

UNIVERSITY OF CAPE COAST

PREVALENCE AND RISK FACTORS FOR PERCUTANEOUS INJURIES,
BLOOD AND BODY FLUIDS EXPOSURES AMONG NURSES IN THE
TAMALE METROPOLIS

GEORGE DASSAH

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TAMALE METROPOLIS

BY

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Thesis submitted to the School of Nursing and Midwifery of the College of
Health and Allied Sciences, University of Cape Coast in partial fulfilment of
the requirements for the award of Master of Nursing Degree

JULY, 2018

DECLARATION

Candidate's declaration

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

Candidate's signature:..... Date:.....

Name: George Dassah

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature:..... Date:.....

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Co-Supervisor's Signature:..... Date:.....

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ABSTRACT

Exposure to percutaneous injuries and blood/body fluids are serious occupational hazards that contribute to the transmission of a variety of blood borne pathogens. The study was conducted to determine the prevalence and risk factors associated with percutaneous injuries and exposure to patients' blood and other body fluids among nurses in the Tamale metropolis. A cross-sectional design was adopted for the study. A total population of 572 was targeted with a sample size of 224 nurses obtained for the study. However, analysis was done with a sample size of 215 based on a 96% response rate. The researcher used descriptive and inferential statistics to analyse the data. Results from the study indicate that the prevalence of percutaneous injuries (PIs) and blood/body fluid exposures (BBFEs) in the two hospitals was high (61%). Sex, highest level of education, work experience, availability of Personal Protective Equipment (PPEs) and having a procedure/protocol for reporting, following standard operational protocols, wearing PPEs, working in haste, engaging in improper disposal and reporting accidental exposures all showed statistically significant association ($p \leq .05$). In conclusion, the prevalence of PIs and BBFEs among nurses in the two hospitals was high. Also some, personal factors, organizational factors and behavioural factors influenced the occurrence of these exposures among the nurses. Heads of the health facilities in the Tamale Metropolis should therefore sensitize their nurses to understand the risks associated with these injuries and exposures to encourage them to comply with the standard precautions.

DEDICATION

To my wife Hamdiya, my children (Edwin, Edwina, Fedora and Fedosia) and all those who supported me to successfully complete this work.

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KEY WORDS

Blood/body fluids

Exposures

Needle stick/sharp injuries

Nurses

Percutaneous Injuries

Prevalence

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LIST OF ACRONYMS

BBFEs	Blood/Body Fluid Exposures
CDC	Centers for Disease Control and Prevention
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HCWs	Healthcare Workers
HIV	Human Immunodeficiency Virus
IPC	Infection Prevention and Control
MHMT)	Metropolitan Health Management Team
MHD	Metropolitan Health Directorate
NIOSH	National Institute for Occupational Safety and Health
NSI	Needle Stick Injury
PPE	Personal Protective Equipment
PIs	Percutaneous Injuries
SI	Sharp Injury
SOPs	Standard Operational Protocols
SPSS	Statistical Package for Social Sciences
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION

Any healthcare worker handling sharp objects or devices such as scalpels, sutures, hypodermic needles, blood collection devices, or phlebotomy devices is at risk of occupational exposure to blood borne pathogens. However, the risk varies across disciplines, with nurses seen to be the most at risk due to the nature of their work (Desalegn, Beyene, & Yamada, 2012). Studies have shown that even though all healthcare workers [HCWs] whose work demand contact with patients are at risk of exposure to sharp injuries and patients' blood and other body fluids, nurses report majority of these injuries and exposures. This is because nurses are more likely to handle sharp devices and also have more contact periods with patients than other healthcare professionals (Mbaisi, 2013).

Some of these injuries and exposures may result from time pressures leading to nurses working in haste, misunderstandings among health team members, fatigue, inadequate staffing, lack of awareness, reduced attention during procedures, and lack of cooperation from patients (Cicconi, Claypool, & Stevens, 2010). Exposure to blood borne pathogens has been identified as one of the most serious occupational health risks encountered by nurses in the healthcare profession worldwide (Leow, Groen, Bae, Adisa, Kingham, & Kushner, 2012 ; Wicker, Jung, Allwinn, Gottschalk, & Rabenau, 2008).

Background to the Study

Globally, more than 35 million healthcare workers face the risk of percutaneous injuries with contaminated sharp objects every year (Wicker et al., 2008). The Centers for Disease Control and Prevention [CDC] estimated that, 385,000 sharp injuries occurred yearly among hospital workers in the United States (CDC, 2008). It is also estimated that 100,000 of these injuries occur annually in the United Kingdom and 500,000 annually in Germany (Rampal, Rampal, Rosidah, Whye-Sook, & Azhar, 2010).

Percutaneous injuries [PIs] are well known occupational hazards among healthcare workers. They are significant sources of infections with blood borne pathogens among healthcare workers including nurses (Aderaw, 2013). The major source of blood borne infections among hospital workers is through injuries either from needles or other sharp instruments (World Health Organization [WHO], 2011). Percutaneous injury is defined by the CDC (2011) as “a penetrating stab wound from a needle, scalpel, or other sharp object that may result in exposure to blood or other body fluids”.

In the healthcare setting, sharp objects such as needles and ampoules are the most common items causing PIs, and their handling is one of the most performed daily activities. Handling sharp objects therefore represent a major risk for Healthcare Workers (HCWs) and more particularly for nurses (Elseviers, Arias-Guillén, Gorke, & Arens, 2014). Also, a percutaneous exposure occurs when the skin is cut or penetrated by a needle or other sharp object that may be contaminated with blood or other body fluid (CDC, 2009).

Blood and body fluids on the other hand are described as fluid contained in the fluid compartments of the body, they include: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures and body fluids visibly contaminated with blood (Cherie, Allen & Kevin 2010).

Exposure to Percutaneous injuries and blood/body fluids are serious occupational hazards in the transmission of a variety of blood borne pathogens such as; Hepatitis B virus [HBV], Hepatitis C virus [HCV], and Human Immunodeficiency Virus [HIV] among HCWs. The number of these workers annually exposed to sharps injuries contaminated with HBV, HCV, and HIV has been reported to be 2.1 million, 926,000, and 327,000, respectively (Wicker et al., 2008). Blood borne pathogen exposures can result from PIs or through contact of blood and body fluids [BBFEs] with mucous membranes or non-intact skin. These exposures pose a risk of transmission of HIV, HBV, HCV and other pathogens to healthcare workers (Kessler, McGuinn, Spec, Christensen, Baragi, & Hershov, 2011). Studies in Nigeria have shown that occupational injuries and illnesses among healthcare workers are ranked among the highest of any industry though this situation could be reversed or eliminated (Amosun, Degun, Atulomah, Olanrewaju, & Aderibigbe, 2011).

The gravity of workplace risks is seen in the International Labour Organization [ILO] estimates that, among the world's 2.7 billion workers, at least 2 million deaths per year were due to occupational infections and injuries. The ILO also noted that nearly 4 per cent of GDP could be lost due to work-related diseases and injuries (ILO, 2003). These constitute deaths related to only infectious injuries and diseases. O'Malley et al. (2007) in 2006 conducted an

economic analysis of the management costs of occupational exposure to blood and body fluids, including post-exposure prophylaxis in the United States of America. The study revealed that the overall cost ranged from US\$ 71 to US\$5000.

Apart from the economic factors, these exposures also cause psychological trauma to HCWs. The challenges are further complicated if potential chronic disability is developed leading to loss of employment, denial of compensation claims and even liver disease requiring liver transplant (Moazzam, Salem, & Griffith, 2010). NIOSH (2008) considers exposure to needle stick injuries and infectious diseases as factors leading to occupational stress among most healthcare workers. They are also known to be responsible for psychological distress, burn-out, absenteeism, reduced patient satisfaction and treatment errors among health care workers.

Despite the consequence and negative effects of these exposures among nurses and other HCWs, several reports from both developed and developing countries still show a continued high prevalence of needle stick injuries, sharp injuries and splashes of patients' blood and body fluids (Seyed & Kaveh, 2009). Some studies further indicated that about three-quarters (40-70%) of these injuries are mostly unreported in developing countries (Habib, Ahmed, & Aziz, 2011).

Sharp injuries are the most common type of percutaneous injury sustained by nurses (Subratty & Moussa, 2007). In a study of US hospitals, the results revealed that nurses accounted for almost half of all reported needle stick injuries (Chen & Jenkins, 2007). This is because nurses are directly at risk of transmission of blood borne pathogens through their handling of contaminated

body fluids (Lee, 2009 ; Wicker et al., 2008). In Ethiopia, Alemayehu, Worku and Assefa (2016) indicated that among nurses, midwives and medical doctors, nurses were the most exposed to sharp injuries (28.8%) while medical doctors were the most exposed to BBFEs (42%). Similarly, in Saudi Arabia, a 5 year surveillance study also found that most reported injuries involved the nursing staff, followed by doctors, then downstream staff (El-Hazmi & Al-Majid, 2008). A cross-sectional study among nurses in Turkey, Iran and Uganda reported a prevalence rate of 30.1%, 75.6% and 3.94% respectively of sharp injuries in the previous year.

At the local level, a study conducted among nurses at the emergency unit of the Komfo Anokye Teaching Hospital in Ghana indicated that, sharp injuries were very prevalent, with about one-third of respondents reporting four (4) or more injuries in the past 12 months (Lori, McCullagh, Krueger, & Oteng, 2016). This high rate of repeated exposures may put these nurses at a high risk for acquiring serious infection which may result in chronic infectious diseases like HIV, hepatitis B and hepatitis C. If a tertiary facility with all the proper surveillance systems that ensures the safety of their workers could record such high rate of repeated exposures to sharp injuries. It therefore shows that at the lower level care facilities the situation could be worse considering the fact that surveillance systems in most cases are either weak or absent.

Certain work practices such as administering injections, taking blood samples, recapping and disposing used needles, handling trash, and during the transfer of body fluids from a syringe to a specimen container have all been identified as some major activities causing PIs and splash exposures (Lakbala, Ebadiazar, & Kamali, 2012). Despite these levels of exposures, reports still

indicate that non-reporting of injuries and exposures are highly prevalent (Irmak, 2012 ; Nasiri, Vahedi, Siamian, Mortazavi, & Jafari, 2010 ; Nsubuga & Jaakkola, 2005).

In developing countries, studies have revealed that occupational infections are mostly less often documented because of the lack of routine surveillance of sharp injuries and blood and body fluid exposures (Phillips, Simwale, Chung, Parker, Perry, & Jagger, 2012). The situation in Ghana is not different as data on occupational exposure to PIs and BBFEs in most health facilities are scarce despite the risk these injuries and exposures pose to nurses and other HCWs.

Statement of the Problem

Even though there is a national guideline on infection prevention and occupational health and safety practices in Ghana, little is known about the prevalence and risks factors associated with PIs and BBFEs.

Furthermore, studies have shown that occupational injuries occur highest among nurses (Amosun, Degun, Atulomah, Olanrewaju, & Aderibigbe, 2011; Chen & Jenkins, 2007). However, there is little information as to the cadre of nurses mostly affected, this is because majority of the studies mostly focused on all HCWs and just a few actually looked at the different cadre of nurses.

As a result of the lack of data, authorities are mostly unable to estimate the impact of these exposures in order to inform policy. The research was necessitated out of the need to obtain information on the prevalence of these exposures and assess their associated risk factors among nurses in the Tamale Metropolis, Ghana.

Purpose of the Study

The purpose of this study is to determine the prevalence of percutaneous injuries and blood/body fluid exposures and assess their associated factors among nurses at two hospitals in the Tamale Metropolis.

Research Questions

1. What is the prevalence of percutaneous injuries and blood/body fluid exposures among nurses at the Tamale Metropolis?
2. What are the socio-demographic factors associated with percutaneous injuries and blood/body fluid exposures in the Tamale Metropolis?
3. What are the organizational factors associated with percutaneous injuries and blood/body fluid exposures in the Tamale Metropolis?
4. What are the behavioural factors associated with percutaneous injuries and blood/body fluid exposures among nurses in Tamale West and Central Hospitals?

Specific Objectives of the Study

The specific objectives of this study are to:

1. Determine the prevalence of percutaneous injuries and blood/body fluid exposures among nurses in Tamale West and Central Hospitals.
2. Assess the socio-demographic factors associated with percutaneous injuries and blood/body fluid exposures among nurses in Tamale West and Central Hospitals.
3. Identify the organizational factors associated with percutaneous injuries and blood/body fluid exposures among nurses in Tamale West and Central Hospitals.

4. Examine the behavioural factors associated with percutaneous injuries and blood/body fluid exposures among nurses in Tamale West and Central Hospitals.

Significance of the Study

It is expected that the results of this research would be made available on scientific platforms. The availability of this information may assist hospitals in Tamale Metropolis to identify the dangers percutaneous injuries and blood/body fluid exposures pose to nurses, so as to enable them encourage their staff to prevent exposures, report incidents and document with accuracy; the type of exposure, the exposed individuals, and the outcome of the exposure for necessary actions to be taken. Evaluation of the prevalence and factors associated with percutaneous injuries and blood/body fluids exposures would be helpful in taking effective and appropriate strategies and plans for reducing their incidence among nurses and other HCWs in order to improve the safety of the patients and that of the HCWs.

Additionally, since this research is the first of its kind in the research area, results of this study will serve as baseline data on the subject matter. It will also give insights for appropriate measures to be put in place to prevent and manage these exposures. Furthermore, it will enable managers, stakeholders and high-risk groups like nurses and other HCWs understand the extent of the burden these injuries and exposures pose in order for them to pay much attention to them. Finally, a study of this nature would improve knowledge and practice on issues pertaining to occupational health and safety at hospitals in Northern Region and also contribute to enriching nursing literature in Ghana.

Delimitations of the Study

Nurses are normally exposed to many occupational hazards within the Healthcare setting. Some of these hazards include workload overload, emotional stress disturbance, back injuries, latex allergies, radiation exposures, toxic chemical wastes exposures, pharmaceutical wastes exposures and many others. This study however was limited to only percutaneous injuries (needles sticks and sharp injuries) and exposure to patients' blood and other body fluids and not the whole spectrum of healthcare occupational hazards.

In furtherance, this study was conducted among nurses practicing within the Tamale Metropolis. The participants were drawn from the two main non-tertiary government hospitals within the Metropolis: Tamale Central and Tamale West Hospitals. Nurses and all other healthcare workers working in other health facilities within the Metropolis were not involved in the study. The result of this study is therefore limited to the Tamale Metropolis and may not be generalized to cover all nurses or HCWs in the whole region and country. Additionally, this study was a one-time study and there was no follow-up study thereafter.

Limitations of the Study

The researcher acknowledges the following limitations to this study, the respondents were required to recall all incidents of percutaneous injuries (needle sticks and sharps injuries) and exposures to patients' blood and other body fluids in the last 12 months. It is therefore possible that the respondents may not recall all the incidents that happened over the period. Additionally, a cross-sectional study design cannot establish cause and effects relationships and the lack of

similar studies in these hospitals to make comparative discussion of the results was also a major setback.

Definition of Terms

Blood/Body Fluid Exposures (BBFEs): defined as splashing of patients' blood or other body fluids onto the skin or mucous membranes. In this study blood and body fluid refers to fluids from patients containing visible blood or other fluids that are potentially infectious including; vomitus, stool, semen, vaginal secretions and saliva.

Exposure: Is an accidental injury to needle sticks or cut from sharp objects and splashes of blood and other body fluids to mucous membranes or the skin (Roland & Michelle, 2009). In this study, the term exposure refers to injuries from needle sticks, cuts from sharp objects and contact of the skin with blood and other body fluids.

Needle Stick Injury (NSI): are injuries caused by sharps such as hypodermic needles, blood collection needles, IV cannulas, suture needles, winged needles IV sets and needles used to connect parts of IV delivery systems. In this study NSI refers to PIs.

Nurse: Persons educated and licensed in the practice of nursing; one who is concerned with diagnosis and treatment of human responses to actual or potential health problems (Anderson, Novak, & Elliot, 2002). Nurses in this study refer to registered nurses, enrolled nurses and midwives.

Percutaneous injuries (PIs): is the penetration or piercing of skin by a needle or cut from sharp objects, which has come into contact with blood, or other body fluids before the exposure and mostly caused by needle and medical sharp objects (Anderson, Novak, & Elliot, 2002). In this study percutaneous injuries

are injuries from needle sticks and cuts from medical sharp objects like scalpel blade, instruments, broken bottles and ampoules etc.

Prevalence: Refers to the number of cases of disease including old and new that are present in a particular population at a given time.

Sharp Injury (SI): any skin penetrating stab wound caused by a sharp instrument such as lancet, scalpel, trocar, scissors, and drill bit, sawing blade or broken glass. In this study SI refers to PIs.

Organization of the Study

This study is organized into five chapters. Chapter one contains the background to the study as well as the problem statement. It also highlighted the significance of this study and outlined the limitations and delimitations of the study. The key terms used in the study were also defined here. Chapter two was dedicated to review of literature related to the study and the theoretical and conceptual frameworks supporting the study. Chapter three described the methodology adopted to conduct this study and chapter four followed with presentation and discussion of results. The study concluded with chapter five which summarized the study and presented conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

Introduction

In research, a literature review is a written summary of the state of evidence on a research problem (Polit & Beck, 2008). The purpose of the literature review is to review or further look at what has previously been written on a particular subject. A literature review is intended to convey to the reader the current state of knowledge in the subject area, its strengths, and limitations. Literature review for this study focused on studies related to percutaneous injuries (needle sticks and medical sharp injuries) and exposures to patients' blood and other body fluids in nurses and other healthcare Workers. The review examined the broader and narrow situation (globally and locally) of occupational exposures to PIs and blood/body fluids among nurses and other healthcare workers. The review also examined extensively the prevalence of PIs and BBFEs among nurses and other HCWs and the factors associated with the occurrence of these exposures.

Literature was reviewed under the empirical and theoretical framework. Empirical data was reviewed under thematic areas in line with the research objectives and questions. A review of the literature on percutaneous injuries and blood/body fluid exposures was carried out using databases such as PubMed, Medline, Medline Plus, Google Scholar and CINAHL. The search terms included blood and body fluid exposures, needle stick injuries, sharps injuries, blood and body fluid splashes/exposures, percutaneous exposures/injuries,

occupational injuries, prevention of injuries, reporting, underreporting and non-reporting of exposures among nurses and other HCWs. Theoretically, the hierarchy of controls theory for reducing occupational hazards was used as a guide for review of this study.

Theoretical Review

The theoretical framework underpinning this study is the ‘hierarchy of controls’ theory for reducing occupational hazards. Controlling exposures to occupational hazards is the fundamental method of protecting workers. Hierarchy of controls is used as a means of determining how to implement feasible and effective control solutions (CDC, 2016). This theory is therefore relevant to the prevention of accidental injuries and exposures among healthcare workers due to PIs and BBFEs. The theory provides an effective framework for the prevention of injuries either by identifying or eliminating the hazards or modifying risk behaviour or adopting safer strategies to achieve these goals.

The hierarchy of control theory was founded by the Industrial Hygiene Community in the 1930’s, they established a priority order in which hazards and risk controls should be considered according to the level of their effectiveness. Though it was developed by the Industrial Hygienist, it is widely adopted in different disciplines and proven to be very effective in preventing occupational hazards. The Hierarchy of Control is a list of control measures in a priority order that can be used to prevent or reduce exposure to hazards. Figure 1 is a diagram illustrating the Hierarchy of Control model.

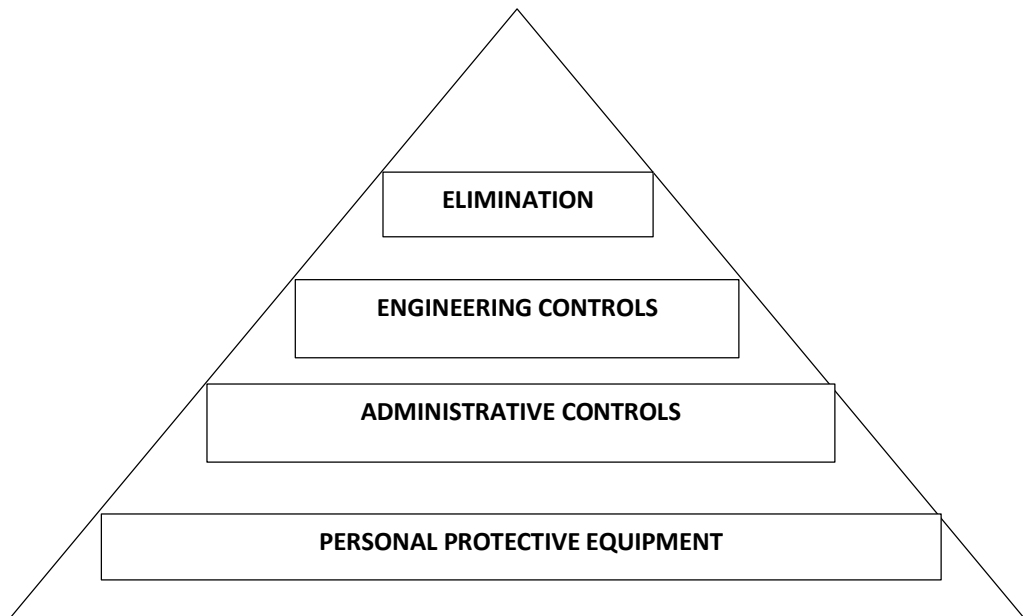


Figure 1: Hierarchy of Control model (CDC-NIOSH, 2016)

The idea behind this hierarchy is that the control methods at the top are potentially more effective and protective than those at the bottom (CDC, 2016). According to European Agency for Safety and Health (2010), elimination of hazards entail complete removal of the hazard from the workplace. It is considered the most effective way to control hazards. This can be achieved by changing sharps and needles whenever possible or replacing traditional sharps and needle system with needleless systems.

Engineering controls on the other hand focuses on maintaining safe work environment, either by isolating or removing a hazard from the workplace. Under this control, environmental factors like; adequate number of sharp disposal containers, good lightening and adequate space to carry out procedures is necessary. Additionally, the use of safety engineered devices is required to minimize injuries.

Administrative controls are measures that focus on policies, practices and safety guidelines, in-service education, regular trainings and vaccination of HCWs. Administrative controls requires all healthcare workers to know their health and safety responsibilities from their employers. It also requires employers to coordinate and adequately resource the safety needs of employees through the setting up of hazard prevention committees and health and safety committees. Administrative controls also include sharp policies, infection control measures and safer working system.

Work practice controls, though not part of the model, focuses on behaviour change strategies that can reduce exposures to needle sticks and sharp objects. Practices such as no recapping of needles, availability and accessibility of sharps containers, proper disposal of sharps immediately after use, timely management of sharp injuries are the main focus of work practice control. Finally, Personal protective equipment (PPEs) though found to be least effective measure in the prevention of PIs, could help limit the exposure to blood splashes through the use of items like; eye goggles, aprons, gloves, gowns, boots and face masks.

The CDC (2008) also recognizes elimination as the first priority in the prevention order, with the aim of eliminating and reducing the use of devices like needles or sharps as much as possible. Isolation of the hazard comes in second place. This concept works with protecting the exposed individuals or through the use of engineered control devices. When these strategies are not available or are not effective for full protection, the focus then shifts to work-practice controls and personal protective equipment [PPE].

Levy and Wegman (2000), proposed in a study, a hierarchy of three types of controls that should be implemented in a certain order to reduce the risk for occupational injuries and exposures. These three levels of controls suggested are; engineering controls, administrative controls and personal protective equipment (PPE). The first level of control they proposed is engineering controls, this they said involved, altering the environment or the processes that pose risks to HCWs (e.g., replacing all needles without retractable safety devices with those that have safety mechanisms).

According to Levy and Wegman (2000), engineering controls should be implemented before the other two types of controls because engineering controls are most effective. The second level of controls according to Levy and Wegman (2000) is administrative controls, which employs strategies such as safety training and setting limits on nurse-patient loads, reducing hours of work among others. The third type of controls proposed is the personal protective equipment. PPE, though a simple strategy to implement, is considered the least effective in reducing the risk of occupational harm (Salazar, 2006).

Administrative and PPE controls are said to be active preventive measures whiles engineering controls are passive prevention measures (Levy & Wegman, 2000 ; Salazar, 2006). The hierarchy of controls framework suggests that the occupational risk of experiencing a PIs and BBFEs can be reduced by implementing these levels of controls in healthcare facilities. Engineering, administrative, and PPEs controls can therefore be used to prevent PIs and BBFEs among nurses in the Tamale Metropolis.

Conceptual Framework

The researcher developed a model that explains the various factors that could lead to the occurrence of percutaneous injuries and blood/body fluid exposures. According to this model the occurrence of the exposure is influenced by three interacting factors. The first factor is the personal factors; they are the socio-demographic characteristics of the individual (age, gender, level of education, job category and work experience) that are known to be associated with the occurrence of PIs and BBFEs.

The second factor that is associated with the occurrence of PIs and BBFEs is the organizational factors. They are factors within the job environment that are associated with the occurrence of these injuries and exposures. They include; training programs for staffs, the working unit or department, the working space and the availability of universal safety guidelines. The behavioural factor is the third and final factor associated with the occurrence of PIs and BBFEs. They are the work practices and behaviour of HCWs that could lead to the occurrence of PIs and BBFEs. They include, refusal to use personal protective equipment, non-reporting or underreporting of exposures and the non-adherence to universal precaution measures. Organizational and behavioural factors can sometimes have direct influence on the personal factors. The outcome of all these interactions is the occurrence of PIs and BBFEs. The conceptual framework for this study is presented in figure 2.

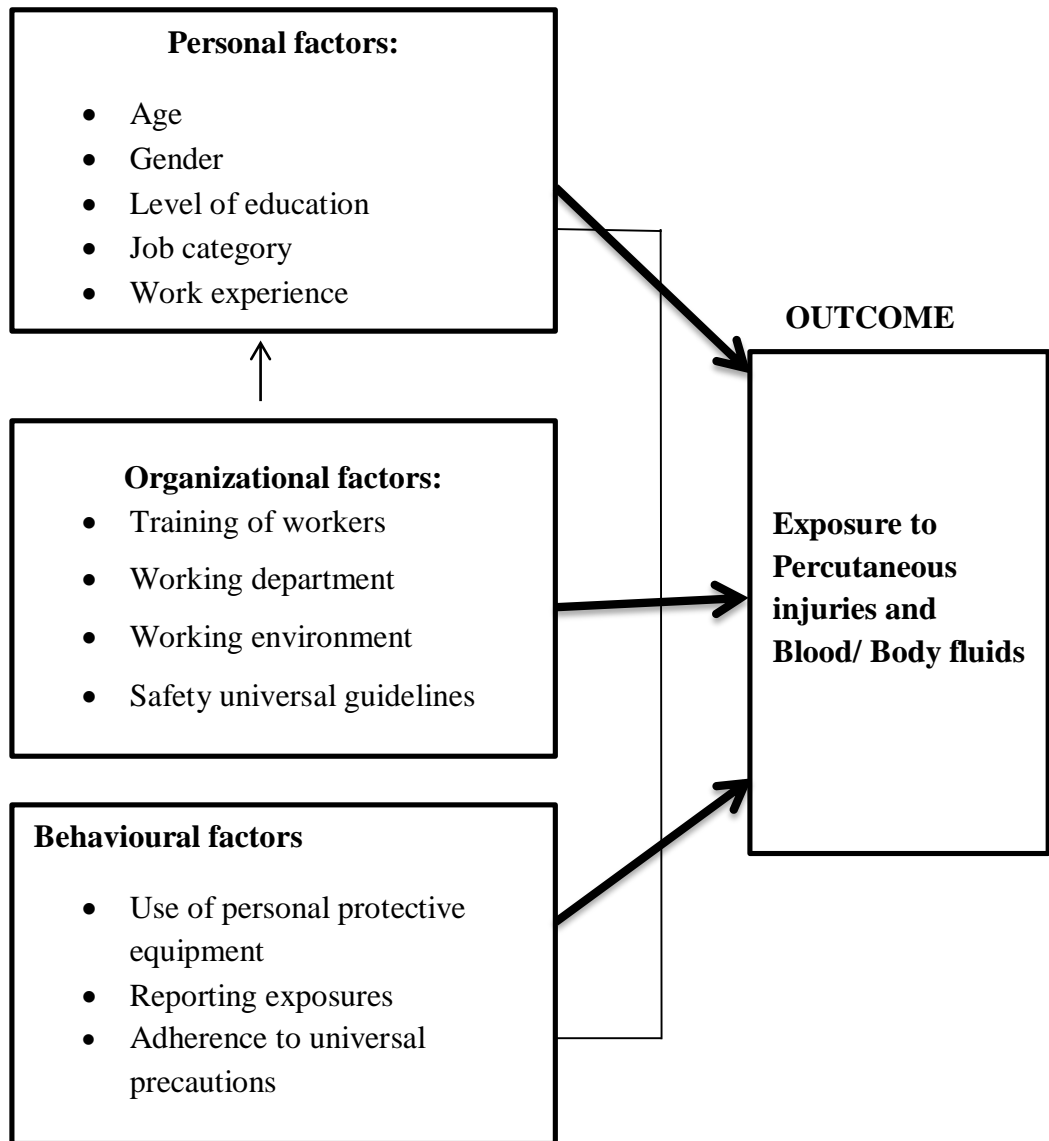


Figure 2: Conceptual Framework

Source: Author, 2017

Prevalence of Percutaneous Injuries and Blood/Body Fluid Exposures

Studies conducted in several countries across the globe have reported different rates of percutaneous injuries and exposure to patients’ blood and other body fluids in nurses and other HCWs. The rates of these injuries and exposures vary greatly across different countries and sometimes within the same country. In order to effectively reduce percutaneous injuries and blood/body fluid exposures, it will be required that management, stakeholders and the healthcare

workers themselves have a full understanding of the magnitude of the problem and how it affects their lives and the work they do.

The global burden of diseases from percutaneous injuries to nurses and other healthcare workers includes 40% of all hepatitis infections and 4.4% of all HIV infections. The risks of infection due to needle stick injuries and from medical sharp objects depend on the microorganism involved (WHO, 2005 ; Wilburn, 2004). Percutaneous injuries and blood/body fluid exposures are often faced by individuals handling needles and medical sharps in the healthcare setting (Wicker et al.,2008).

Literature has shown that needle stick injuries are the most common source of occupational exposures to blood which result in transmission of blood-borne infections (Amira & Awobusuyi, 2014). These injuries and exposures are preventable and efforts should therefore be targeted at their elimination. The U.S. Public Health Service in 2010 called for the reduction of sharp injuries among healthcare workers by 30% as a national health objective (CDC, 2010). This great initiative could be replicated in developing countries where literature has reported an increase rate of injuries among HCWs in most healthcare settings.

The World Health Organization (WHO, 2005) estimates that, 3 million percutaneous exposures occur annually among 35 million HCW globally and over 90% of such injuries and exposures occur mostly in resource constrained countries (Pruss, Rapiti, & Hutin, 2005). According to the CDC, nearly 385,000 needle sticks and sharp injuries occur yearly among HCWs with most of them occurring among nurses than other job cadres (Hosoglu, Akalin, Sunbul, Otkun, & Ozturk, 2009; CDC, 2011). Some studies in the developed world also

estimated that about 100,000 needle stick injuries occurred in the United Kingdom, 500,000 in Germany and 600,000 – 800,000 in the USA annually (Memish, Assiri, Eldalatomy, Hathout, Alzoman, & Undaya, 2013 ; Rampal et al., 2010).

A cross-sectional survey to examine the incidence to needle stick or sharp injuries and identify the factors associated with such injuries among hospital nurses in South Korea showed that, 70.4% of the nurses had experienced a needle stick or sharp injury in the previous year (Choa, Leea, Choib, Park, Yooa & Aikend, 2013). The study gathered data from 3079 registered nurses in 60 acute hospitals in South Korea using stratified random sampling method. The large sample size was deemed appropriate because it enabled them capture more registered nurses from different hospital settings in the study area. The result can be said to be representative considering the sample size and number of hospitals sampled.

Lori et al., (2016), also revealed in a study to examine the frequency of sharps injuries, and assess the adequacy, understanding, and use of post-exposure protocols among 45 nursing staff at a tertiary hospital in Ghana that, out of the over one-quarter respondents who reported sharps injuries in the past 12 months, over one-third of that indicated encountering four or more sharps injuries. This study employed mixed-methods design, including key informant interviews, a structured survey and document review. Using mixed-methods design is good for gathering rich and in-depth data, however the small sample size used in the study (45) will make generalizability of the findings inappropriate.

Similarly, studies by Galougahi (2010), Manzoor, Daud, Hashmi, Sardar, Babar, and Rahman (2010), and Lukianskyte, Gataeva, and Radziunaite (2011), to determine the prevalence of PIs and investigate the associated factors among nurses in Iran, Pakistan and Lithuania reported a prevalence rate of 22.15%, 71% and 38.5% of injuries respectively in the last 12 months. Interestingly, common to all these studies was the fact that, they were restricted to only nurses and the results could have been affected by the homogeneity of the participants.

Furthermore, studies conducted among nurses in Thai Regional Hospital and in Central India also reported a prevalence of 55.5% and 31.78% of PIs during the previous 12 months respectively. Most of the nurses in the study mentioned experiencing at least one episode of PIs in the last one year (Bagdey, Humne, & Wankhede, 2014 ; Honda, Chompikul, & Rattanapan, 2011). Also, Salminen and Parantainen (2012), and Sharma, Rasania, Verma, and Singh (2010), reported a prevalence of 25.3% and 80% of needle stick injuries among healthcare workers in Helsinki and India respectively in the last 12 months. Similar to all the studies mentioned is the fact that respondents were to recollect the occurrence of their exposures in the last 12 months and this could therefore make their study prone to recall bias as some respondents may not be able to actually recollect all the exposure events.

In Africa, several studies conducted have also reported different prevalence rates of percutaneous injuries and exposure to patients' blood and other body fluids among nurses and other HCWs. A descriptive cross-sectional study using self-administered questionnaires to describe the patterns of exposure to patients' body fluids among HCWs at a university hospital in

Ethiopia revealed that, 22.2% of the healthcare workers had experienced at least one sharp or needle stick injury in the last one year, with two thirds of these HCWs reporting an accidental exposure to patients' body fluids (Atlaw, 2013).

Similarly, a case-control study to examine the occurrence of sharp injuries and exposure to blood and body fluids among HCWs in healthcare centres in Ethiopia, also reported that, a high number of the respondents mentioned ever being exposed to a sharp injury or exposed to blood and other body fluids during the last 12 months (Alemayehu, Worku & Assefa, 2016). Unlike cross-sectional studies, case control studies can establish association between exposure to risk factors and a disease. They are mostly used where little is known about the association between the risk factor and the disease under study. However, they are prone to selection bias and confounding factors which could influence the results.

A Kenyan study conducted among HCWs reported a 19.3% prevalence of percutaneous injuries and 7.2% for blood and other body fluid exposure. The study further indicated that a significant proportion of the respondents mentioned experiencing an exposure more than once in the last one year (Mbaisi, 2013). Studies in three teaching hospitals in Egypt and another in Northwest Ethiopia among HCWs to investigate needle stick injuries, reported a rate of 67.9% and 31% of injuries respectively in the last 12 months (Hanafi, Mohamed, Kassem, & Shawki, 2011; Walle et al., 2013).

In South African, a study conducted among 110 surgeons practicing in 14 Sub-Saharan African countries to document the frequency and circumstances of blood borne pathogen exposures showed that 91% of them reported encountering one or more percutaneous injury and 80% exposed to patients'

blood or other body fluids (Elayne, Sats, Paul, & Janine, 2011). This study, however, was restricted to only surgeons and the results may have been affected by the homogeneity of the respondents and also, the fact that the surgeons were required to recall events of exposure could subject the study to recall bias. In Ghana, data on percutaneous injuries and blood/body fluid exposures are very scarce due to underreporting and the lack of proper documentation which make authorities unable to measure the effects of these exposures for policy directives (Sagoe-Moses et al., 2001; Salelkar, Motghare, Kulkarni, & Vaz, 2010).

Personal Factors (Socio-demographic characteristics) Associated with Percutaneous Injuries and Blood/Body Fluid Exposures

Research has shown that socio-demographic characteristics of healthcare workers like; job category, age, gender, level of education, unit/department assigned are all factors that could lead to the occurrence of PIs and BBFEs among HCWs. Majority of reported exposures are said to occur during activities such as drawing blood sample, giving injection, IV catheter insertion, disposal of contaminated needles, needle recapping and washing of instruments (NIOSH, 2008).

Occupational exposures per gender of nurses and other HCWs

There are varied literature regarding gender of healthcare workers and the occurrence of percutaneous injuries and blood/body fluid exposures. While some studies reported higher occupational exposures among male HCWs other studies reported the opposite. A case-control study to examine the occurrence of sharp injuries and exposure to blood/body fluids in healthcare workers in Ethiopia found sex of the respondent and being a nurse as determinants for exposure to PIs or BBFEs (Alemayehu et al., 2016). Cross-sectional studies

among HCWs in Jamaica and Thailand, showed that females were at a lower risk of BBFEs than males (Vaz, McGrowder, Crawford, Alexander-Lindo, & Irving, 2010; Kasatpibal et al., 2016). Similarly, Mehrdad, Soheila, and Marion (2008) and Kassa et al. (2016), also reported higher chances of experiencing injuries and exposures to PIs in male HCWs than females in Iran, France, United States of America and Botswana. Additionally, Chalya et al. (2015) and El-Hazmi & Al-Majid (2008) also reported in their studies that injuries involved more female nurses than males.

In a sharp contrast, cross-sectional studies by Hanafi et al. (2011) and Rampal et al. (2010) both reported no significant association between gender and occurrence of occupational sharp injury. The difference in the results could be influenced by the sample size and the proportion of males and females in the sample population.

Occupational exposures per age of nurses and other HCWs

A study among HCWs in Botswana and another in Thailand both reported that age was not a factor for accidental exposures to percutaneous injuries and blood/body fluid exposures (Kassa et al., 2016 ; Kasatpibal et al.,2016). However, a study conducted in South Africa Witbank hospital revealed that younger HCWs are at a higher risk of exposure to patients' body fluids. The study further added that those within the age range 20–29 years were mostly exposed than those above that age range (Lachowicz & Matthews, 2009). Similarly, Chalya et al. (2015), reported that HCWs between the age group 21 - 30 years had the highest rate of injuries than those above 40 years. Contrary to these studies, Sabbah, Sabbah, Sabbah, Akoum, & Droubi (2013) rather reported in a study among HCWs in southern Lebanon that older and

more experienced HCWs were most exposed to BBFEs than the younger and less experience workers.

Occupational exposures per work experience of nurses and other HCWs

Kassa et al. (2016) revealed that HCWs with more than 5 years of working experience have a lower risk of exposure than those with less than 5 years' working experience. Similarly, Honda et al. (2011), Sabbah et al. (2013) and Chalya et al. (2015) all reported in their studies that, nurses and HCWs with more years of experience had less risk of occupational exposure than the less experienced ones. Additionally, Lema & Teka (2015) also reported in their study that, HCWs with less than one year of experience were less likely to experience exposures than those with more than 15 years of working experience.

However, Laisser and Home (2017), in a descriptive cross sectional study to determine the incidence and human factors associated with percutaneous injuries and splash exposures among HCWs in Tanzania reported the contrary. The findings from their study rather indicated that HCWs with 10 years (more experience) of work experience encountered more PIs exposures than the less experienced staff.

Additionally, results of a study in South Korea to examine the incidence to needlestick or sharp injuries and identify the factors associated with such injuries among hospital nurses, found a significant association in working experience of the nurses and the occurrence of injuries. The study also found that nurses with fewer years of experience had more injuries (Choa, Leea, Choib,Park, Yooa, & Aikend, 2013). This could be due to the fact that younger nurses apply more newly acquired knowledge into practice, while the

experienced ones may be complacent which make them take fewer precautions when working.

Occupational exposures per educational level of nurses and other HCWs

Tang, Jamulitrat, Chongsuvivatwong, & McNeil (2009) in their study to assess the incidence and risk factors for sharps injury among healthcare workers in China's Hospitals, found no relationship between level of education and the risk of sharps injury. A cross-sectional study among HCWs in Tehran revealed that, educational level influenced the occurrence of occupational exposures. Higher education was associated with increased workload and responsibility, therefore increasing ones chances of acquiring PIs (Yarahmadi, Dizaji, Hossieni, Farshad, & Bakand, 2014). Similarly, Ghofranipour, (2009), also reported that nurses with high academic qualifications were at a lower risk of sharps injury than those without high academic qualifications. Also, findings by Wafula (2012) showed that, respondents with diploma education and above stand a lower chance of being involved in a sharps injury incidence than those with education level below diploma. The differences in exposure levels across the different educational levels could be that, those with higher education has adequate knowledge in the prevention of injuries and exposures that those with low level of education (certificate).

Occupational exposures per job category of nurses and other HCWs

Several studies have recognized certain cadre of workers to be at greater risk than others because of the nature of their work. Medical, Dental, Nursing and Midwifery workers are at higher risk for occupational exposure to blood borne pathogens due to PIs and BBFEs than other HCWs (Hofranipour, Asadpour, Ardebili, Niknami, & Hajizadeh, 2009). Most studies have reported

higher rates of percutaneous injuries among nurses than other HCWs. There are various factors that have been identified as causing more exposures among nurses. These factors include among others; a relatively higher number of nurses in health settings than doctors and other HCWs, reluctance of doctors to report injuries, the lack of experience in conducting some medical procedures, insufficient training on exposure prevention, work overload and fatigue (Bahadori & Sadigh, 2010). Similarly, a southern Lebanon study among HCWs to examine their occupational exposures to blood and body fluids indicated that, nurses were the most affected group among the different categories of health care workers (Sabbah et al., 2013).

Additionally, a study among nurses in India and another among HCWs in Kenya, both reported that nurses were more exposed to the risk of PIs and exposure to blood-borne diseases than those working in other job cadres in the hospital (Bagdey et al., 2014; Wafula, 2012). Mahfouz et al. (2009) conducted a study among physicians and nurses in Saudi Arabia, the results of this study showed that a higher percentage of the exposures to NSI occurred among the nurses than physicians.

Organizational Factors Associated with Percutaneous Injuries and Blood/Body Fluid Exposures

Occupational exposures per unit/department of nurses and other HCWs

Results of studies conducted in India and another in Ethiopia reported that, sharp injuries and exposures to patients' body fluids occurred highest among HCWs working in in-patients wards than those in other units (Chakravarthy, Singh, Arora, Sengupta, & Munshi, 2015; Atlaw, 2013). Additionally, a descriptive cross-sectional study conducted in north-western

Tanzania reported that HCWs from Paediatric department reported more incidence of PI than those in others department (Laisser & Home, 2017). Another study in a Hospital in Malaysia, also reported that HCWs from the medical ward reported the highest cases of sharps injuries than those in other department (Ramphal et al., 2010).

Studies in Washington DC and Ethiopia reported that exposure to splashes and PIs occurred predominantly in acute settings like in operation rooms. The studies also indicated that HCWs who worked in the maternity wards were less likely to get injured by PIs than those who worked in Emergency unit. The studies further suggested that HCWs working in maternity units had a higher risk of exposure to blood and other body fluids than those at the emergency unit (Treakle, Schultz, Giannakos, Joyce, & Gordin, 2011; Walle et al., 2013).

Contrary to these studies, a case-control study to examine the occurrence of PIs and exposure to blood and other body fluids in healthcare workers in Ethiopia also confirmed that, the risks of PIs and BBFEs varies between different units. The findings further revealed that, most of the exposures in the study occurred at the Out-patient department than the in-inpatient wards (Alemayehu, Worku & Assefa, 2016). The differences in exposure levels across the various units could be due to the fact that different cadres of nurses are mostly assigned to some particular units/departments to perform different nursing procedures and activities from those in other units/departments.

Occupational exposures per training of nurses and other HCWs

A study in Nigeria to identify exposure to work-related sharp injuries among nurses reported that, more than half of the respondents said they had

attended a training program prior to the study, while 42.5% of them had not (Adejumo & Taofikat, 2014). Results of a study in Tanzania among healthcare workers showed that, those who had not attended any training on needle stick and splash exposures prevention and management were at a greater risk of sustaining injuries and exposures than those who had some training (Chalya et al., 2015). Similarly, cross-sectional studies in Botswana and Thailand by Kassa et al. (2016) and Kasatpibal et al. (2016) among HCWs also reported that untrained HCWs are at greater risk of exposure than those trained. Additionally, Janjua, Khan & Mahmood (2010) and Tang et al. (2009) also revealed in their studies that, HCWs with higher knowledge of the risks of exposure to medical sharps were associated with fewer injuries.

Occupational exposures per working environment of nurses and other HCWs

The health care environment is a hectic and stressful one, and long duty hours are common. It must be ensured that people putting in long hours continuously get to take short breaks in between, to refresh themselves up. Afridi, Kumar, and Sayani (2013) conducted a study to determine the factors associated with Needle Stick Injuries (NSIs) in healthcare occupation. The study indicated that the highest incidence of NSIs was seen in nurses and that the associated factor was number of shifts per month (stress).

Mehrdad, Atkins, Sharifian and Pouryaghoub, (2014) also conducted a cross-sectional study to assess needle stick, sharp injury and exposure to blood-borne pathogens among nurses in Iran and to determine the association between these exposures and psychosocial factors at work. Of the 339 participants, 197 (58.1%) reported needle-stick injury, 186 (54.6%) reported another type of

sharp injury, and 112 (33%) reported a mucous membrane exposure during the previous year. Those with middle or high level of stress had higher crude and adjusted odds than those with lower stress for all kinds of exposure.

Safety and universal precaution guidelines

Universal precautions have been reported to reduce the risk of HIV transmission and other blood-borne pathogens among health care workers. However, some studies have indicated poor compliance to universal precautions particularly in developing countries where the prevalence of these pathogens is reported to be high (Amira & Awobusuyi, 2014). A cross-sectional study among healthcare workers to determine the frequency and factors contributing to NSIs and splash exposures as well as post-exposure practices reported that most needle stick injuries and splash exposures occurred when universal precautions or standard procedures were not followed (87.7%), while a much smaller proportion (12.3%) had needle-stick injuries and splash exposures despite following adequate universal precautions (Chalya et al., 2015).

According to the Centers for Disease Controls and Prevention, interventions like strict adherence to universal precautions and double gloving during surgical procedures have almost eliminated the possibility of transmitting HBV, HCV and HIV viruses from healthcare provider to patients (CDC, 2013).

In a cross sectional study conducted among 526 HCWs working in two public hospitals in Ethiopia, the results revealed that, 48.2 % of the HCWs reported that they regularly followed standard procedures. However, their findings indicated that regularly following standard precautions has no significant relation with percutaneous injury (Fisman, Harris, Rubin, Sorock, &

Mittleman, (2007); Pathak, Kahlon, Ahluwalia, Sharma, & Bhardwaj, 2012). Also, a study to explore the frequency of sharp injuries and to identify risk factors for these injuries among HCWs in the United Arab Emirates showed that compliance with standard precautions significantly reduces the risk of suffering a sharps injury (Jacob, Newson-Smith, Murphy, Steiner, & Dick, 2010).

Behavioural factors associated with exposure to Percutaneous Injuries and Blood/Body Fluid Exposures

Several conditions and factors are associated with percutaneous injuries and splash exposures among nurses and other HCWs. The common factors associated with these injuries and exposures include; working in haste, high workload, fatigue, inadequate working space, improper disposal of sharps and recapping of needles (Blenkharn, 2009).

Other factors may lead to the occurrence of PIs. According to literature, the common factors leading to the occurrence of exposures include: double-handed recapping, unsafe collection and disposal of used sharps, the overuse of injection, lack of supply of adequate PPEs, lack of hazards awareness, lack of training and improper disposal of used needles and sharps (Abkar, Wahdan, Sherif, & Raja'a, 2013 ; Yacoub, Al Ali, Moukeh, Lahdo, Mouhammad, & Nasser, 2010).

A cross-sectional study among nurses in Thailand found that, nurses do experience PIs while performing some duties and procedures. These duties and procedures include; administering of injections, recapping of needles, assisting with a surgical operation, cleaning instruments during surgery, cleaning instruments after surgery and many others. The study further found an association between working in haste, lack of hazard awareness, not wearing

PPEs, and high work load with exposure to PIs and BBFEs (Kasatpibal et al., 2016).

Another cross-sectional descriptive survey among nurses in Nigeria also revealed that, exposure to work related sharp injuries occurred while they were administering injections, recapping needles, breaking medication ampoules and while packing used syringes and needles for disposal. Additionally, they also cited attempting to meet patient's needs in a hurry (haste), individual carelessness, attempting to recap punctured infusion bag with needles and assisting in the operating theatre as some activities that exposed the nurses to injuries (Adejumo & Taofikat, 2014). A retrospective study among healthcare professionals in Saudi Arabia also mentioned the circumstances leading to injuries to include; during needle disposal, during a medical procedure, during recapping of needle and during surgery as some of the events that caused their injuries (Syam, Santos, & Hakawi, 2013).

Mahfouz et al. (2009) also in Saudi Arabia mentioned that, needle recapping and bending needle (manipulation) after use prior to their disposal were common and associated with the occurrence of injuries. In a study to assess the use of sharps with safety features and evaluate underreporting in workplace-based surveillance, Quinn et al., (2009) found that contributing factors were sharps disposal, contact with waste and patient handling. Manzoor et al. (2010) in a study in Pakistan stated that respondents in their study cited activities like: drawing blood, giving an injection, opening syringe cap, breaking ampoules and recapping syringes as the causes of their NSI exposures.

Also, Adejumo and Taofikat (2014) mentioned in their study that activities like; manipulating needles, disposal of needles and sharps, collision

with other workers, during sharps cleaning, accessing IV line and recapping needles exposed HCWs to percutaneous injuries. Furthermore findings from two studies conducted among healthcare workers in Ethiopia showed that needle stick injuries remain the leading cause of occupational exposures to percutaneous injuries, blood and body fluids. One of the studies also reported that, about half of the injuries occurred as a result of a sharp object placed in a wrong place or while inserting the object in the sharp disposal container; with recapping of used needles identified to be the highest cause of PIs (Alemayehu et al., 2016 ; Atlaw, 2013 ; Mandal, 2013).

Preventive measures of the exposures of PIs and BBFEs

Percutaneous injuries, blood and body fluid exposures can be prevented if basic infection prevention strategies are followed. In some high-income countries, implementation of Standard/Universal Precaution measures, injury surveillance programs, provision of personal protective equipment (PPE), routine hepatitis B vaccination, post-exposure prophylaxis (PEP) and engineered safety devices have yielded results (Sangwan, Kotwal, & Verma, 2011).

Van der Molen, Zwinderman, Sluiter, & Frings-Dresen, (2011) recommended in their study the introduction of safety devices as the way to prevent PIs. Also preventive measures, such as training in safe working routines and personal protective equipment are expected to improve safe working conditions of HCWs.

The CDC also recommended the universal precaution guidelines with the main themes of the guidelines being injury prevention through handling and proper disposal of the sharps (CDC, 2008). The International Health Care

Worker Safety Centre (2012) also proposed that every health care institution should aim at eliminating the risk posed by PIs. They encouraged health facilities to initiate periodic reviews and update exposure control plans and also be able to make them available within fifteen days if requested.

A needle stick injury exposure in African countries is mostly higher than other countries due to the inadequate supply of PPEs and limited organizational support (Moges & Tadesse, 2010; Alemayehu, 2008).

Strategies for a safer work environment are mandatory for protection of health care workers from blood borne infections. According to the American Nurses Association, more than 80% of needle-stick injuries can be prevented with safer equipment such as: by the use of goggles, face masks or face shields, gloves, gowns, aprons, boots (Royal College of Nursing, 1997). Furthermore, utilization of personal protective devices, availability of safety box at work place, infection prevention training, vaccination against infectious diseases and availability of infection control policies and protocols can address issues in relation to blood borne diseases (WHO, 1995; Sadoh, Fawole, Sado, et al., 2006).

Reporting behaviour of nurses and other HCWs

Reporting of injuries to occupational health departments can reduce rates of injury through identification of risk-prone behaviours and practices. Under-reporting may lead to inaccurate information regarding the overall risk of exposure to pathogens and full documentation and reporting of exposures and injuries mostly lead to improvements in their prevention (Martins, Coelho, Vieira, Matos, & Pinto, 2012). Healthcare workers who report their injuries to the concerned body are less likely to be exposed to PIs in future than those who

don't report their injuries (Walle et al., 2013). Lukianskyte et al. (2011) also revealed in a study to determine the frequency of needle sticks and sharps injuries that, about half of the injuries sustained by the respondents were not reported to the necessary authority. They believe that it was not important to report, they not having time to report and they not knowing how or where to report the injuries were some of the reasons respondents gave for not reporting.

Honda et al. (2011) revealed that only a quarter of the nurses who sustained PIs in their study reported their injuries to the hospital. They mentioned the injury not being too serious, the fact that they were too busy to report, the absence of a systematic reporting system, and they considering the source of injury not to be infectious as some reasons for not reporting the injuries. Sabbah et al. (2013) in their study to assess the knowledge, attitude and practice of healthcare workers in occupational exposures to blood/body fluids in Lebanon indicated that, even though 30% of the respondents got accidental exposures to PIs and BBFEs, only two thirds of them actually reported their exposure to the department responsible for managing them.

Chapter Summary

The literature review presented in this chapter identified the hierarchy of control theory which served as the theoretical model for the study with some of the relevant constructs of the model adopted. The review also highlighted the global and Sub-Saharan Africa perspectives of occupational exposures to percutaneous injuries and blood/body fluids among Nurses and other HCWs and the factors associated with the exposures. The literature reviewed so far indicate there is abundant literature in the developed countries on occupational exposure to nurses and the healthcare workers to percutaneous injuries and blood/body

fluid exposures. Regrettably, very little has been reported in developing countries where most of these exposures are frequent. At the national level, the researcher came across one study done at the emergency unit of the Komfo Anokye Teaching Hospital among 45 operation room nurses. This study apart from the fact that the sample size used was too small, the study only examined the frequency of sharps injuries and did not include blood and body fluid exposures. It also failed to point out the category of nurses who were involved in the study.

Additionally, the study also denied nurses in other units and departments who also stand a higher risk of encountering these injuries and exposures the chance to be part of the study. The current study however, looked at needle sticks, sharp injuries and contact with patients' blood and body fluids among three different categories of nurses (Registered nurses, Enrolled nurses and Midwives) working at different units and departments at the Tamale West and Central hospitals. A cursory look at the forgoing points to the need to conduct this study in Ghana due to the scanty research in the topic area. The next chapter will describe the methodology used to conduct the current study.

CHAPTER THREE

RESEARCH METHODS

Introduction

This chapter describes the overall approach employed in this study to achieve the research objectives. This study establishes the prevalence and factors associated with percutaneous injuries, and blood/body fluids exposures among nurses at two hospitals in the Tamale Metropolis. The research design, the setting in which the study was conducted, the study population and the sampling method used are all described in this chapter. Additionally, the data collection method and the data analysis plan are also presented here. Lastly, details pertaining to measures of validity and reliability and the ethical considerations applied in this study are discussed in this chapter.

Research Design

Research design is a comprehensive plan for data collection in an empirical research project. It is a blueprint for empirical research aimed at answering specific research questions or testing specific hypotheses (Bhattacharjee, 2012). Depending on the purpose and objectives of a study, different researchers can adopt different research designs such as laboratory experiments, field experiments, field surveys, case research, phenomenology, ethnography and many other designs to conduct their studies. According to Opoku (2005), the research design is the plan and structure of the research to guide data collection. It helps the researcher to know in advance the statistical

test needed to analyse data. In order to accomplish the objectives of this study, the cross-sectional descriptive quantitative survey was employed.

The cross-sectional descriptive method involves description of events, situation and phenomena. Olsen and St George (2004) define cross-sectional survey as a type of observational study that involves the analysis of data collected from a population or a sample at one specific point in time. In cross-sectional surveys, dependent and independent variables are measured at the same point in time (Bhattacharjee, 2012).

This design was chosen because the purpose of this study was to gather and analyse data. Additionally, this study design was used due to its advantages of being relatively less time consuming, less costly, easy to apply in quantitative approaches and its accurateness in collecting data for the subject under study. Also, it is particularly suitable for estimating the prevalence of a behaviour or disease in a population (Sedgwick, 2014). The researcher therefore settled on it as the design of choice for this study because the main objective of this study was to estimate the prevalence and factors associated with percutaneous injuries and blood/body fluid exposures among nurses in the Tamale Metropolis.

However, despite the known strengths of a cross-sectional survey, it is not without any weaknesses. Bhattacharjee (2012), states that due to the non-temporal nature of cross-sectional surveys, cause-effect relationships are difficult to infer and they may be subject to respondent biases. However, pre-testing of the data collection instruments and limited contact with respondents was used to overcome these weaknesses. Additionally, a structured self-administered questionnaire was used to collect data for this study.

Study Area

The study was conducted in the Tamale Metropolitan Area, the capital town of the Northern Region of Ghana. Tamale is Ghana's fourth largest city with a population of 233,252, according to the 2010 population and housing census (Ghana Statistical Service, 2014). The town is located 600 km (370 miles) north of Accra. Tamale is in the Northern region, more precisely in the Kingdom of Dagbon, with most of the inhabitants mainly Dagombas and Muslims. The Tamale Metropolis is one of the 26 districts in the Northern Region of Ghana. It is located in the central part of the Region and shares boundaries with the Sagnarigu District to the West-North, Mion District to the East, East Gonja to the south and Central Gonja to the south-west.

The health services in the Metropolis are managed at three (3) levels, namely: Metropolitan Health Administration level, Sub-district level and the Community level. At the administrative level, the Metropolitan Health Management Team (MHMT) is responsible for the overall planning, monitoring, supervision, evaluation, training and co-ordination of all health programmes in the Metropolis. The city is host to the Tamale Teaching Hospital which is a tertiary facility that serves as a major referral facility for hospitals in the three northern regions. The number of health facilities within the Metropolis is quite satisfactory, however, most of these facilities are in the rural areas and poorly equipped. Aside the Tamale Teaching Hospital, the Tamale Central and Tamale West Hospitals are the only well-equipped government facilities in the Metropolis (Tamale Metropolitan Health Directorate [TMHD], 2015).

This study was conducted in the Tamale West Hospital and Tamale Central Hospital, two major facilities in the Metropolis. These hospitals serve the people of Tamale and its environs with a target population of not less than 350,000 people (Annual Mid-year Review Reports, 2016). The facilities were purposively selected based on their size and secondly due to the large number of nurses working there. The two hospitals also serve as referral point for clinics and health centres from nearby districts like; Tolon, Kumbungu, Mion, Central Gonja and Savelugu/Nanton districts. They provide 24 hour services and offer the following: Medical services, Antenatal Care [ANC] services, Prevention of Mother to Child Transmission and Counselling [PMTCT] Services and Anti-Retroviral Treatment [ART] Services. The rest are Laboratory and Radiological services, Ultrasonography Services, Ear, Nose and Throat [ENT] Services, Ophthalmic services, Gynaecological Services, Surgical services, and Herbal treatment services. The two facilities are fully accredited with the National Health Insurance Scheme and other private mutual health scheme in the region.

Study Population

The study targeted Registered nurses (Certificate, Diploma, and Degree), Midwives (all category) and Enrolled nurses who are known to be potentially at risk of being injured or infected due to their exposure to needle sticks, sharp injuries and blood/body fluids. A total study population of 572 nurses was targeted for this study from the two hospitals, out of which a statistically representative sample was drawn. Nurses working in the following departments: Medical wards, Emergency wards, Paediatric wards, Surgical wards, Labour wards, Surgical theatres, Maternity wards, Out-Patient

Department and other high risk units of the two hospitals were considered for this study. The study population composition and size is presented in table 1.

Table 1: Population of Nurses by Health Facilities

Category of Nurses	Tamale Central Hospital	Tamale West Hospital	Total
Registered nurses	82	72	154
Midwives	33	42	75
Enrolled nurses	166	177	343
Facility total	281	291	572

Source: Second Quarter Hospital Nominal Rolls (2016)

Sampling Size and Sample size Determination

Burns and Grove (2005) defined sample as a subset of the population that is selected for a study. Sampling includes selecting groups of people, events, behaviours or other elements with which to conduct a study. A sample size of 224 nurses who met the inclusion criteria were drawn from a total population of 572 nurses for the study.

The sample size was calculated using the formula developed by Cochran (1963) to yield a representative sample for proportions. The proportion of nurses at risk of PI injury in Ghana is estimated to be 29% (Lori et al., 2016). Also, a confidence level of 95% and a desired level of precision set at 5% were used for the sample size determination.

$$n_0 = \frac{z^2 pq}{e^2}$$

Where,

n_0 = the sample size

z = standard normal deviation which is 1.96 at 95% confidence interval

p = proportion of the population estimated to be at risk (0.29)

q = proportion of the population not at risk (1 - 0.29 = 0.71)

e = desired level of precision set at 5% (0.05)

This implies,

$$n_0 = \frac{1.96^2 \times 0.29 \times 0.71}{0.05^2}$$

$$0.05^2$$

$$n_0 = \frac{0.7909}{0.0025}$$

$$0.0025$$

$$n_0 = 316$$

Since the target population was less than 10,000, the final sample size was

adjusted using the formula:

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

Where,

n = sample size desired when the population is less than 10,000 and

N = the population size = 572

This gives,

$$n = \frac{316}{\frac{1 + 316 - 1}{572}}$$

$$n = \frac{316}{1 + 0.551}$$

$$n = \frac{316}{1.55}$$

$$n = 204$$

The minimum sample size for the study was 204 nurses, but there was an upward adjustment of 10% for non-response rate. By considering the non-response rate, the final sample size used for the study was 224 nurses.

The allocation of the sample size across strata was done using the proportional allocation method to determine the sample figure for each of the category of nurses in the two hospitals to get their respective sample figure as shown in table 2 using the formula:

$$n(k) = n \left(\frac{N_k}{\sum N_k} \right)$$

Let k represent the categories of nurses, the formula for the k sample size is given as;

$$n(k) = \text{number selected from each stratum}$$

$$n = \text{sample size} = 224$$

$$N_k = \text{population in each stratum}$$

$$\sum N_k = \text{total number of strata (categories of nurses)} = 572$$

The questionnaires were distributed to 60 Registered nurses, 30 Midwives and 134 Enrolled nurses across the two selected facilities. From the total of 224

questionnaires distributed to the respondents, 215 usable questionnaires (96% response rate) were retrieved and used for the study. The remaining 9(4%) constituted missing, wrongly filled and half-filled questionnaires that were considered unusable.

Table 2: Stratified Representative Population of Nurses used for the Study

Category	Tamale Central Hospital	Tamale West Hospital	Total
Registered General Nurses	32	28	60
Midwives	13	17	30
Enrolled Nurses	65	69	134
Facility Total	110	114	224

Sampling Technique

Nurses from the two secondary hospitals in the Metropolis, the Tamale West and Tamale Central hospitals were selected for this study. A proportional stratified sampling method was used to sample the different categories of nurses for the study. “In stratified sampling, the sampling frame is divided into homogeneous and non-overlapping subgroups called (“strata”) (Bhattacharjee, 2012). In this study, the participants were segmented into three subsets based on the nurse categories (Registered nurses, Midwives and Enrolled nurses). The number of nurses in each category was chosen based on the proportion of nurses in that category in the total population. The stratified random sampling method

was used to select respondents from each stratum to get the required sample size of 224 nurses.

Inclusion Criteria

The study included nurses from the two selected hospitals who were Registered nurses (certificate, diploma and degree), Midwives (all categories) or Enrolled nurses who were at risk of percutaneous injuries and exposure to patients' blood and body fluids.

Exclusion Criteria

Community Health Nurses, Ward Assistants, Student Nurses, Nurse Interns, Nurses on leave (maternity, sick, annual, and study leave) and all those working at non-clinical areas were excluded from the study.

Data Collection Instrument

A structured and self-administered questionnaire with closed ended questions developed by the researcher was used for the data collection. In designing the instrument, the purpose and objectives of the study served as standard reference points for selecting the items. Headings were carved out of the objectives and research questions of the study. The questionnaire was subdivided into four sections with 28 items. Section A had 5 items that captured the socio-demographic characteristics of the respondents. Section B had 3 items with questions determining the occurrence of percutaneous injuries, blood and body fluid exposures among nurses. Section C had 13 items with questions that identified the organizational factors associated with percutaneous injuries, blood and body fluid exposures, and Section D had 7 items with questions that examined the behavioural factors associated with exposures to percutaneous injuries, blood and body fluid.

Pretesting of Instrument

Pre-testing of the data collection instrument refers to testing the instrument prior to the actual collection of data (Polit, & Beck, 2008). The questionnaire with 28 items was pre-tested on the 20th March, 2017 at the Savelugu Municipal Hospital, one of the hospitals in the Northern Region with similar characteristics with the chosen study area. The pre-test was carried out among 20 nurses (6 Registered nurses, 6 Midwives and 8 Enrolled nurses) working in high risk exposure areas. The respondents were requested to indicate if they had any difficulty in understanding the questionnaire's instructions or the meaning of the words in the questionnaire. The respondents however indicated that they had no difficulty in answering the questions or understanding the instructions, changes were therefore not made to the instrument.

The data obtained from the 20 pre-tested questionnaires (100% return rate) was entered into Statistical Package for Social Sciences (SPSS) version 22.0 and statistically tested to determine normality of the data as well as the internal consistency of the instrument. The Q-Q and scatter plot test of normality was employed and the results showed a dispersed distribution, hence, non-normally distributed.

Validity and Reliability of Instrument

Validity refers to an instrument being able to measure what it is supposed to measure and reliability on the other hand ensures the consistency and dependability of the instrument. To establish validity and reliability of the instrument, the researcher adopted steps to ensure that objectives set truly reflected the focus and purpose of the study. These objectives were established following rigorous literature review of percutaneous injuries and blood/body

fluid exposures among nurses and other health workers. More so, a pilot study was conducted on 20 nurses at the Savelugu Municipal Hospital; this hospital shares similar characteristics with hospitals in Tamale Metropolis.

A Cronbach's alpha (α) test was done on the piloted questionnaire to determine internal correlation between variables. Rovai, Baker, & Ponton (2014) recommended measuring internal consistency and reliability using Cronbach's alpha. An alpha value of 0.75 was considered reliable and a value greater than 0.7 considered acceptable (George & Mallery, 2003). The reliability statistic, Cronbach's coefficient alpha value for this study tool was 0.74.

Additionally, the respondents were carefully selected using stratified random sampling method. This offered a fair representation to the three nursing categories in the two hospitals to ensure that a credible data was produced. Also, the instrument was subjected to critiquing by supervisors and colleague researchers which led to some modifications and improvement of its quality. Finally, the study was conducted in a logical flow and items simplified to make for uniformity in meaning for better understanding and responses.

Data Collection Procedure

Data collection was done over a period of three weeks, thus from 13th April – 3rd May, 2017. The questionnaire, along with a cover letter to introduce the purpose of the study and the rights of respondents were personally distributed to the respondents by the researcher and the research assistants. The researcher recruited three nurses with bachelor degree and adequately trained them to serve as research assistants for the data collection process. Information was given to each of them on the objectives, relevance of the study, confidentiality, respondent characteristics and informed consent. Two persons

each were assigned to each of the two chosen hospitals for the data collection process (The three research assistants plus the principal researcher). The whole data collection process was under the sole supervision of the principal researcher. Respondents were then requested to read the consent form and sign to indicate their consent to the study. The respondents were randomly selected from the three categories of nurses grouped into strata and only those who consented to take part were included in the study.

A period of one week was allowed for consented respondents to complete the survey. The researcher and his assistants then went round the various facilities to collect the completed questionnaire. The questionnaires were distributed to 60 Registered nurses, 30 Midwives and 134 Enrolled nurses across the two selected facilities. For those who were unable to complete it within the stipulated time, another week was given for them to do so. A final mop-up was done during the third week to gather the remaining questionnaires.

Some nurses' refusal to take part in the research and reports of missing questionnaires were some few challenges encountered during the data collection process. However, this did not affect the sample size since 10% non-response rate was calculated and added to the final sample size. From the total 224 questionnaires distributed to the respondents, 215 usable questionnaires were retrieved and used for the study. A questionnaire return rate of 96% was therefore achieved.

Data Processing and Analysis

Data analysis is the systematic organization and synthesis of research data. Retrieved questionnaires were checked for completeness and missing values. Each questionnaire completed by the respondents was checked for

accuracy and consistency of the responses to the items on the instrument. The questionnaire was also checked for comprehensiveness of the responses. After the editing, a template was developed and used to create a data analysis matrix on the computer, as well as code responses to the items on the instrument. After the coding, the data was then entered into the SPSS version 22.0, processed and analysed.

Data entry was done facility by facility and after completing entry of each questionnaire, it was marked entered to prevent duplication. When all questionnaires from both facilities were completed, they were bagged in an envelope and labelled completed and sealed. Throughout the process of data entry, the statistical software was set to automatically save data, and the researcher also did manual saving every five minutes. At the end of each day, the data was backed up on an external drive.

For research question one which was meant to determine the prevalence of percutaneous injuries and blood/body fluid exposures among nurses at the Tamale West and Central Hospitals, three (3) questions were used for the analysis. The three 3 questions were measured using dichotomous responses of 'Yes' and 'No'. The responses were further categorized into 'high' and 'low' exposure to percutaneous injuries and blood and body fluid based on the responses provided for each of the questions. Any respondent who chose 2-3 'Yes' for all the items was put into the category of 'high' exposure to percutaneous injuries and blood/body fluid. Respondents who chose 0-1 'Yes' were put into the category 'low' exposure to percutaneous injuries and blood/body fluid.

The results were analysed using the formula;

$$\text{Prevalence (\%)} = \frac{\text{Number of respondents with 'high' exposures}}{\text{Total number of respondents}} \times 100$$

Research question two focused on the personal/ socio-demographic factors associated with percutaneous injuries and blood/body fluid exposures. This research question was analysed using chi-square test for independence. The choice of chi-square test for independence was influenced by the fact that there was an interest in exploring the association between personal/socio-demographic factors and percutaneous injuries and blood/body fluid exposures. The use of chi-square test was appropriate since the independent variables (age, gender, level of education, job category and work experience) were measured on a nominal scale and their responses were put into different categories and the dependent variable (prevalence of percutaneous injuries and blood/body fluid exposures) was categorized into two groups 'high' and 'low'. The analysis was based on a cross-tabulation table, with cases classified according to the categories in each variable. Results were interpreted using chi-square values and p-values at 95% confidence interval, where p-values less than 0.05 were interpreted as statistically significant.

Research question three, which focused on the organizational factors associated with percutaneous injuries and blood/body fluid exposures among nurses in the Tamale Metropolis, was also analysed using chi-square test for independence. The choice of chi-square test for independence was influenced by the fact that there was an interest in exploring the association between

organizational factors and percutaneous injuries and blood/body fluid exposures. The use of chi-square test was appropriate since the independent variables (training of workers, working department and safety universal guidelines) were measured on a nominal scale and their responses were put into dichotomies of 'Yes' and 'No' and the dependent variable (prevalence of percutaneous injuries and blood/body fluid exposures) was categorized into two groups 'high' and 'low'. The analysis was based on a cross-tabulation table, with cases classified according to the categories in each variable. Results were interpreted using chi-square values and p-values at 95% confidence interval, where p-values less than 0.05 were interpreted as statistically significant.

The fourth research question which focused on the behavioural factors associated with percutaneous injuries and blood/body fluid exposures was analysed using chi-square test for independence. The choice of chi-square test for independence was influenced by the fact that there was an interest in exploring the association between behavioural factors and percutaneous injuries and blood/body fluid exposures. The use of chi-square test was appropriate since the independent variables (behavioural factors) were measured on a nominal scale and their responses were categorised using 'Yes' and 'No' and the dependent variable (prevalence of percutaneous injuries and blood/body fluid exposures) was categorized into two groups 'high' and 'low'. The analysis was based on a cross-tabulation table, with cases classified according to the categories in each variable. Results were interpreted using chi-square values and p-values at 95% confidence interval, where p-values less than 0.05 were interpreted as statistically significant.

Ethical Considerations

The researcher sought approval from the Institutional Review Board (IRB) of the University of Cape Coast and clearance obtained from the Ghana Health Service through the Northern Regional Health Directorate. The research participants were involved on voluntary basis by allowing them read and sign a consent form. The benefits for participating in this study were explained to them. They were assured of utmost confidentiality with regards to all the information they provided and that the study would not pose any discomfort to them. Additionally, data was collected anonymously using codes and not names of participants. Participants were given a consent form which explained their understanding of the research and signed to indicate their acceptance to participate in the study. A witness or the lead researcher counter signed to confirm the respondent's consent to participate in the research.

Chapter Summary

A cross-sectional survey design with a quantitative approach was employed to carry out the study at two hospitals in the Tamale Metropolis of the Northern Region, Ghana. The stratified random sampling technique was used to select 215 nurses (Registered nurses, Midwives and Enrolled nurses) for this study using a structured self-administered pretested questionnaire with reliability of 0.74 to collect the data. The questionnaire was designed to reflect the focus and purpose of the study recorded a return rate of 96%.

Retrieved questionnaires were checked for completeness, missing values, coded, entered into the SPSS version 22.0 and analysed. Descriptive statistic technique was employed using frequency and percentages and inferential statistics done using chi-square test for independence. This study was

conducted among nurses practicing within the Tamale Metropolis. The result of this study is therefore limited to the Tamale Metropolis and may not be generalized to cover all nurses or HCWs in the whole region or country.

Additionally, the cross-sectional study design was employed. Despite its advantage of being relatively less expensive to conduct it cannot establish cause and effects relationships or give in-depth meaning/clarification to answers. This chapter also highlighted the inclusion and exclusion criteria and the ethical considerations complied with in this study. The next chapter however will present the results and discussion of the findings of the current study.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter deals with presentation and discussion of the results obtained for this study. The purpose of this study was to determine the prevalence of percutaneous injuries and exposure to patients' blood and body fluid and also assess their associated factors among nurses at the Tamale Metropolis. The study involved 224 nurses in the study area who were potentially at risk of being injured or exposed to needle sticks, sharp injuries and splashes of blood and other body fluids.

The study employed stratified random sampling technique to select nurses from the three different categories working at the two selected hospitals in the Metropolis. The questionnaires were distributed to 60 Registered nurses, 30 Midwives and 134 Enrolled nurses who met the inclusion criteria in the two selected facilities. A total of 215 usable questionnaires were retrieved from the nurses giving a retrieval rate of 96%. The result is presented per the research questions with discussion of the result presented at the end of the chapter.

Results

Research Question One: What is the prevalence of percutaneous injuries and blood/body fluid exposures among nurses at the Tamale Metropolis?

$$\text{Prevalence (\%)} = \frac{\text{Number of respondents with 'high' exposures}}{\text{Total number of respondents}} \times 100$$

Where;

Number of respondents with 'high' exposures = 131

Total number of respondents = 215

$$\begin{aligned} \text{Prevalence (\%)} &= \frac{131}{215} \times 100 \\ &= 0.609 \times 100 \\ &= 61\% \end{aligned}$$

Figure 3 contains the results obtained from the study which indicate that majority of the respondents 61% (131) had high percutaneous injuries and blood/body fluid exposures while 39% (84) had low percutaneous injuries and blood/body fluid exposures.

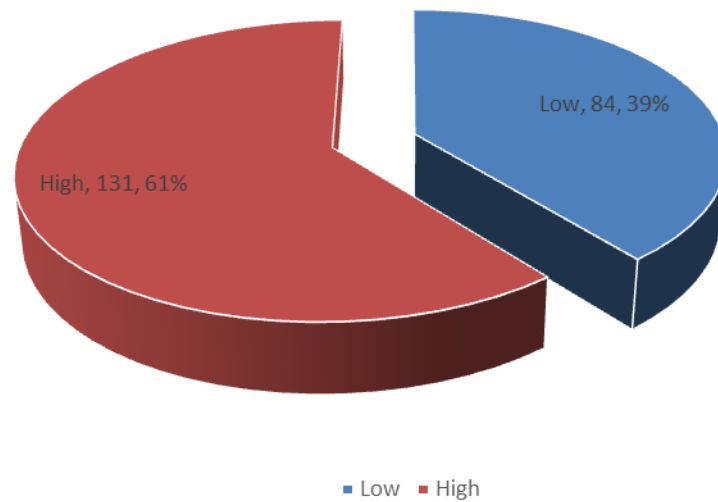


Figure 3: Prevalence of percutaneous injuries and blood/body fluid exposures among nurses

Source: Field Survey, 2017

Research Question Two: What are the socio-demographic factors associated with percutaneous injuries and blood/body fluid exposures among nurses in the Tamale Metropolis?

Table 3 contains the results of chi-square analysis to show the socio-demographic factors associated with percutaneous injuries and blood/body fluid exposures. Comparison of the socio-demographic factors of the respondents in relation to sex shows that 50.7% (n = 38) of the respondents who were male experienced low exposures to percutaneous injuries and blood/body fluid while 67.1% (n = 94) of the females had high exposures to percutaneous injuries and blood/body fluid. Results from the study also showed that there was a statistically significant association between sex and percutaneous injuries and blood/body fluid exposures ($\chi^2 [1, N = 215] = 6.507, p \leq 0.011$) [Table 3].

Table 3: Socio-demographic Factors Associated with Percutaneous Injuries and Blood and Body Fluid Exposures

Variables	Low n (%)	High n (%)	χ^2	p-value
Sex			6.507	0.011*
Male	38 (50.7)	37 (49.3)		
Female	46 (32.9)	94 (67.1)		
Age			2.730	0.604
20-24	1 (33.3)	2 (66.7)		
25-29	54 (43.2)	71 (56.8)		
30-34	10 (28.6)	25 (71.4)		
35-39	12 (37.5)	20 (62.5)		
40 and above	7 (35.0)	13 (65.0)		
Highest educational qualification			13.711	0.001*
Certificate	59 (33.7)	116 (66.3)		
Diploma	16 (55.2)	13 (44.8)		
Degree	9 (81.8)	2 (18.2)		
Job category			3.562	0.168
Registered general nurse	11 (27.5)	29 (72.5)		
Enrolled nurse	71 (41.3)	101(58.7)		
Midwife	2 (66.7)	1 (17.3)		
Work experience			12.124	0.016*
1 – 4 years	49 (35.3)	90 (64.7)		
5 or more years	35 (46.1)	41 (53.9)		

Source: Field Survey, 2017

Again, 43.2% (n = 54) of respondents aged 20-29 years had low exposures to percutaneous injuries and blood/body fluid, while 71.4% (n = 25) of those aged 30-34 years had high exposures percutaneous injuries and blood/body fluid. Results from the study on the association between age and

percutaneous injuries and blood/body fluid exposures showed no statistically significant association (χ^2 [4, N = 215] = 2.730, $p \leq 0.604$) [Table 3].

Comparison of the socio-demographic characteristics of the respondents in relation to highest educational qualification showed that 81.8% (n = 9) of those with degree had low exposures to percutaneous injuries and blood/body fluid, while 66.3% (n = 116) of those who had certificate had high exposures to percutaneous injuries and blood/body fluid. Results on the chi-square test revealed that there was a statistically significant association between highest educational qualification and percutaneous injuries and blood/body fluid exposures (χ^2 [2, N = 215] = 13.711, $p \leq 0.001$) [Table 3]. With job category, 66.7% (n = 2) of the respondents who were midwives had low exposures to percutaneous injuries and blood/body fluid, while 72.5% (n = 29) of the registered nurses had high exposures to percutaneous injuries and blood/body fluid. Results of the chi-square test indicate no statistically significant association between job category and exposure to percutaneous injuries and blood/ body fluid (χ^2 [2, N = 215] = 3.562, $p \leq 0.168$) [Table 3].

Finally, 64.7% (n= 90) of the respondents with 1-4 years' work experience had high exposures to percutaneous injuries and blood/body fluid, while 53.9% (n=41) of those with 5 or more years work experience had low exposures to percutaneous injuries and blood/body fluid. Results on the chi-square test revealed that there was a statistically significant association between work experience and percutaneous injuries and blood and body fluid exposures (χ^2 [4, N = 215] = 13.124, $p \leq 0.016$) [Table 3].

Research Question Three: What are the organizational factors associated with percutaneous injuries and blood/body fluid exposures among nurses in the Tamale Metropolis?

Table 4 contains the results of chi-square analysis to show the organizational factors associated with percutaneous injuries and blood/body fluid exposures.

Table 4: Organizational factors associated with percutaneous injuries and blood and body fluid exposures

Variables	Low n (%)	High n (%)	χ^2	p-value
Working unit/department			6.138	0.408
Medical ward	23 (50.0)	23 (50.0)		
Emergency ward	12 (34.3)	23 (65.7)		
Paediatrics ward	14 (45.2)	17 (54.8)		
Surgical ward	18 (36.0)	32 (64.0)		
Labour ward	5 (50.0)	5 (50.0)		
Maternity ward	3 (25.0)	9 (75.0)		
OPD	9 (29.0)	22 (71.0)		
Does your facility have a procedure/protocol for reporting needle sticks, sharp injuries and splashes of blood and other body fluids?			4.400	0.036*
Yes	16 (27.6)	42 (72.4)		
No	68 (43.3)	89 (56.7)		
Does your hospital provide masks for your use?			5.378	0.020*
Yes	68 (43.9)	87 (56.1)		
No	16 (26.7)	44 (73.3)		
Does your hospital provide gloves for your use?			3.958	0.047*
Yes	83 (39.9)	125 (60.1)		
No	1 (14.3)	6 (85.7)		
Does your hospital provide aprons for your use?			0.383	0.536
Yes	51 (37.5)	85 (62.5)		
No	33 (41.8)	46 (58.2)		
Does your hospital provide lab coats for your use?			4.400	0.036*
Yes	16 (27.6)	42 (72.4)		
No	68 (43.3)	89 (56.7)		
Does your hospital provide safety boots for your use?			3.050	0.081
Yes	34 (33.0)	69 (69.0)		
No	50 (44.6)	62 (56.4)		
Does your hospital provide safety goggles for your use?			0.024	0.876
Yes	21 (38.2)	34 (61.8)		
No	63 (39.4)	97 (60.6)		

Table 4 continued

Variables	Low n (%)	High n (%)	χ^2	p-value
Do you consider the personal protective equipment provided adequate for use all the time?			4.722	0.030*
Yes	23 (29.5)	55 (70.5)		
No	61 (44.5)	76 (55.5)		
Does your facility have Infection prevention and control team/committee in place?			0.221	0.639
Yes	46 (37.7)	76 (62.3)		
No	38 (40.9)	55 (59.1)		
Does your work put so much stress on you?			5.433	0.020*
Yes	48 (33.6)	95 (66.4)		
No	36 (50.0)	36 (50.0)		
Have you received enough pre-service training that can help you deal with exposures to percutaneous injuries, blood and body fluid?			8.367	0.004*
Yes	26 (57.8)	19 (42.2)		
No	58 (34.1)	112 (65.9)		
Has your hospital given you adequate in-service training on how to prevent exposures to percutaneous injuries, blood and body fluid?			6.998	0.008*
Yes	68 (44.7)	84 (53.3)		
No	16 (25.4)	47 (74.6)		

Source: Field Survey, 2017

The results shows that 50% (n = 23) and 50% (n = 5) of the respondents in the medical ward and labour ward had low percutaneous injuries and blood/body fluid exposures, while 75% (n = 9) of those at the maternity ward had high percutaneous injuries and blood/body fluid exposures. Results on the chi-square test show no statistically significant association between working

unit/department and exposure to percutaneous injuries and blood/body fluid (χ^2 [6, N = 215] = 6.138, $p \leq 0.408$) [Table 4].

Surprisingly, 56.7% (n = 89) of the respondents who said their facilities do not have a procedure/protocol for reporting needle sticks, sharp injuries and splashes of blood and other body fluids had low percutaneous injuries and blood/body fluid exposures, while 72.4% (n = 42) of those who said their facilities have a procedure/protocol for reporting needle sticks, sharp injuries and splashes of blood and other body fluids had high exposure to percutaneous injuries and blood/body fluid. Results of the chi-square tests show a statistically significant association between the existence of procedure/protocol for reporting needle sticks, sharp injuries and splashes of blood and other body fluids in health facilities and exposure to percutaneous injuries and blood/body fluid (χ^2 [1, N = 215] = 4.400, $p \leq 0.036$) [Table 4].

Also, the result revealed that, the provision of mask for use by the hospitals showed a lower exposure to percutaneous injuries and blood/body fluid exposures in respondents (43.9% [n = 68]), while the non-provision of mask for use by hospitals showed a higher exposure to percutaneous injuries and blood/body fluid exposures in respondents (26.7% [n = 16]). Results of the chi-square tests show a statistically significant association between the provision of masks in hospitals and percutaneous injuries and blood/body fluid exposures (χ^2 [1, N = 215] = 5.378, $p \leq 0.020$) [Table 4].

Additionally, the non-provision of gloves for use by hospitals showed a higher exposure to percutaneous injuries and blood/body fluid exposures in respondents (85.7% [n = 6]), while the provision of gloves for use by hospitals showed a lower exposure to percutaneous injuries and blood/body fluid

exposures in respondents (60.1% [n = 125]). Results of the chi-square tests show a statistically significant association between the provision of gloves in hospitals and percutaneous injuries and blood/body fluid exposures (χ^2 [1, N = 215] = 3.958, $p \leq 0.047$) [Table 4].

Additionally, the non-provision of aprons for use by hospitals showed a lower exposure to percutaneous injuries and blood/body fluid exposures in respondents (58.2% [n= 46]) than respondents in hospitals that provided aprons for use showed a higher exposure to percutaneous injuries and blood/body fluid exposures (62.5% [n = 85]). Results of the chi-square tests showed no statistically significant association between the provision of aprons in hospitals and exposure to percutaneous injuries and blood/body fluid (χ^2 [1, N = 215] = 0.383, $p \leq 0.536$) [Table 4].

On the provision of lab coats by the hospitals, the results showed a lower exposure in respondents in hospitals that did not provide adequate lab coats for use (56.7% [n = 89]), while a higher exposure was reported among respondents in hospitals that provided lab coats for their use 72.4% (n = 42). Results of the chi-square tests showed a statistically significant association between the provision of lab coats in hospitals and exposures to percutaneous injuries and blood/body fluid (χ^2 [1, N = 215] = 4.400, $p \leq 0.036$) [Table 4].

Additionally, the non-provision of safety boots for use by hospitals showed a lower exposure to percutaneous injuries and blood/body fluid exposures in respondents (56.4% [n= 62]) than respondents in hospitals that provided safety boots for use which showed a higher exposure to percutaneous injuries and blood/body fluid exposures (69.0% [n = 69]). Results of the chi-square tests showed no statistically significant association between the

provision of safety boots in hospitals and percutaneous injuries and blood/body fluid exposures ($\chi^2 [1, N = 215] = 3.050, p \leq 0.081$) [Table 4].

Additionally, the non-provision of safety goggles for use by hospitals showed a lower exposure to percutaneous injuries and blood/body fluid exposures in respondents (60.6% [n= 97]) than respondents in hospitals that provided safety boots for use which rather showed a higher exposure to percutaneous injuries and blood/body fluid exposures (61.8% [n = 34]). Results of the chi-square tests showed no statistically significant association between the provision of safety goggles in hospitals and exposure to percutaneous injuries and blood/body fluid ($\chi^2 [1, N = 215] = 0.024, p \leq 0.876$) [Table 4].

The inadequate provision of personal protective equipment for use by hospitals showed a lower exposure to percutaneous injuries and blood/body fluid exposures in respondents (55.5% [n= 76]) than respondents in hospitals that provided adequate personal protective equipment for use which rather showed higher exposure to percutaneous injuries and blood/body fluid exposures (70.5% [n = 55]). Results of the chi-square tests showed statistically significant association between provision of adequate personal protective equipment and percutaneous injuries and blood/body fluid exposures ($\chi^2 [1, N = 215] = 4.722, p \leq 0.030$) [Table 4].

Moreover, the respondents in hospitals with infection prevention and control team/committee showed a lower exposure to percutaneous injuries and blood/body fluid exposures in respondents (59.1% [n= 55]) than those in hospitals without infection prevention and control team/committee in place which rather showed higher exposure to percutaneous injuries and blood/body fluid exposures (62.3% [n = 76]). Results of the chi-square tests showed no

statistically significant association between existence of infection prevention and control team/committee and percutaneous injuries and blood/body fluid exposures ($\chi^2 [1, N = 215] = 0.221, p \leq 0.639$) [Table 4].

Furthermore, the respondents in hospitals with less work stress showed a lower exposure to percutaneous injuries and blood/body fluid exposures in respondents (50.0% [n= 36]) than those in hospitals with much work stress who showed higher exposure to percutaneous injuries and blood/body fluid exposures (66.4% [n = 95]). Results of the chi-square tests showed a statistically significant association between work stress and exposure to percutaneous injuries and blood and body fluid ($\chi^2 [1, N = 215] = 0.221, p \leq 0.020$) [Table 4].

Results of the study also indicate that, the respondents who received enough pre-service training in hospitals showed a lower exposure to percutaneous injuries and blood/body fluid exposures in respondents (44.7% [n= 68]) than those in hospitals who did not receive enough pre-service training as they showed higher exposure to percutaneous injuries and blood/body fluid exposures (57.8% [n = 26]). Results of the chi-square tests showed a statistically significant association between enough pre-service training and percutaneous injuries and blood/body fluid exposures ($\chi^2 [1, N = 215] = 8.367, p \leq 0.004$) [Table 4].

Finally, respondents who received adequate in-service training in their hospitals showed a lower exposure to percutaneous injuries and blood/body fluid exposures in respondents (25.4% [n= 16]) than those in hospitals who did not receive adequate in-service training as they showed higher exposure to percutaneous injuries and blood/body fluid exposures (65.9% [n = 112]).

Results of the chi-square tests showed a statistically significant association between adequate in-service training and percutaneous injuries and blood/body fluid exposures ($\chi^2 [1, N = 215] = 6.998, p \leq 0.008$) [Table 4].

Research Question Four: What are behavioural factors associated with percutaneous injuries and blood/body fluid exposures among nurses in Tamale west and Central Hospitals?

Table 5 contains the results of the chi-square tests to show the behavioural factors associated with percutaneous injuries and blood/body fluid exposures among nurses in Tamale West and Central Hospitals.

Table 5: Behavioural factors associated with percutaneous injuries and blood/body fluid exposures

Variables	Low n (%)	High n (%)	χ^2	p-value
Do you follow the standard operational protocols when executing your duties?			5.318	0.021*
Yes	52 (46.4)	60 (53.6)		
No	32 (31.1)	71 (68.9)		
Do you wear PPEs when performing your duties?			8.008	0.005*
Yes	79 (42.9)	105 (57.1)		
No	5 (16.1)	26 (83.9)		
Do you sometimes work in haste when you are under pressure or want to meet urgent patients' needs?			6.413	0.011*
Yes	32 (52.5)	29 (47.5)		
No	52 (33.8)	102 (66.2)		
Do you attempt to recap punctured infusion bag?			3.723	0.054
Yes	1 (10.0)	9 (90.0)		
No	83 (40.5)	122 (59.5)		
Do you engage in improper disposal of used needles and sharps?			5.608	0.018*
Yes	19 (57.6)	14 (42.4)		
No	65 (35.7)	117 (64.3)		
Do you practice double-handed recapping?			1.107	0.293
Yes	10 (50.0)	10 (50.0)		
No	74 (37.9)	121 (62.1)		
Do you report accidental exposures to the head of the health facility?			7.964	0.005*
Yes	55 (47.8)	60 (52.2)		
No	29 (29.0)	71 (71.0)		

Source: Field survey, 2017

Results of the study indicate that 46.4% (n = 52) of the respondents who follow the standard operational protocols when executing their duties had low percutaneous injuries and blood/body fluid exposures while 68.9% (n = 71) of those who do not follow the standard operational protocols when executing their duties had high exposure to percutaneous injuries and blood/body fluid. Results of the chi-square tests showed a statistically significant association between following the standard operational protocols when executing duties and exposure to percutaneous injuries and blood/body fluid ($\chi^2 [1, N = 215] = 5.318, p \leq 0.021$) [Table 5].

Again, 42.9% (n = 79) of the respondents who said they wear PPEs when performing their duties had low percutaneous injuries and blood/body fluid exposures while 83.9% (n = 26) of those who do not wear PPEs when performing duties had high percutaneous injuries and blood/body fluid exposures. Results of the chi-square tests showed a statistically significant association between wearing PPEs when performing duties and exposure to percutaneous injuries and blood/body fluid ($\chi^2 [1, N = 215] = 8.008, p \leq 0.005$) [Table 5].

In relation to working in haste as a behavioural factor, 52.5% (n = 32) of those who sometimes work in haste when they are under pressure or want to meet urgent patients' needs had low percutaneous injuries and blood/body fluid exposures while 66.2% (n = 102) of those who do not sometimes work in haste when they are under pressure or want to meet urgent patients' needs had high percutaneous injuries and blood/body fluid exposures. Results of the chi-square tests showed a statistically significant association between working in haste when under pressure or want to meet urgent patients' needs and percutaneous

injuries and blood/body fluid exposures ($\chi^2 [1, N = 215] = 6.413, p \leq 0.011$) [Table 5].

In relation to the attempt to recap punctured infusion bag, 40.5% (n = 83) of respondents who said they do not attempt to recap punctured infusion bag had low percutaneous injuries and blood/body fluid exposures, while 90% (n = 9) of those who attempt to recap punctured infusion bag had high percutaneous injuries and blood/body fluid exposures. Results of the chi-square tests showed a statistically significant association between the attempting to recap punctured infusion bag and exposure to percutaneous injuries and blood/body fluid ($\chi^2 [1, N = 215] = 3.723, p \leq 0.054.05$) [Table 5].

On engaging in improper disposal of used needles and sharps, 57.6% (n = 19) of the respondents who engaged in improper disposal of used needles and sharps had low percutaneous injuries and blood/body fluid exposures, while 64.3% (n = 117) of those who do not engage in improper disposal of used needles and sharps had high exposure to percutaneous injuries and blood/body fluid. Results of the chi-square tests showed a statistically significant association between engaging in improper disposal of used needles and sharps and percutaneous injuries and blood/body fluid exposures ($\chi^2 [1, N = 215] = 5.608, p \leq 0.018$) [Table 5].

Also, 50% (n = 10) of respondents who practice double-handed recapping had low percutaneous injuries and blood/body fluid exposures, while 62.1% (n = 121) of those who do not practice double-handed recapping had high percutaneous injuries and blood/body fluid exposures. Results of the chi-square tests showed no statistically significant association between the practice of

double-handed recapping and percutaneous injuries and blood/body fluid exposures ($\chi^2 [1, N = 215] = 1.107, p \leq 0.293.05$) [Table 5].

Finally, 47.8% ($n = 55$) of the respondents who report accidental exposures to the head of the health facility had low percutaneous injuries and blood/body fluid exposures while 71% ($n = 71$) of those who do not report accidental exposures to the head of the health facility had high percutaneous injuries and blood/body fluid exposures. Results of the chi-square tests showed a statistically significant association between the reporting of accidental exposures and percutaneous injuries and blood/body fluid exposures ($\chi^2 [1, N = 215] = 7.964, p \leq 0.005$) [Table 5].

Discussion

This section of the chapter four discusses the results of the study in relation to the literature review. The discussion was based on the research questions. The research questions are:

1. What is the prevalence of percutaneous injuries and blood/body fluid exposures among nurses at the Tamale Metropolis?
2. What are the socio-demographic factors associated with percutaneous injuries and blood/body fluid exposures in the Tamale Metropolis?
3. What are the organizational factors associated with percutaneous injuries and blood/body fluid exposures in the Tamale Metropolis?
4. What are behavioural factors associated with percutaneous injuries and blood/body fluid exposures among nurses in Tamale west and Central Hospitals?

Research Question One: What is the prevalence of percutaneous injuries and blood/body fluid exposures among nurses at the Tamale Metropolis?

The first research question focused on the prevalence of percutaneous injuries and blood/body fluid exposures among nurses at the Tamale Metropolis. Findings from the study indicate that prevalence of percutaneous injuries, blood and body fluid exposures among nurses at the Tamale Metropolis is high. Findings of the study confirm the findings of studies by Amira and Awobusuyi, (2014) and Sagoe-Moses et al. (2001) who found that needle-stick injuries are the most common source of occupational exposures to blood which result in transmission of blood-borne infections (82.9% and 53%). Findings of the study further support the findings obtained in a cross-sectional survey by Choa et al.

(2013) who found that 70.4% of the nurses had experienced a needle stick or sharp injury in the previous year.

Additionally, the findings of the study also corroborate the results in studies by Alemayehu et al. (2016) and Lori et al. (2016), who both reported high number of their respondents mentioning ever being exposed to a sharp injury or exposed to blood and other body fluids during the last 12 months. The reason for the high prevalence of percutaneous injuries, blood and body fluid exposures may be due to the existence of several factors within the health facilities that put the nurses at risk of such exposures. Such factors may include inadequate training, non-use of PPE, non-adherence to universal precautions and job stress.

On the other hand, findings of the study contradict the findings of a Kenyan study by Mbaisi (2013), who reported a 19.3% prevalence of percutaneous injuries and 7.2% for blood and other body fluid exposure among health care workers. Similarly, findings of the study do not support the findings of studies by Atlaw (2013), Galougahi (2010) and Lukianskyte et al. (2011) where a prevalence rate of 22.2% , 22.15% , and 38.5% of injuries and exposures respectively was recorded in the last 12 months among health care workers. The difference in prevalence levels of these studies could be due to the existence of several factors within the health facilities that protect nurses from the risk of these exposures. Such factors may include adequate training, adherence to universal precautions and PPE use.

Research Question Two: What are the socio-demographic factors associated with percutaneous injuries and blood/body fluid exposures in the Tamale Metropolis?

The second research question was on the socio-demographic factors associated with percutaneous injuries and blood/body fluid exposures in the Tamale Metropolis. Results from the study indicate that sex, highest level of education and work experience had statistically significant association with percutaneous injuries, blood/body fluid exposures.

Findings on the association between sex and percutaneous injuries, blood and body fluid exposures confirm the findings obtained by Vaz et al. (2010) and Kasatpibal et al. (2016). Similarly findings by Alemayehu et al. (2016) also found an association between sex of respondents and exposure to percutaneous injuries and blood and body fluid. The female predominance in this study can be explained by the fact that the vast majority of the nurses in the two hospitals were females (65%).

On the contrary, findings of the study contradict the findings of cross-sectional studies by Hanafi et al. (2011) and Rampal et al. (2010) who both reported no significant association between gender and occurrence of occupational exposures. Similarly, findings of this study also contradicts results of studies done in Jamaica, Thailand, Iran, France, United States of America and Botswana by Vaz, McGrowder, Crawford, Alexander-Lindo, & Irving, (2010); Kasatpibal et al., (2016) ; Mehrdad, Soheila, and Marion (2008) and Kassa et al., (2016) who all reported higher chances of experiencing injuries and exposures to PIs in male HCWs than females.

On the association between level of education and percutaneous injuries and blood/body fluid exposures, the findings of the study confirm that of Yarahmadi, Dizaji, Hossieni, Farshad, & Bakand, (2014) who in a cross-sectional study among HCWs in Tehran revealed that, educational level influenced the occurrence of occupational exposures. Also, findings on the association between highest level of education and exposure to percutaneous injuries, blood and body fluid are in line with the findings of Ghofranipour, (2009) and Wafula, (2012) who both reported that nurses with high academic qualifications were at a lower risk of sharps injury than those with low academic qualifications. Those with higher education may be well equipped with the requisite knowledge on adherence to standard precautions and PPEs use.

On the contrary, the findings of the study contradict the findings of Tang et al. (2009), who in their study on the incidence and risk factors for sharp injury among Healthcare Workers, found no relationship between level of education and the risk of sharps injury. This contradiction could largely be attributed to factor such as; non-availability of PPEs, lack of training and the lack of protocols in the facility.

Finally, findings on the association between work experience and percutaneous injuries and blood/body fluid exposures from the study corroborates the findings of Kassa et al. (2016), Honda et al. (2011), Sabbah et al. (2013) and Chalya et al. (2015) who all revealed in their studies that nurses and HCWs with more than 5 years of working experience have a lower risk of occupational exposure than those with less years working experience.

On the contrary, Laisser and Home (2017) in their study reported that, HCWs with more years of work experience encountered more PIs exposures

than the less experienced staff. Additionally, Lema & Teka (2015) also reported in their study that, HCWs with less than one year of experience were less likely to experience NSIs than those with more years of working experience.

The reason for the association between work experience and percutaneous injuries, blood and body fluid exposures could be due to the fact that the higher the working experience, the more experience and knowledge an individual will have to avoid percutaneous injuries, blood and body fluid exposures. However, the more experienced health workers on the other hand may be at higher risk of exposures due to complacency and disregard to use of PPEs.

Research Question Three: What are the organizational factors associated with percutaneous injuries and blood/body fluid exposures in the Tamale Metropolis?

The third research question looked at the organizational factors associated with percutaneous injuries and blood/body fluid exposures in the Tamale Metropolis. Findings from the study indicate an association between having a procedure/protocol for reporting needle sticks, sharp injuries and splashes of blood and other body fluids in the hospital, availability of PPEs (masks, gloves and lab coats), work stress, enough pre-service training and adequate in-service training and exposure to percutaneous injuries, blood and body fluid.

On safety and universal guidelines, findings from the study confirm the findings of Chalya et al. (2015), who found that most needle-stick injuries and splash exposures occurred when universal precautions or standard procedures were not followed. Similarly, findings of the study support the of CDC (2013)

that found that strict adherence to universal precautions and double gloving during surgical procedures have almost eliminated the possibility of transmitting HBV, HCV and HIV viruses from healthcare provider to patients. Additionally, results of a study by Jacob, Newson-Smith, Murphy, Steiner, & Dick, (2010) showed that compliance with standard precautions significantly reduces the risk of suffering a sharps injury.

On the other hand, the findings contradicts that of a study conducted in Ethiopia that indicated that regularly following standard precautions has no significant relation with percutaneous injury (Fisman, Harris, Rubin, Sorock, & Mittleman, (2007); Pathak, Kahlon, Ahluwalia, Sharma & Bhardwaj, 2012).

The reason for the association between the existence of safety and universal guidelines and percutaneous injuries, blood and body fluid exposures could be that, the existence of such guidelines provides the platform for HCWs to follow what is expected of them and compliance to such guidelines contributes to low percutaneous injuries and blood and body fluid exposures.

The findings on the association between work stress and percutaneous injuries and blood/body fluid exposures confirm the findings of previous studies by Afridi et al. (2013), where the highest incidence of NSIs was seen in nurses and that the associated factor was number of shifts per month. The results of the current study further corroborate the findings of Mehrdad et al. (2014), who found that individuals with middle or high level of stress had higher crude and adjusted odds than those with lower stress for all kinds of exposure. The reason for such findings could be as a result of the fact that working under stress affects the cognitive abilities of HCWs and such people are prone to accidents including percutaneous injuries and blood and body fluid exposures.

Finally, findings on the association between training and percutaneous injuries and blood and body fluid exposures are in line with the findings of Chalya et al., (2015) who in their study found that healthcare workers who had not attended any training on needle stick and splash exposures prevention and management were at a greater risk of sustaining injuries and exposures than those who have had some training. Similarly, findings of the study support the findings of cross-sectional studies by Kassa et al. (2016) and Kasatpibal et al. (2016), who reported that untrained HCWs are at greater risk of exposure than those trained.

The reason for such findings is that the more training the individual has, the more knowledge the person obtains. Moreover, in situations where the training is related to percutaneous injuries, blood and body fluid exposures, the individual is likely to get knowledge that will help reduce the risks.

Research Question Four: What are the behavioural factors associated with percutaneous injuries and blood/body fluid exposures among nurses in Tamale West and Central Hospitals?

The final research question focused on the behavioural factors associated with percutaneous injuries and blood/body fluid exposures among nurses in Tamale West and Central Hospitals. Results from the study found an association between following standard operational protocols, wearing PPEs, working in haste, engaging in improper disposal of used needles and sharps and reporting accidental exposures to the head of the health facility and percutaneous injuries and blood/body fluid exposures.

Findings on the use of PPEs/SOPs and exposure to percutaneous injuries and blood/body fluid confirm the findings of Kasatpibal et al. (2016), who found

an association between not wearing PPEs and exposure percutaneous injuries and blood/body fluid. Similarly, Van der Molen, Zwinderman, Sluiter, & Frings-Dresen, (2011) recommended in their study for the introduction preventive measures such as training in use of personal protective equipment to improve safe working conditions of HCWs. Additionally, Chalya et al. (2015) reported in their study that, most needle stick injuries and splash exposures occurred when universal precautions or standard procedures were not followed. The reason for the association between the use of PPEs and percutaneous injuries and blood/body fluid exposures could be that when PPEs are used effectively, the likelihood of the occurrence of percutaneous injuries and blood/body fluid exposures is minimised as the use of those materials serve as protection for HCWs.

Findings on working in haste and exposure to percutaneous injuries and blood/body fluid is in line with the findings of a study by Kasatpibal et al., (2016) that also found an association between working in haste, lack of hazard awareness, not wearing PPEs and high work load with exposure to PIs and BBFEs. Additionally, Adejumo & Taofikat, (2014) also cited attempting to meet patient's needs in a hurry (haste), individual carelessness, attempting to recap punctured infusion bag with needles and assisting in the operating theatre as some activities that exposed the nurses to injuries. Similarly, Blenkarn, (2009) identified working in haste, high workload, fatigue, inadequate working space, improper disposal of sharps and recapping of needles as some common factors associated with exposures and injuries.

Findings on the association between engaging in recapping and improper disposal of used needles and sharps and exposures to percutaneous

injuries, blood and body fluid confirm that of Adejumo and Taofikat, (2014) who identified that exposure to work related sharp injuries among HCWs occurred while they were recapping needles and while packing used syringes and needles for disposal. Also, Abkar et al. (2013) and Yacoub et al. (2010) found double-handed recapping and the unsafe disposal of used sharps as some common factors leading to the occurrence of exposures. Also, Manzoor, et al. (2010) indicated their study in Pakistan that 32% of the respondents cited recapping syringes as the causes of their NSI exposures.

Additionally, a cross-sectional retrospective study among healthcare professionals in Saudi Arabia also cited the causes of injuries to include recapping of needles as one of the activities that caused their injuries (Syam, Santos, & Hakawi, 2013). Lukianskyte, Gataeva & Radziunaite (2011) also identified needle recapping (46%) as the lead cause of the occurrence of NSI among the participants. Finally, a focus group discussion with nurses in a cross sectional study among health care workers in Kenya revealed that most of the respondents indicated that they got injured when they attempted recapping a needle (Wafula, 2012).

Finally, findings on the association between reporting accidental exposures and percutaneous injuries, blood and body fluid exposures confirm that of Martins, Coelho, Vieira, Matos, & Pinto, (2012) who indicated in their study that reporting of injuries and exposures can reduce their rates. Similarly, Walle et al., (2013) also indicated that healthcare workers who report their injuries to the concerned body are less likely to be exposed to PIs in future than those who don't.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the summary of the findings, conclusions and recommendations made in respect of the study. The summary is based on the findings obtained from the study; conclusions were then made based on the stated objectives for the study and relevant recommendations also indicated.

Summary

The study was carried out to determine the prevalence of percutaneous injuries and blood/body fluid exposures and assess their associated factors among nurses at two hospitals in the Tamale Metropolis. A descriptive cross-sectional design was adopted for the study. The study was conducted in the Tamale Metropolitan Area, the capital town of the Northern Region of Ghana. A target population of 572 was used for the study. This was made up of registered nurses, midwives and enrolled nurses of Tamale Central Hospital and Tamale West Hospital. A sample size of 224 nurses was obtained for the study. However, analysis was done with a sample size of 215 based on a 96% response rate. Stratified sampling was used to sample respondents from the two hospitals and random sampling used to select respondents from for the study. Questionnaire was the main source of collecting data for the study. The researcher used descriptive statistics of frequencies and percentages and chi-square test to analyse the data.

Key Findings

1. Prevalence of percutaneous injuries and blood and body fluid exposures in the two hospitals was high (61%).
2. Sex, level of education and work experience had statistically significant association with percutaneous injuries, blood and body fluid exposures. Female respondents, those with lower educational qualification (certificate holders) and those with less than five years work experience recorded high exposure to percutaneous injuries, blood and body fluid.
3. Statistically significant association was also found between availability of procedure/protocol for reporting needle sticks, sharp injuries and splashes of blood and other body fluids in a hospital, provision of adequate personal protective equipment [PPE's] (masks, gloves and lab coats), work stress, enough pre-service training and in-service training and exposure to percutaneous injuries, blood and body fluid. The availability of procedures and protocols for reporting, inadequate provision of PPE's like: face mask and gloves, more work stress, lack of pre-service and in-service training were found to be associated with high exposure to percutaneous injuries, blood and body fluid.
4. Statistically significant association was also found between behavioural factors like: adherence to standard operational protocols (SOPs), wearing PPEs, working in haste, engaging in improper disposal of used needles and sharps, reporting accidental exposures and exposure to percutaneous injuries and blood/body fluid. With non-adherence to SOPs and PPEs use, not working in haste, not engaging in improper disposal of used sharps and needles and recapping of punctured infusion

all experiencing high exposures. Similarly, not those who did not practice double handed recapping and did not reporting exposures also experienced high exposures to percutaneous injuries and blood/body fluid as well.

Conclusions

From the findings obtained from the study the following conclusions were made:

1. The prevalence of percutaneous injuries, blood and body fluid exposures among nurses in the Tamale West and Central hospitals was high (61%).
2. The occurrence of percutaneous injuries and blood/body fluid exposures were influenced by personal factors such as: sex, level of education and work experience of the nurses in the two hospitals.
3. Organizational factors like: availability of procedures/protocols for reporting exposures, provision of adequate personal protective equipment, work stress, pre-service and in-service trainings of the nurses all influenced the occurrence of percutaneous injuries and blood/body fluid exposures in the study area.
4. Finally, behavioural factors such as: adherence to SOPs, wearing of PPEs, working in haste, improper disposal of waste were found to have an influence in the occurrence of PI and BBFEs among nurses in the Tamale West and Central hospitals.

Recommendations/Implication on policy

Based on the findings of the study the following recommendations were made.

1. Heads of the health facilities in the Tamale Metropolis should sensitize nurses on the need to understand the risks associated with percutaneous injuries and blood/body fluid exposures and encourage them to comply with the standard precautions to reduce the prevalence of the exposures in the Tamale Metropolis.
2. Health facilities in the Metropolis through the Ghana Health Service should provide nurses with the needed PPEs to enhance practice and help to avoid percutaneous injuries and blood/body fluid exposures.
3. Pre-service training obtained by nurses should provide the opportunity for nurse to learn more about percutaneous injuries and blood/body fluid exposures as a way of equipping them with the skills they need to reduce or avoid such exposures.
4. Also, health facilities in the Tamale Metropolis should organize regular in-service training for nurses on percutaneous injuries and blood/body fluid exposures and how to prevent them.
5. Government and management of health facilities should provide good working environment with healthy working conditions to help reduce nurses' exposure to percutaneous injuries and blood/body fluid.
6. Training programs in the area of infection prevention and control should be tailored to suit the level of education and work experience of the different cadre of nurses.

Suggestions for Further Studies

Further studies should examine the effect of percutaneous injuries, blood and body fluid exposures on the health of nurses in the Tamale Metropolis. There is also the need for another study to be conducted among all health workers and not only nurses on the prevalence and risk factors associated with percutaneous injuries and blood/body fluid exposures in the Northern Region.

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APPENDIX: A

RESEARCH QUESTIONNAIRE

Research Title: Prevalence and Risk Factors Associated with Percutaneous Injuries and Exposure to Patients' Blood and Other Body Fluids Among Nurses in the Tamale Metropolis.

Identifiers

- I. Questionnaire number
- II. Facility Name _____

Dear participant, I am a student of the School of Nursing, University of Cape Coast. I am conducting a study on percutaneous injuries and blood/body fluid exposure among nurses in Tamale Metropolis. The purpose of the study is to determine the prevalence and risk associated with needles sticks, sharp injuries and exposure to patients' blood and other body fluids among nurses in the Metropolis. The study will involve answering questions from this questionnaire. I will appreciate your participation since your responses would be extremely valuable to this study. This is purely for the purposes of academic research which is part of the requirement for the award of Master of Nursing degree. Information provided will be handled with strict confidentiality and will be used only for the research purposes.

Instructions: Please kindly fill in or tick [√] the appropriate answer to the questions. Some questions have multiple answers, where applicable, you can tick as many answers as possible.

Note: Please do not write your name on the questionnaire, the researcher wants participants to remain anonymous. Answering the questionnaires is not by compulsion but rather your own free will. **Thank you.**

A. Socio-demographic factors associated with the occurrence of percutaneous injuries and blood/body fluid exposure among nurses

1. Gender Male Female

2. Age (in years)

3. What is your highest educational qualification?

Certificate Diploma Degree Masters

Doctoral

4. Job Category

Registered General Nurse Enrolled Nurse Midwife

5. What is your work experience? (In years)

B. Occurrence of percutaneous injuries and blood/body fluid exposure among nurses

6. Have you had an accidental exposure to needle stick while performing or assisting a procedure in the last 1 year?

Yes No

7. Have you had an accidental exposure to sharp injury while performing or assisting a procedure in the last 1 year?

Yes No

8. Have you had an accidental exposure to blood/body fluids while performing or assisting a procedure in the last 1 year?

Yes No

C. Organizational factors associated with percutaneous injuries and blood/body fluid exposure

9. Unit / Department

Medical ward Emergency ward Paediatrics ward

Surgical ward Labour ward Surgical theatre

Maternity ward OPD

Others, (specify) _____

10. Does your facility have a procedure/protocol for reporting needle sticks, sharp injuries and splashes of blood and other body fluids?

Yes No Don't know

11. Does your hospital provide masks for your use?

Yes No

12. Does your hospital provide gloves for your use?

Yes No

13. Does your hospital provide aprons for your use?

Yes No

14. Does your hospital provide lab coats for your use?

Yes No

15. Does your hospital provide safety boots for your use?

Yes No

16. Does your hospital provide safety goggles for your use?

Yes No

17. Do you consider the personal protective equipment provided adequate for use all the time?

Yes No

18. Does your facility have Infection prevention and control team/committee in place?

Yes No Don't know

19. Does your work put so much stress on you?

Yes No

20. Have you received enough pre-service training that can help you deal with exposures to percutaneous injuries, blood and body fluid?

Yes No

21. Has your hospital given you adequate in-service training on how to prevent exposures to percutaneous injuries, blood and body fluid?

Yes No

D. Behavioural factors associated with exposures to percutaneous injuries and blood/body fluid

22. Do you follow the standard operational protocols when executing your duties?

Yes No

23. Do you wear PPEs when performing your duties?

Yes No

24. Do you sometimes work in haste when you are under pressure or want to meet urgent patients' needs?

Yes No

25. Do you attempt to recap punctured infusion bag?

Yes No

26. Do you engage in improper disposal of used needles and sharps?

Yes No

27. Do you practice double-handed recapping?

Yes No

28. Do you report accidental exposures to the head of the health facility?

Yes No

THANKS FOR YOUR TIME

APPENDIX: B

PERMISSION FOR ETHICAL CLEARANCE

University of Cape Coast

College of Health and Allied Health Sciences

School of Nursing and Midwifery

24th January, 2017.

Thro;

The Dean

School of Nursing and Midwifery

University of Cape Coast.



The Chairman,

Institutional Review Board, UCC.

Dear Sir/madam,

APPLICATION FOR ETHICAL CLEARANCE

I am a level 850 Master of Nursing Student, currently preparing to undertake my research on the topic "Percutaneous Injuries and Blood and Body Fluid Exposures among Nurses in Tamale Metropolis."

Attached to this letter are my CV and other relevant documents.

Thanks you.

Yours faithfully,

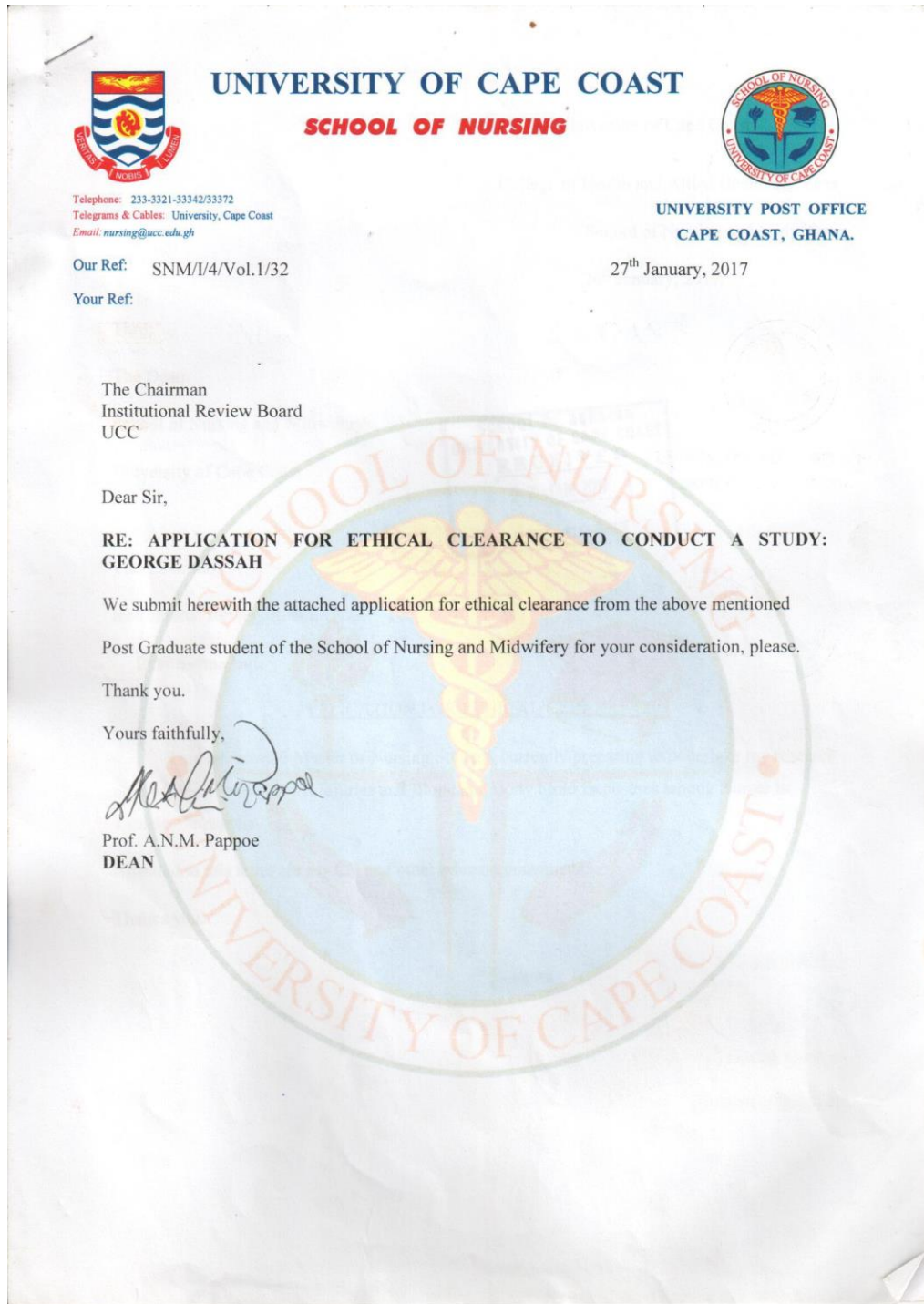
A handwritten signature in blue ink, appearing to read "Dassah George".

Dassah George

(SN/MNS/15/0014)

APPENDIX: C

INTRODUCTORY LETTER FOR ETHICAL CLEARANCE



APPENDIX: D

APPROVAL FOR ETHICAL CLEARANCE

UNIVERSITY OF CAPE COAST
INSTITUTIONAL REVIEW BOARD
SECRETARIAT

TEL: 03321-33172/3 / 0207355653/ 0244207814
E-MAIL: irb@ucc.edu.gh
OUR REF: UCC/IRB/A/2016/127
YOUR REF:
OMB NO: 0990-0279
IORG #: IORG0009096



C/O Directorate of Research, Innovation and Consultancy

16TH MAY, 2017

Mr George Dassah
School of Nursing and Midwifery
University of Cape Coast

Dear Mr Dassah,

ETHICAL CLEARANCE – ID :(UCCIRB/CHAS/2017/11)

The University of Cape Coast Institutional Review Board (UCCIRB) has granted **Provisional Approval** for the implementation of your research protocol titled **‘Percutaneous Injuries and Blood and Body Fluid Exposure among Nurses in Tamale Metropolis’**.

This approval requires that you submit periodic review of the protocol to the Board and a final full review to the UCCIRB on completion of the research. The UCCIRB may observe or cause to be observed procedures and records of the research during and after implementation.

Please note that any modification of the project must be submitted to the UCCIRB for review and approval before its implementation.

You are also required to report all serious adverse events related to this study to the UCCIRB within seven days verbally and fourteen days in writing.

Always quote the protocol identification number in all future correspondence with us in relation to this protocol.

Yours faithfully,

A handwritten signature in blue ink, appearing to read 'Samuel'.

ADMINISTRATOR
INSTITUTIONAL REVIEW BOARD
UNIVERSITY OF CAPE COAST

f: Samuel Asiedu Owusu
Administrator

APPENDIX: E
PERMISSION LETTER (FIELD)

University of Cape Coast
College of Health and Allied Health Sciences
School of Nursing and Midwifery
3rd April, 2017

The Regional Director of Health Services
Ghana Health Service
Northern Region

Dear Sir,

PERMISSION TO CONDUCT A RESEARCH

I would be very grateful if you could grant me permission to conduct an academic research at the Tamale West and Central hospitals on the topic "**Percutaneous injuries and blood and body fluid exposures among nurses in Tamale Metropolis.**"

The purpose of the study is to determine the prevalence, and identify the risk associated with needles sticks, sharp injuries and exposure to patients' blood and other body fluids among nurses in the Metropolis. It is hoped that the findings of this study will help bring to the notice of management, nurses and other stakeholders the level of risk nurses and other healthcare workers are exposed to at the various health facilities.

Please find attached copy of an introductory letter for your perusal.

Your favourable consideration is much appreciated, thank you.

Yours faithfully,



Dassah George

(0243964017)

APPENDIX: F

APPROVAL LETTER FROM REGIONAL HEALTH DIRECTORATE

GHANA HEALTH SERVICE

OUR CORE VALUES:

1. People-centered
2. Professionalism
3. Team work
4. Innovation
5. Discipline
6. Integrity



Regional Health Directorate
Ghana Health Service
P.O. BOX 99
Tamale

Tel: (233) (03720) 22912, 22710,
22146

Fax: (233) (71) 22941

Email: rhds.nr@ghsmail.org

My Ref No: GHS/NR/18-0141
Your Ref No:

10TH APRIL, 2017

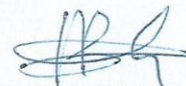
LETTER OF INTRODUCTION - MR. DASSAH GEORGE

This is to introduce to you the above named officer who wants to conduct academic research in your hospitals on the topic "**Percutaneous injuries and blood and body fluid exposures among nurses**".

The research is to help him gain field experience and help bring to the notice of management and nurses the risk nurses and other care givers are exposed to at their various facilities.

I would be most grateful if you could please use your good offices to assist him in that direction.

Thank you.



DR. BRAIMAH ABUBAKARI
DEPUTY DIRECTOR CLINICAL CARE
For. REG. DIR. OF HEALTH SERVICES

THE MEDICAL SUPERINTENDENT
TAMALE CENTRAL HOSPITAL
TAMALEWEST HOSPITAL