its effects. Therefore, the study presents an average prevalence of nosocomial infections (20%) which was used for the calculation of the sample size.

Using the formula by (Cochran & Wiley, 1977)

$n_0 \quad Z^2pq/d^2$

Where

n_0 = estimated sample size

Z = confidence level (95% level of confidence = 1.96)

p = the probability of contracting nosocomial infections = 0.20

q = 1 - p = which is the probability of not contracting nosocomial infections

= 1 – 0.20 = 0.8

d = 0.05 as the acceptable margin of error. Therefore

$$n_0 = \frac{(1.96)^2(0.20)(0.8)}{(0.05)^2} = 245$$

The total number of healthcare workers in the hospital who were considered in the study was 1,116.

Therefore, the sample size for the study was n.

$$n = \frac{\frac{n_0}{1+(n_0-1)}}{N}$$

Where n = sample size

N total population

$n_0 = 245$

Therefore,

$$n = \frac{\frac{245}{1+(245-1)}}{1095} = 245$$

Putting into consideration a 10% non-response rate due to the busy work schedule of healthcare workers at the study site, the minimum sample size for the study was finally arrived at 270 health care workers (Israel, 2013).

3.5 Sampling Method

From the population, 24% of each category was proportionally selected to form a stratum. After the creation of the strata of health care workers, Simple Random Sampling was employed to select respondents from these strata in this study. In each department, the duty roaster of all health care workers was requested from the hospital headquarters and made available to the research team. Natural numbers were allocated to all the personnel on the list. A random number generator was used to select the health care workers proportionally for the study separately for each department as shown in table 3.1.

Table 3.1: Proportionate distribution of healthcare workers in each department.

Srl	Job Category	Number available in dept (%)	Number to be selected 24% of Strata
1.	Nurses	333(30)	80
2.	Laboratory Staff	58(5.2)	14
3	Pharmacy Staff	65(5.9)	16
4.	Doctors/Physician Assistants/Student Doctors	147(13.2)	35
5.	Ward Assistants	234(21.1)	56
6.	Public Health staff	71(6.4)	17
7.	Dental technicians/staff	46(4.1)	11
8	Radiology Staff	45(4.0)	11
9.	Laundry staff	56(5)	14
8.	CSSDstaff	55(5)	13
	Total	N= 1,110(100)	n= 267 + 3 from dominant category=270

3.6 Study Variables

3.6.1 Dependent variable

The dependent variable for the study is the incidence of Hospital Acquired Infections.

3.6.2 Independent variables

The independent variables include; Human and Socio-Demographic factors such as age, sex, educational level, income level and job category. Management factors such as the safety culture, the use of Personal Protective Equipment and procedural behaviours fall under this category. Finally, environmental factors such as the level of exposure, working conditions and ergonomics shall be manipulated.

3.7 Inclusion criteria

The study participants were healthcare workers who belonged to the following professions: Doctors, Physician/Medical Assistants, Nurses, Ward Assistants, Laboratory staff, Radiology staff, Dental Technicians, Public Health staff and Pharmacy staff at the 37 Military Hospital who were willing to voluntarily take part in the study.

3.8 Exclusion criteria

The study excluded all other personnel who did not fall within the mentioned professions and all who may belong to the source population but did not wish to participate or follow the study protocols. The study also excluded some healthcare workers in the Accident and Emergency department for reason of inability to follow study protocol due to the nature of their work.

3.9 Data Collection

3.9.1 Data Collection Tool

A questionnaire having five (5) parts found in Appendix 1 was administered to collect responses on socio-demography, knowledge level on nosocomial infections, determinants and potential causes of nosocomial infections, the frequency of nosocomial infections and performance of workplace safety procedures for staff.

The first part of the questionnaire was used to collect data on Socio-demographic factors age, sex, level of education, medical profession type, rank and the years of health service. The second part assessed the participant's knowledge on nosocomial infections where questions were asked to find out whether health workers were aware of these infections and how adept they were in the types and sources of infections. The third and fourth part of the questionnaire was used to determine the factors that were responsible for hospital-acquired infections and also measure the frequency of infections among health workers on a weekly, monthly, bi-annually and annually.

The fifth part of the questionnaire sought to evaluate the safety procedures put in place by the management of the hospital for staff. This is aimed to gather data on the provision of personal protective equipment, the regularity of safety audits, hospital surveillance, the provision and use of post-exposure prophylaxis (PEP) and the accepted and agreed procedural behaviours of staff at the health facility (Biboh, 2012; Ibrahim & Elshafie, 2016).

3.10 Quality Control

Research assistants were trained to help in the collection of data. Data extraction forms and questionnaires were critically examined at the end of each day. Data handled by the research assistants were cross-checked for consistency and completeness. Research

assistants also cross-checked data gathered by the principal investigator. The questionnaire was pretested at the Legon Hospital, to ascertain the average time needed to complete the questionnaire, check for inconsistencies and the general understanding of questions by prospective participants.

3.11 Data Processing and Analysis

Prior to the onset of data collection, research assistants were trained on the administration of questionnaires to the study population and also address issues pertaining to and arising from the questionnaires. Completed questionnaires were cleaned and data was coded and entered into Microsoft Excel spreadsheet. Data was then processed with SPSS v25 for descriptive statistical analysis including frequencies, crosstabs and chi-square analysis.

3.12 Ethical Consideration

Ethical approval to conduct the study was obtained from the 37 Military Hospital Institutional Review Board, through the School of Public Health, University of Ghana. This is found in Appendix 3.

Written consent of all respondents found in Appendix 2 was also sought before including them as participants in the study. Privacy and confidentiality were maintained throughout. In ensuring confidentiality, the questionnaire was coded prior to its administration instead of using names. In ensuring privacy, data collected was stored in a password-protected electronic storage device with access limited to only the principal investigator and the research supervisor.

Participation in the study was completely voluntary. There was no consequence of refusal to participate in the study. The refusal to answer any question bore no consequence. Withdrawal from the study at any point in time was allowed without any consequence for doing so.

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter presents the results of the analyses conducted in achieving the objectives of the study. It is organized as follows: Socio-Demographic characteristics of respondents, the knowledge level of healthcare providers on infection prevention control measures (IPC) of nosocomial infections, factors responsible for HAI's, frequency of infection among healthcare providers and the evaluation of the safety procedures on HAI's for staff.

4.2 Socio-Demographic Characteristics of Respondents

This section describes the background characteristics of the participants. A total of 270 healthcare workers were selected for the study. The major socio-demographic characteristics of respondents such as sex, age, marital status, educational level, nursing profession type, rank, number of years in service are discussed in table 4.1. The mean age of the health workers in the study was 34.5 years (SD±10) with an age range of 20 years to 49 years.

The study shows that the largest category of the respondents were in the 30-39 age groups (60.0%). This was followed by health workers in the 20-29 age categories (38.1%). The least category of respondents was within the 40-49 age bracket constituting 1.9% of the entire study population. The study shows that the majority of respondents were males (57.0%) as against the 43.0% being females.

The nature of the health care occupation requires advance education achievement hence, all the respondents attained at least Certificate or Diploma levels of education with the highest level being the post-graduate qualification. Almost half of the entire population

(49.6%) had attained first degree qualifications in health-related areas. Healthcare workers with either Certificate or Diploma's made up 25.2% of the population. Other respondents with specific MBChB qualifications consist of 19.3% of the total population. The remaining 5.9% of the respondents had attained post-graduate education qualification in health.

The profession of respondents presents similar proportions as the educational level in the aforementioned results. The medical doctors, dentists and physician assistants constituted the major profession of respondents with 65.2% of the total population. The nurses with degrees, diplomas and certificate followed with 15.6% of total respondents. The remaining professions were public health staff, ward assistants, laboratory staff, radiology staff, CSSD, pharmacy staff and casual workers such as cleaners in smaller proportions. In terms of rank within the hospital set up, the majority (58.9%) of the respondents held junior staff ranks with 39.3% of them occupied the senior staff ranks leaving the remaining 1.9 % being the principal staff of the hospital.

Years of service within the health sector among the respondents indicated that the largest proportion of them had worked less than 5 years (44.4%). Respondents who had worked between 5 and 9 years represented 30.7% of total population. The remaining respondents had worked between 10 and 20 years in health service delivery.

Concerning the number of working hours of respondents, the study found out that most of the health workers did an average of 50 hours per week including overtime. Specifically, 28.1% of respondents worked a total of 50-60 hours weekly. The least working hours were reported by 2.6% of respondents who indicated working between 10-20 hours per week.

Table 4.1: Socio-Demographic Characteristics of health workers

Variable name	Number	Valid
Gender		
Male	154	57.0
Female	116	43.0
Age (years)		
20-29	103	38.1
30-39	162	60.0
40-49	5	1.9
Education		
SHS/Cert/Diploma	68	25.2
1st Degree	134	49.6
Masters	16	5.9
Medical Doctor	52	19.3
Profession		
MD/Dentist/PA	176	65.2
Nurse	42	15.6
Public Health Staff	26	9.6
Radiology Staff	7	2.6
CSSD staff	15	5.6
Casual staff	4	1.5
Rank/Position		
Principal Staff	5	1.9
Senior Staff	106	39.3
Junior Staff	159	58.9
Years of health service		
- 5	120	44.4
5-9	83	30.7
10-14	52	19.3
15-20	15	5.6
Weekly working Hours		
10-20	7	2.6
21-30	66	24.4
31-40	59	21.9
41-50	24	8.9
51-60	76	28.1
>60	38	24.4

Source: Fieldwork, 2019.

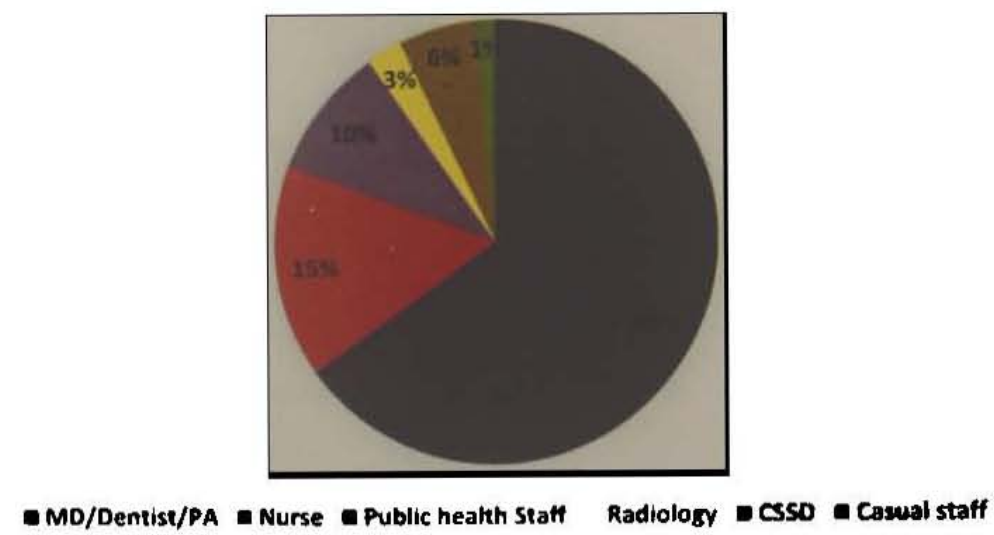

Figure 4.1: Profession of respondents

The various distinct professions of the respondents are displayed in figure 4.1.

4.3 Knowledge level of healthcare providers on HAI's and infection prevention and control (IPC) measures.

The study initially sought to find out the level of knowledge of the health workers on hospital-acquired infections and also find out information on the prevention and control of such infections. The results are categorized in table 4.2. and 4.3 respectively

Table 4.2: Knowledge Level on Hospital Acquired Infections

Variable name	Number	Valid
Awareness of HAIs		
Yes	253	93.7
No	17	6.3
Common HAI among staff		
CUATI	47	17.4
SSI	51	18.9
VAP	29	10.7
CLABSI	10	3.7
Skin Infections	133	49.3
Most Susceptible staff to HAI		
MD/Dentist/PA	26	9.6
CSSD staff	10	3.7
Casual staff	12	4.4
Nurse	189	70.0
Public Health Staff	19	7.0
Laboratory Staff	14	5.2
Most important source of HAI		
Inpatients	166	61.5
Outpatients	14	5.2
Medical Doctors	14	5.2
Nurses	10	3.7
Caregivers/attendants	25	9.3
Visitors	12	4.4
Casual staff	29	10.7

Source: Fieldwork, 2019.
CAUTI: Catheter-Associated Urinary Tract Infections
CLABSI: Central Line-Associated Bloodstream Infections
SSI: Surgical Site Infections
VAP: Ventilator-Associated Pneumonia

Table 4.2 presents an overview of the level of knowledge of hospital-acquired infections among respondents. Overwhelmingly, almost (93.7%) all the health workers interviews indicated that they were very much aware of hospital-acquired infections in general.

In relation to the common HAI's that affect staff easily at the hospital, almost half (49.3%) of respondents asserted to skin infections. This was followed by surgical site infections (18.9%). Catheter-Associated Urinary Tract Infections and Ventilator-associated

pneumonia infections also consisted of (28.1%) of total responses. The least common type of HAI's that affect staff at the hospital was the Central Line-Associated Bloodstream Infections (3.7%).

The study found out that nurses were the most susceptible staff to hospital-acquired infections. This was asserted by 70.0% of the total population. This was followed by the Medical doctors and their assistants representing 9.6% of respondents. The remaining 20.4% was attributed to the laboratory staff, public health staff, CSSD staff and casual workers of the hospital.

Regarding the most important source or reservoir of HAI's, 61.5% of respondents asserted emphatically that patients who lived in the hospital while undergoing treatment are the most potential source. Respondents indicated that caregivers and attendants were also important sources of HAI. A total of 9.3% health workers asserted to this. Other sources respondents indicated were among casual workers (10.7%), medical doctors and outpatients (10.4) and visitors (4.4%).

Table 4.3: Knowledge of Infection prevention control (IPC) measures

Variable name	Number	Valid
Awareness of standard isolation precautions		
Yes	198	73.3
No	72	26.7
Most effective method to prevent HAI		
Proper hand washing	211	78.1
Wearing PPE	24	8.9
Regular vaccination of staff	12	4.4
Isolation of infected patients	4	1.5
Educating staff, patients & families	12	4.4
Visitor management	7	2.6
Most infectious product from patients		
Blood	224	83.0
Vomitus	12	4.4
Faeces	14	5.2
Sweat	20	7.4
Awareness of nosocomial infection monitoring programme at Facility		
Yes	43	15.9
No	227	84.1
Which Programme		
IPC unit	33	12.2
Monthly IPC workshop	4	1.5
Using PPE's	6	2.2
Practice the six-step handwash technique		
Yes	265	98.1
No	5	1.9

Source: Fieldwork, 2019.

Table 4.3 shows results on awareness of nosocomial infection control measures. The majority (73.3%) of respondents were well aware of the standard isolation precautions within their health facility. The remaining 26.7% were oblivious of any such arrangement on isolation in their facility.

Majority of the respondents alluded to the fact that, hand washing was the most effective method of preventing nosocomial infections. An overwhelming 78.1% of respondents asserted to this. This was followed by wearing of protective clothing (8.9%) such as

gowns, face masks, goggles, gloves among other pertinent protective gears. The remaining respondents asserted to regular vaccination of health staff (4.4%), educating health staff, patients and families (4.4%), management of visitors at the hospitals (2.6%) and the isolation or cohorting of infected patients (1.5%) as other measures to prevent HAI's. the study sought to find out which products from patients were deemed infectious by the health staff in a bid to understand their IPC programmes and measures. Over 80% of respondents indicated that blood from patients was the most infectious in the hospital setting. These include blood from the theatre, wards, cuts and abrasions etc. Respondents indicated that sweat (7.4%) and faecal matter (5.2%) from patients were also infectious. The least product from patients that respondents considered infectious was vomitus (4.4%).

The study again found out that majority of the health workers were not aware of any nosocomial infection monitoring programme in their medical facility. This was alluded to by 84% of the total respondents. On the other hand, 43 health workers representing 15.9% of total respondents indicated being abreast with some nosocomial infection monitoring programmes at their facility. Some of these infection monitoring programmes respondents indicated include monthly department IPC workshops (12.2), IPC workshops at the in-service training centre (1.5%) and the use of personal protective equipment (2.2%).

The study again found out that almost all the health workers were aware and practised the 6-step hand washing technique when carrying out their various duties at work. A preponderance of 98.1% of respondents affirmed this stance while only 5 health staff representing 1.9% was not aware and did not practice this hygienic technique.

Table 4.4: Chi-square analysis of Background Characteristics and Knowledge level of Healthcare workers.

Variable name	Aware of HAI			Aware of Stand. Isolation Hospital		
	Yes	No	χ^2 (p-value)	Yes	No	χ^2 (p-value)
Gender						
Male	142	12	1.360	115	39	0.330
Female	111	5	(0.244)	83	33	(0.566)
Age (years)						
20-29	96	7	0.384	80	23	3.871
30-39	152	10	(0.825)	113	49	(0.144)
40-49	5	0		5	0	
Education						
SHS/Cert/Diploma	68	12	8.221	39	29	22.625
1st Degree	122	0	**(0.042)***	96	38	**(0.000)***
Masters	16	5		16	0	
Medical Doctor	47	17		47	5	
Profession						
MD/Dentist/PA	171	5	111.001	145	31	67.396
Nurse	15	0	**(0.000)***	32	10	**(0.000)***
Public Health Staff	4	0		14	14	
Radiology Staff	37	5		7	0	
CSSD staff	26	0		0	15	
Casual staff	0	7		0	4	
Rank/Position						
Principal Staff	5	0	0.215	0	5	21.731
Senior Staff	96	10	**(0.043)***	89	17	**(0.000)***
Junior Staff	152	7		109	50	
Years of health service						
<5	113	7	22.133	101	19	26.280
5-9	78	5	**(0.000)***	51	32	**(0.000)***
10-14	52	0		41	11	
15-20	10	5		5	72	
Weekly working Hours						
10-20	0	7	129.311	7	0	39.769
20-30	59	0	**(0.000)***	44	22	**(0.000)***
30-40	19	5		36	23	
40-50	76	0		9	15	
50-60	33	5		69	7	
>60	66	0		33	5	

Source: Fieldwork, 2019.
Significant level (95%) $p<0.05$ * significant at 0.05

From table 4.4, a chi-square analysis was done to determine the associations between respondent's socio-demographic characteristics and their knowledge level of hospital-acquired infections.

Respondent age categories above 40 years were all aware and abreast of nosocomial infections and incidence in their various facilities. However, some very few respondents in the 30-39 age categories were unaware of nosocomial infections while the remaining 83.8% were aware of nosocomial infections. Subsequently, the 20-29 age category also had 6.8% of respondents who were oblivious of nosocomial infections. The chi-square tests did not show significance among the knowledge level and the age groups.

Regarding education level, respondents with the medical degrees (26.6%) were oblivious of nosocomial infections in the medical facility while health workers with the first degree qualification alone were fully aware of HAI's in their facility. The chi-square tests show a significance of ($p=0.042$) among the knowledge level and the education of respondents.

The results also indicate that all respondents of principal staff status were fully aware of HAI's while the lower-ranked staff were not fully aware of HAI's. The chi-square tests show a significance of ($p= 0.043$) among the knowledge level and the rank/position of respondents.

From the results, associations between the particular profession of respondents, years of work in the health service and the knowledge level of HAI's yielded significant results at ($p\geq 0.01$). Associations between health workers hours of work per week and their awareness of nosocomial infections was found to be statistically significant ($p\geq 0.01$).

Regarding the awareness and practice of standard isolation precautions within respondent's health facilities, the study found out that there was no statistical significance between gender ($p= 0.566$) and the various age categories ($p= 0.144$). However, the results

show that respondents education level ($p \geq 0.01$), profession type ($p \geq 0.01$), rank or position at work ($p \geq 0.01$), years of work in the health service ($p \geq 0.01$), and number of working hours per week ($p \geq 0.01$) have significant effect on the knowledge of awareness and practice of standard isolation precautions.

4.4 Items and equipment responsible for the spread of HAIs

The research sough to test the knowledge of respondents concerning factors responsible for the spread of hospital-acquired infections. Selected channels and behaviour were itemized and presented to the health workers, out of which they were to determine those that led to a possible cause and spread of HAI's. The results were analysed based on the total counts from the individual item case and from the overall items cases. This is presented in table 4.5 to 4.7

Table 4.5: Channels for the spread of Hospital Acquired Infections

Items that spread HAI's	Total count N	Percent of Single case (270)	Total Response case (100%)
White coat	183	67.8	11.7
thermometer	173	64.1	11.0
mattress	222	82.2	14.0
nurse uniforms	176	65.2	11.2
stethoscope	165	61.1	10.5
sphygmomanometer	164	60.7	10.5
wrist watch	160	59.3	10.2
chairs	162	60.0	10.3
bedside curtains	164	60.7	10.5
Total	1569	581.1	100.0

Source: Fieldwork, 2019

The study enquired form the health workers, which of the hospital equipment and accessories were most likely to spread nosocomial infections among the health staff within the hospitals. Overall, respondents indicated that hospital mattresses, the doctor's white coat and nurses' uniforms were the most likely to spread nosocomial infections amongst them. This was asserted by 14.0%, 11.7% and 11.2% of the total population cases respectively. Other hospital items such as the use of the thermometer, stethoscope, sphygmomanometer and sharing chairs were indicated by health workers as the avenues responsible for the spread of hospital-acquired infections. This was also indicated by 11.0%, 10.5%, 10.5 and 10.3 of the remaining population cases.

Table 4.6: Behaviour that spread of HAI's

Behaviours that spread HAI's	Total count N	Percent of Single case (270)	Total Response case (100%)
Coughing	270	100.0	20.1
Spitting	182	67.4	13.5
Sneezing	213	78.9	15.8
Talking	11	4.1	0.8
Hugging	113	41.9	8.4
Kissing	170	63.9	12.6
Hand shaking	186	68.9	13.8
Sharing straws	199	73 7	14.8
Total	1569	497.8	100.0

Concerning some behaviour of health workers that may cause the spread of nosocomial infections, the study found out that coughing (20.1%) and sneezing (15.8%) were the highest in that regard. Other respondents indicated that spitting around (13.5) and shakings hands with patients (13.8%) were probable mediums of spreading nosocomial infections among health workers. The least proportion of respondents indicated that even talking

(0.8%) was a potential act that could lead to the spread of infections as some droplets of saliva emanate from the mouth of people when talking at times and this may cause HAI's.

Table 4.7: HAI predisposing behaviours

Variable name	Number	Valid
Direct contact with patients during work		
Yes	244	90.4
No	26	9.6
Exposed to hygiene training		
Yes	270	100
Handwashing before and after patient encounter		
Yes	235	87.0
No	35	13.0

Source: Fieldwork, 2019.

The study again found out that the majority of health workers had direct contact with patients as they discharged their duties. This was asserted by 90.4% of total respondents. The remaining 9.6% indicated they did not have direct contact with patients in the health facility. The results thus suggest that most of the health workers are at high risk of contracting an infection during work as they encounter patients directly.

Again, all of the respondents indicated that they have received hygiene training in a bid to avert the spread of HAI's. since handwashing was very important to infection control, majority of the respondents (87.0%) admitted to washing their hands before and after every patient encounter. The remaining 13.0% of health workers confessed to not always practising handwashing prior to seeing patients and after.

4.5 The frequency of infection among healthcare providers

The study again sought to determine the incidence and frequency of hospital-acquired infections among workers in their health facility. The results are displayed in table 4.8.

Table 4.8: Incidence & Frequency of nosocomial infections

Variable name	Number	Valid
Contracted any HAI		
Yes	74	27.4
No	196	72.6
Frequency of HAI contraction		
N/A	196	72.6
Once	29	10.7
Twice	4	1.5
3-5 times	36	13.3
More than 5 times	5	1.9
Incidence of Last HAI contraction		
N/A	196	72.6
A month ago	4	1.5
Within 6 months	20	7.4
Within 1 year	15	5.6
Within 3 years	21	7.8
More than 3 years	14	5.2
Particular HAI contracted		
N/A	196	72.6
Upper Respiratory Infection	50	18.5
Skin infection	8	3.0
Urinary Tract Infection	6	2.2
Chicken pox	3	1.1
Cholera	4	1.5
Ear infection	2	1.1
Mode of contraction		
N/A	196	72.6
Direct contact with patient	26	9.6
Coughing/sneezing from patient	27	10.0
Sharing public washrooms	6	2.2
Direct contact with patient garments	8	3.0
Using hospital stethoscopes	3	1.1
During patient clean-up	4	1.5

Source: Fieldwork, 2019.

From the results, 27.4% of the total respondents admitted to ever contracting nosocomial infections. The majority of health workers interviewed, however, had never contracted a hospital-acquired infection. This group represented 72.6% of the total population. Out of the proportion of respondents that had ever contracted nosocomial infections, the majority indicated to getting it more than 3-5 separate instances (13.3%). Respondents who had recorded HAI's once in their years of service also represent 10.7% of the total population. The least group (1.5) recorded nosocomial infections on two occasions in their years of health service while those that had contracted infections over 5 times represented 1.9% of the population.

The particular kind of HAI that respondents had ever contracted was mainly that of upper respiratory tract infections (URTI's) of which influenza/flu was the most dominant. Others were catarrh and tonsillitis. These were reported by 18.5% of total respondents. Skin infections and urinary infections were also reported as the nosocomial infections contracted. They also constituted an assertion from 5.2% of total respondents. Consequently, lesser incidences of cholera, chickenpox and ear infection were all reported totalling 3.7% of total respondents.

The mode of contracting these infections was mainly through coughing, sneezing and having direct contact with patients at the hospital premises. A total of 19.6% of respondents asserted this. The remaining respondents indicate to contracting the infections from sharing public washrooms (UTI), using hospital stethoscopes, contact with patient garments, and cleaning up after patients (cholera). These were also asserted by 5.8% of total respondents

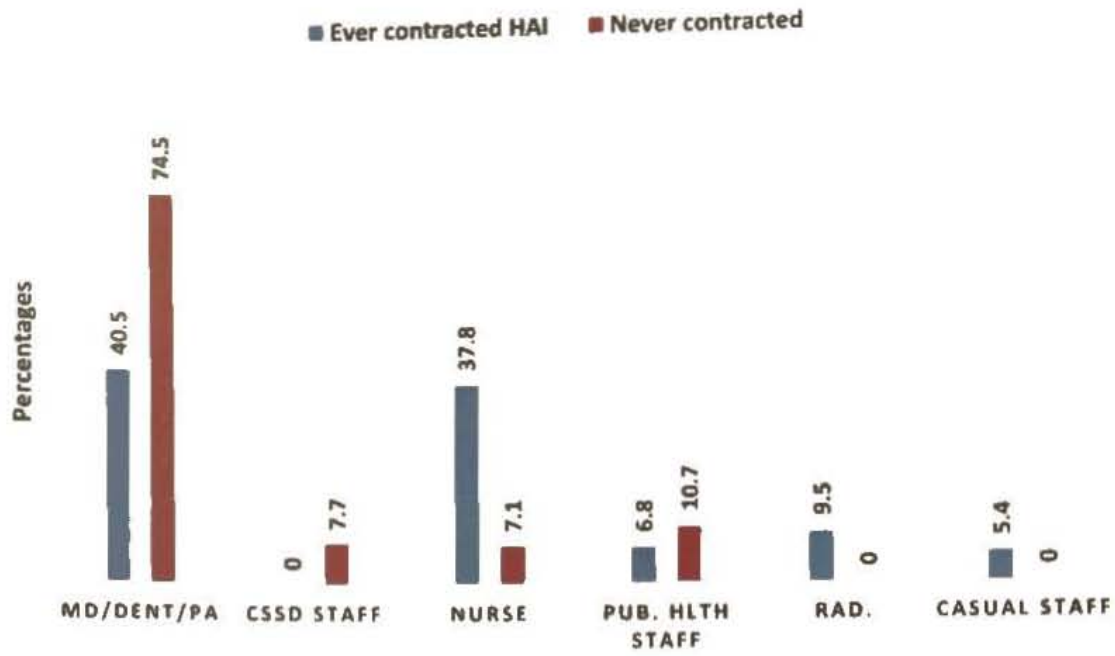

Figure 4.2: Profession type and HAI.

The study went further to cross-tabulate the various profession types against the contraction of HAI's. The results indicate that Medical doctors, Dentists and Physician assistants (40.5%) were the most medical practitioners to have been infected by nosocomial infections. Nurses followed closely with 37.7% of their population admitting to ever contracting nosocomial infections. On the other hand, no staff from the Central Sterile Services Department (CSSD) had ever contracted any HAI's.

4.6 Evaluation of workplace safety procedures on HAIs for staff.

The study finally sought to evaluate the performance of the safety procedures put in place to manage hospital-acquired infections. The results are displayed in table 4.9.

Table 4.9: Workplace safety measures for HAI's

Variable name	Number	Valid
HAI & IPC training recipient		
Yes	219	81.1
No	51	18.9
Satisfied with training		
N/A	51	18.9.
Yes	176	65.2
No	43	15.9
Facility has good IPC mgt.& practice		
Yes	146	54.1
No	124	45.9
View on workplace IPC		
N/A	146	54.1
Provision of education & training for staff	57	21.1
Provision of IPC logistics	47	17.4
Enhance supervision on IPC	11	4.1
Provision of more ventilation in wards	9	3.3
Work staff model of IPC practices		
Yes	237	87.8
No	33	12.2

Source: Fieldwork, 2019.

Management of hospital Acquired infections has many facets and the study explored salient aspects of them. The results from the research show that in order to ensure workplace safety, over 80% of respondents had received training on HAI and IPC protocols at their medical facility. The remaining 18.9% had not received any training on IPC from the health facility

Concerning as to whether respondents were satisfied with the nature and calibre of IPC training they received, more than half 65.2% attested to having had rewarding training sessions within the facility on IPC. The remaining 15.9% of respondents were not impressed by the training they received by the health facility.

The study results also found out that respondents are closely divided between rating their health facility as a having a good IPC management and practice system or otherwise. This was reflected as 54.1% attested to the better IPC management system against 45.9% of them not agreeing to the good measures put in place to ensure workplace safety and for HAI's

Soliciting views concerning the way forward with keeping the workplace safe against HAI's revealed that the provision of education and routine training for staff was paramount among the responses (21.1%). Following closely is the provision of IPC logistics such as handwashing outlets, and standard personal protective equipment to health staff (17.4%). other respondents asserted that the effective supervision of health workers must be upgraded so as to keep tabs on the observance of IPC protocols (4.3%).

The final view of respondents on how to enhance workplace safety was on the provision of adequate ventilation outlets within the wards (3.3%). This was particularly affecting the spread of URTI's which was the highest type HAI to be contracted in their time.

The study also found out overwhelmingly that all the health staff of the hospital acts as role models to them (87.8). The remaining (12.2%) indicated that their workmates or work colleagues do not motivate them to practice good IPC among each other

CHAPTER FIVE

DISCUSSION

5.1 Introduction

This chapter presents a discussion of the research findings on the prevalence and determinants of nosocomial infections among health care workers in 37 Military Hospital. This is done in achieving the objectives of the study. The discussion is organized is organized as follows. Socio-Demographic characteristics of respondents, the knowledge level of healthcare providers on infection prevention control (IPC) measures, to determine the factors responsible for HAIs, to determine the frequency of infection among care providers and to evaluate the safety procedures on HAIs for staff.

Socio demographic characteristics

The majority (44.4%) of the health workers had less than 5 years of experience in the health service as at the time of the survey. This is mirrored in a recent study by Salem (2019) in Saudi Arabia, where the majority (68.3%) of the health workers had obtained less than 5 years. This local trend may be due to the nature of the health workers education in Ghana especially the MBCHB degree which spans over 6 years after secondary high school education, they tend to start practicing at a later age of above 25 years and by their early 30's would have barely passed the 5 years' experience milestone. However, in a related study by Parmeggiani et al., (2010), in eight randomly selected non-academic acute general public hospitals in the geographic area of Caserta and Naples, (Italy), the mean age of health workers was 44 years, where the mean number of years in practice was 11 years. The mean age of this present study was 34.5 years and an increase to about 11 years would certainly afford health workers some more years of practice to attain the 11 years

reported in the work of Parmeggiani et al., (2010). Work experience in the health profession has remained key to better health care delivery.

The knowledge level of the health workers in the hospital on nosocomial infections was revealed to be 93.7% while the most susceptible staff to contracting nosocomial infections were nurses (70.0%). This mirrors a similar study by Nag et al., (2018) in Tripura, India, where 87.4% of health care workers were knowledgeable about nosocomial infections while the nurses (34.6%) were the most susceptible health staff to contacting HAI's.

These results have been consistent with several researches indicating health care workers have good knowledge about infection control measures (Naikoba & Hayward, 2001; Alam, 2002; Kabbash et al., 2007). However, this stance has been refuted in studies by Soliman (2007) and Salam et al., (2014) where most nurses and physicians had poor knowledge regarding standard precautions in primary healthcare centres due to lack of awareness, training and education of nurses. Also, this study provides no significant relationship between health workers age and their knowledge level, but a study by Desta et al., (2018) in North-western Ethiopia revealed that healthcare workers with advanced age were significantly associated with knowledge (AOR = 3.15, 95% with CI of 2.467–5.025). This may be attributed to the fact that as the health workers get older, they are more likely to advance their knowledge through experience and working with other senior staff.

On the other hand, the knowledge level of the health workers regarding infection prevention and control in the hospital was revealed to be 73.7%. This result is mirrored in another study on infection prevention and control practices at the Greater Accra Regional Hospital (formerly Ridge Hospital) where 70.6% of respondents indicated to be knowledgeable about IPC (Hayeh & Esena, 2013).

The study found out that hand washing (78.1%) as the most effective method of preventing HAI's among the health workers and was followed by wearing of PPE's. Hand washing similarly ranked highest (78.3%) and (41.2%) in the study by Salem (2019) and Hayeh & Esena (2013) among health workers. This was also followed by wearing of PPE's in the latter study by Hayeh & Esena (2013). In another study by Oli et al., (2016), the use of PPE's was ranked a little higher than hand hygiene among health workers in the Delta State of Nigeria.

Regarding the hospital equipment that lead to the occurrence of contracting nosocomial infections, stethoscopes was indicated by 61.1% of respondents to be a contributing factor. In a similar study by Asiedu (2012) at the Komfo Anokye Teaching Hospital, Kumasi, the stethoscope produced a mean colony count (MCC) of 15.4 colonies per membrane which caused 58 (39.7%) out of 146 examined stethoscopes infected with bacterial contaminations. This made the stethoscopes potential conduits for transmitting microorganisms. This may be managed by cleaning regularly with an alcohol-based solution. Also, the study indicates white coat was reported by 183 (67.8%) health workers as a conduit for the spread and contraction of HAI's. This assertion is confirmed by a study by Mwamungule at al., (2015) where 72.8% of white coats screened were contaminated with bacteria. Regular sanitization of the white coats would reduce the high microbial contaminations and reduce nosocomial risks

The research reveals the frequency of contracting nosocomial infections among health workers. Medical doctors, dentists and physician assistants representing 40.5% of total health workers, were the most victims of HAI's. This reflects contrary to a study by Malangu & Legothoane (2013) in the Limpopo province of South Africa, where nurses were the most Hospital-acquired infections was among nurses with about 62% of the total population The gender that had the Majority (58.1%) of HAI's was reported to be

females. This is also consistent in the same study by Malangu & Legothoane (2013) where females dominated (67.9%) in the total number of infected health workers.

From the study, the most common nosocomial infections contracted by health workers was that of Upper Respiratory Infections (18.5%) followed by Skin infections (3.0%) and Urinary Tract Infections (2.2%). However, the health workers indicated that it was skin infections that was the common HAI among them. These results are in contradiction to a study by Oli et al., (2016) among health workers in health facilities located in 15 Local Government Areas in Delta State, Nigeria. Their study found out that Urinary Tract Infections (UTI) (61.4%) followed by hospital-acquired pneumonia (55.6%) were the prevalent types of HAI's contracted by health workers.

The study also reveals that out of the health workers who had ever contracted HAI's, 94.6% of them had direct contact with patients. This was also corroborated in an earlier study by Reynolds et al., (2006) where 81% of total patients who contracted Severe Acute Respiratory Syndrome (SARS) infections had direct contact with patients at their medical facility. This shows a strong relationship between direct contact and incidence of contracting nosocomial infections as observed in previous studies.

The study reveals the prevalence rate of nosocomial infections as 27.4% emanating from 74 reported incidences. Similarly, the total number of cases of infectious diseases reported during the study period was 56 of which tuberculosis was responsible for 83.9% of all cases reported to the Limpopo Compensation Commissioner as reported in a study by Malangu & Legothoane (2013).

The study recommended the provision of education and training for staff and also provision of infection prevention logistics such as handwashing outlets and standard PPEs as a way of tackling incidence of nosocomial infections. In a related study by Haque et al.,

(2018), they called for the routine educational interventions for health care professionals as a means to help change their hand-washing practices to prevent the spread of infection They further admonished the compliance of the WHO provided guidelines to promote hand-washing practices among member countries.

5.2 Study Limitations

The study is challenged with some minor constraints that may affect the scope and analysis performed

First, due to the cross-sectional nature of the study, different results may be gotten using a different time frame This means that a possible replication of the study may not yield the same results. The timing of the snapshot data collection is also not guaranteed to be a true representation which makes it difficult to proffer causal inferences with a cross-sectional study (Bryman, 2016).

Also, due to the hospital-based nature of the study, the findings cannot be generalized to the larger population In addition, recall bias (response bias) and attempts to please the healthcare provider may have an influence on patients' responses to the questionnaires (Bowling & Ebrahim, 2005).

Lastly, regarding the nature of the study, having a qualitative aspect would have given some in-depth information regarding knowledge levels and practices of infection control prevention protocols but time constraints and financial resources did not permit the researcher to carry out an in-depth interview of key informants to elucidate more on the issue at hand. These views have the propensity to enrich the study.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the conclusions and recommendations of the study. Conclusions on the field data are highlighted based on the findings from the study. This chapter also discusses the recommendations based on the findings of the study and concludes with some reference to other areas for further studies.

6.2 Conclusions

The study was conducted to investigate the prevalence and determinants of hospital-acquired infections among healthcare workers at the 37 Military Hospital. The specific objectives were to measure the knowledge level of healthcare providers on HAI's and infection prevention control (IPC) measures, to determine the factors responsible for HAI's, to determine the frequency of infection among care providers and to evaluate the safety procedures on HAIs for staff.

Regarding the knowledge level of healthcare workers on HAI's, the findings showed that health workers were abreast with nosocomial infections in general and rated skin related infections as the most common of them. More so, nurses were the most susceptible staff to contracting HAI's, while HAI's were mainly spread through patients receiving treatment at the hospital (inpatients). Also, health workers knowledge of IPC measures was above average and rated proper handwashing and wearing of personal protective equipment (PPE's) as the most effective methods of infection control. The findings also show that very few health workers were well informed about IPC programmes such as the monthly IPC workshops and the dedicated IPC unit at the medical facility.

Determinants of nosocomial infections were explored from the behavioural aspect mainly. The findings show that sharing of mattresses among patients, infected doctor's white coats and nurse uniforms, sharing thermometers and sphygmomanometers among patients were the potential factors that led to the spread of HAI's. Subsequently, behaviours that also led to the spread of HAI's were chiefly coughing from infected patients. Others include sneezing, shaking of hands and spitting around. Contact with patients at the hospital was a major factor for spreading HAI's and almost all the health workers had direct contact with patients during work hours which increased their propensity to get infected.

The incidence of contracting nosocomial infections among health workers was at 27.4% of total respondents. This is a rather alarming figure considering their awareness and education in that regard as earlier indicated. The frequency of infections herein also stood between a single incidence to more than 3 times of infection as the highest occurrence. The most recent infections were contracted mostly within the past 2 to 12 months as at the time of data collection. Most notable among the infections contracted were upper respiratory tract infections (URTI's) mainly influenza/flu, catarrh and tonsillitis. The mode health workers contracted these infections were mainly through direct contact with patients. Sharing public washrooms, cleaning up after patients and using hospital stethoscopes also led to the contraction of HAI's by health workers.

Workplace safety concerning the spread of HAI's was well placed to tackle the menace as most of the health workers had received IPC training and were satisfied with the calibre of training received Health workers rated their medical facility as having good IPC management practices and overwhelmingly rated their fellow work colleagues as being role models towards IPC practices while discharging their duties.

6.3 Recommendations

The findings from the study have revealed many important issues concerning hospital-acquired infections within our health care service and delivery system especially at one of the nation's major referral and teaching hospital.

The following recommendations are made from the findings of the study:

Provision of education and training: The public health division in collaboration with the hospital management should ensure the routine quality education and training of newly recruited health workers concerning HAI's and infection prevention control measures. Existing and experienced health workers should also undergo routine refresher training and education sessions to be more aware and abreast of managing themselves so as not to contract such infections.

Provision of IPC logistics: Hospital management should endeavour to make available infection prevention and control logistics such as hand gloves, nose and face masks, among other personal protective equipment that would secure health staff from picking up hospital-acquired infections while on duty.

Vaccination: Hospital management should design a policy on vaccination of newly recruited staff which will ensure that all health workers within the facility are vaccinated against pneumococcal diseases, meningitis, hepatitis b, influenza among other diseases that health workers may fall prone to in the discharge of their duties at work

Enhanced supervision: In order to keep the incidence of nosocomial infections at the barest minimum, hospital management must ensure effective supervision of health workers and conduct a routine appraisal of each workers department with an emphasis on how they manage IPC protocols and PPE's in that regard.

6.3.1 Areas for further research.

The present study focused on the prevalence and determinants of hospital-acquired infections of healthcare workers within a United Nations Level IV Hospital in the West Africa Sub-region. There is however room for future research to be conducted to look at the impact of the existing infection prevention control measures in curbing the incidence and spread of these infections. This kind of research should target both the managers of the IPC programmes and the beneficiaries who are the health workers in a bid to get a fuller picture of whether the laid down IPC protocols are actually impacting on the reduction of HAI's. Also, there is the need to utilize research in understanding the nature of IPC protocols at the various hospital levels as some facilities are impoverished in terms of adequate logistics and personnel among other important components of the IPC programme.

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APPENDICES

Appendix 1: Questionnaire

TOPIC: THE PREVALENCE OF NOSOCOMIAL/HOSPITAL ACQUIRED INFECTIONS AMONG HEALTH CARE PROVIDERS IN 37 MILITARY HOSPITAL

This research is being carried out as part of an MSc. degree in Occupational Hygiene at the School of Public Health, University of Ghana. The information is collected purely for academic research purposes as stated herein and confidentiality will be strictly observed.

Please tick or write where applicable. Thank you for your anticipated participation.

Name of Interviewer:	Date
Questionnaire No:	Department:

PART I. SOCIO-DEMOGRAHC CHARACTERISTICS

1. Age category (years)

a. <20 [ ] b. 20-29 [ ] c. 30-39 [ ] d. 40-49 [ ] e. 50-59 [ ] f. 60 and above

2. Sex: a. Male [ ] b. Female [ ]

3. Marital status a Single [ ] b. Married [ ] c. Divorced [ ] e. Separated [ ] f. Co-habiting [ ] g. Widowed [ ]

4. What is your highest education level?

a. Secondary/Middle School/ Diploma [ ] b. Degree [ ] c Masters [ ]

d. Medical Doctor [ ] e. Doctorate [ ] f. Other(specify).....

5. Profession: a. Medical Doctor/Dentist/PA [ ] b. Nurse [ ] c. Pharmacy staff [ ]

d. Public Health staff [ ] e. Laboratory staff [ ] b. Other specify .....

6. Rank/Position a. Principal Staff [ ] b. Senior Staff [ ] c. Junior staff [ ]

d. Chief Staff Officer [ ] e. Other specify .....

7. Years of service (health work service)

a.<5 [ ] b. 5-9 [ ] c. 10-14 [ ] d. 15-20 [ ] e.>20 [ ]

8. Monthly Income bracket

a. <GHC500[ ] b. GHC500-999 [ ] c GHC 1000-2000 [ ] d. >GHC2000 [ ]

9. How many hours (hrs) do you work a week, including overtime?

a. < 10 [ ] b. 10-20 [ ] c. 20-30 [ ] d. 30-40 [ ] e. 40-50 [ ] f. 50-60 [ ] g. > 60 [ ]

PART II: KNOWLEDGE ON HAI'S AND INFECTION PREVENTION CONTROL (IPC) MEASURES.

1. Are you aware of HAIs in your hospital? a. YES [ ] b. NO [ ]

2. Which of the following HAIs are common among your colleague staff in this hospital?

a. Catheter-Associated Urinary Tract Infections (CAUTI) b. Surgical Site Infections (SSI) c. Ventilator-Associated Pneumonia (VAP) d. Central Line-Associated Bloodstream Infections (CLABSI) F. Skin infections

g.Others; please specify:

.....

3. Which population is the most susceptible to HAIs?

a. Medical Doctor/Dentist/PA [ ] b. Nurse [ ] c. Pharmacy staff [ ] d. Public Health staff [ ] e. Laboratory staff [ ] f. Other specify

.....

4. Which is the most important source/reservoir of HAIs?

a. Inpatients [ ] b. Outpatients [ ] c. Doctors (including medical students and interns) [ ] d. Nurses [ ] e. Caregivers/Attendants [ ] f. Visitors [ ] g. Cleaners [ ]

h. Animals (rodents) [ ] g. Other specify .....

5. Which is the single most effective method to prevent HAIs?

a. Hand washing properly [ ] b. Wearing caps, masks, and shoe covers [ ]

c. Regular vaccination of healthcare workers [ ]

d. Isolation (cohorting) of infected/colonized patients [ ]

e. Cohorting staff (assignment of staff to a cohort of patients) [ ]

f. Prudent use of antibiotics [ ] g. Educating healthcare workers, patients, and families [ ] h. Visitor management [ ]

6. Are you aware of the standard isolation precautions within the health care setting?

a. Yes [ ] b. No [ ] c. I don't know [ ]

7. Which of the followings from patients do you assume to be infectious?

A. Blood [ ] B. Nasal discharge [ ] C. Saliva [ ] D. Vomitus [ ] E. Feces [ ]

F. Urine [ ] G. Sweat [ ] H. Vaginal secretion [ ] I. Non- intact skin (cut, abrasion, eczema) [ ] J. Mucous membranes (oral cavity, eyes) [ ]

8. Do you consider all unsterile needles and sharps contaminated? a. YES [ ] b. NO [ ]

9. Do you know about nosocomial infection monitoring program in your hospital?

a. YES [ ] b. NO [ ]

10. If YES, which program is it

.....

11. Do you know how to wash your hands in the six- step hand washing technique?
a. YES [ ] b. NO [ ]

12. What type of personal protection equipment (PPE) do you wear? Tick more than one if applicable.
a. Gown [ ] b. Mask [ ] c. Goggles [ ] d. Face shield [ ] e. Gloves [ ] f. None [ ]

PART II: TO DETERMINE THE FACTORS RESPONSIBLE FOR HOSPITAL-ACQUIRED INFECTIONS.

1. Which of the following channels are the recognized sources of HAIs' Kindly tick.

White coat		Thermometer		Mattresses and pillows	
Nurse uniform		Sphygmomanometer		Chairs/stools/cabinets	
Stethoscope		Wrist watch		Bedside curtains	

2. Which of the following behaviour(s) can spread infectious organisms? Kindly Tick.

Coughing		Laughing		Hugging	
Spitting		Sneezing		Kissing	
Talking		Hand shaking		Sharing a drinking straw	

3.Do you have direct contact with patients during work? a. Yes [ ] b. No [ ]

4. I was exposed to hand hygiene training a. Yes [ ] b. No [ ] c. I don't know [ ]

5. I have sufficient knowledge about hand hygiene a. Yes [ ] b. No [ ] c. I don't know [ ]

6. Hand hygiene is embedded into my professional practice

a. Yes [ ] b. No [ ] c. I don't know [ ]

7. Do you wash your hands before and after each patient encounter? a. Yes [ ] b. No [ ]
8. Do you follow strict infection control practices when dealing with all Patients
a. Yes [ ] b. No [ ] c. I don't know [ ]

PART IV: TO DETERMINE THE FREQUENCY OF INFECTION AMONG CARE PROVIDERS

1. Have you ever had a nosocomial infection? a. Yes [ ] b. No [ ]
2. If Yes, How many times have you been infected? .....
3. When was your last infection? .....
4. Which particular type of infection was it? .....
5. How did you contract the infection? .....

PART V: TO EVALUATE THE PERFORMANCE OF WORKPLACE SAFETY PROCEDURES FOR STAFF.

1. Were you trained in infection prevention control during your professional training?
a. Yes [ ] b No [ ]
2. Are you satisfied with your training in basic infection prevention and control measures?

a. Yes [ ] b No [ ] c. Not really [ ]

3. Do you think your hospital has good infection control management and practice?

a. Yes [ ] b. No [ ]

4. If Yes, what can you say about it?

.....

5. If No, what and how should be improved?

.....

6. Do your work colleagues and/or seniors act as role models in the practices of infection prevention and control

a. Yes [ ] b. No [ ]

THANK YOU FOR PARTICIPATING

Appendix 2: Consent Form

TOPIC: THE PREVALENCE OF NOSOCOMIAL INFECTIONS AMONG HEALTH CARE PROVIDERS IN 37 MILITARY HOSPITAL.

Principal investigator: Sena Kofi Kunawotor

Address. Department of Biological, Environmental and Occupational Health Science, University of Ghana, Accra, Legon or 37 Military Hospital, Public Health Division.

Mobile: 0243158238 Email Address: senakunat26@gmail.com

Introduction

I am a student from the School of Public Health, University of Ghana conducting a research on the prevalence of nosocomial infections among health care providers in 37 military hospital. Please kindly spend some few minutes to fill the questionnaire. All information collected will be treated as confidential and no one will be able to trace any information back to you.

General Information about Research

This consent form explains the study you are about to participate in. I would like you to read or have someone read it to you so that you can understand the study. You may ask for clarification of anything you do not understand

This study will determine the prevalence of Hospital Acquired Infection among healthcare providers at 37 Military Hospital, Accra, Ghana. Healthcare workers due to their profession, high job demand, and work schedule are exposed to hospital-acquired infections. There are reports of the incidence of these infections among health care workers in medical facilities in Ghana. These infections go a long way to impact on the quality of healthcare delivery within health facilities. You will be asked to answer

questions about yourself and your job category, knowledge of hospital-acquired infections, safety culture, use of Personal Protective equipment and your working conditions at this health facility. Completing the questionnaire will take approximately 20 minutes. It is hoped that the findings of this study will help health care providers and planners in the control and management of nosocomial infections in hospitals and other healthcare providing facilities.

Possible Risk and Discomforts

There are no risks associated with the study.

Possible Benefits

This research may not benefit you immediately. However, data gathered would help increase knowledge and surveillance of nosocomial infections among healthcare workers. It will also help the healthcare management team to put in place measures to protect healthcare workers from contracting these infections. In addition, the recommendations emerging from this study will be useful for improving occupational health and safety in hospitals within the country.

Confidentiality

Questionnaires will be labelled using codes instead of the participant's name. This is to ensure confidentiality and privacy and also keep an encrypted file that coordinates numbers to names on a secure laptop. To ensure privacy, data collected will be stored in a password-protected electronic device and safely locked. Access will be limited only to the principal investigator and the project supervisor.

Compensation

There will be no compensation packages for participants, however, to show appreciation for the participant's time spent, some beverages (a can of milo) may be given to the participant after completing the questionnaire

Voluntary participation and Right to Leave the Research

Participant opinions and experiences are important to us, so we want you to be honest and truthful in answering our questions. Your participation, however, is voluntary and you are free to withdraw at any time. You may stop answering the questionnaire if it makes you uncomfortable at any point.

Termination of participation by the Researcher

Participants are at will to choose interview location to increase privacy. In the case of an adverse event or situation of distress, a subject's participation in the study will be concluded.

Declaration of conflict of interest

I, Sena Kofi Kunawotor (Principal Investigator), declare that to the best of my knowledge there is no actual, perceived or potential conflict of interest that will or may arise as a result of my involvement with this study.

Contacts for Additional Information

In cases of any questions regarding the research, you can contact

- 37 Military Hospital Institutional Review Board

Administrator, Prince Yaw Ashitey (mobile: 0243004247)

- Department of Biological, Environmental and Occupational Health Science, University of Ghana, Legon, Accra.
- Dr Prudence Tettch

Mobile number: +233 (0) 550424815

Email: narhtsay@gmail.com

VOLUNTARY AGREEMENT

The above document describing the benefits, risks, and procedure for the research "The Prevalence of Nosocomial Infections Among Health Care Providers In 37 Military Hospital " has been read and explained to me. I have been given an opportunity to have any questions about the research answered to my satisfaction. I agree to participate as a volunteer

Date

Name and signature or mark of volunteer

If volunteers cannot read the form themselves, a witness must sign here:

I was present while the benefits, risks, and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

Date

Name and signature or mark of volunteer

Statement by the Researcher

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above volunteer.

Date

Name and signature of person who obtained consent

Appendix 3: Ethical Clearance

Institutional Review Board
37 Military Hospital
Neghelli Barracks
ACCRA

Tel: 0302 769667
Email:irbmilhosp@gmail.com

8 May 2019

ETHICAL CLEARANCE

37MH-IRB IPN/297/2019

On 01 April 2019, the 37 Military Hospital (37MH) Institutional Review Board (IRB) at a Board Meeting reviewed and approved your protocol.

TITLE OF PROTOCOL: **The Prevalence and Determinants of Nosocomial Infections among Health Care Workers in 37 Military Hospital**

PRINCIPAL INVESTIGATOR: **Sena Kofi Kunawotor**

Please note that a final review report must be submitted to the Board at the completion of the study.

Please report all serious adverse events related to this study to 37MH-IRB within seven (7) days verbally and fourteen (14) days in writing.

This certificate is valid until 31 March 2020.

IR EDWARD ASUMANU
37MH-IRB, Vice Chairman)

37 MILITARY HOSPITAL
INSTITUTIONAL REVIEW BOARD
DATE

c: Brig Gen MA Yeboah-Agyapong
Commander, 37 Military Hospital