ASSESSMENT OF KNOWLEDGE, ATTITUDE, PRACTICE AND AVAILABILITY OF SAFETY MEASURES TOWARDS PREVENTION OF HEALTHCARE-ASSOCIATED INFECTIONS AMONG PRIMARY HEALTHCARE WORKERS IN NORTH-CENTRAL ZONE, NIGERIA

BY

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A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY ZARIA, NIGERIA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DOCTOR OF PHILOSOPHY DEGREE IN HEALTH EDUCATION

DEPARTMENT OF HUMAN KINETICS AND HEALTH EDUCATION,

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ZARIA, NIGERIA

JUNE, 2018

DECLARATION

I declare that the content of this thesis entitled ‘‘Assessment of Knowledge, attitude, practice and availability of safety measures towards prevention of healthcare-associated infections among primary healthcare workers in North-Central Zone, Nigeria’’ was carried out by me, in the Department of Human Kinetics and Health Education. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at this or any other institution.

_____ _____

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CERTIFICATION

This thesis entitled ‘‘ASSESSMENT OF KNOWLEDGE, ATTITUDE, PRACTICE AND AVAILABILITY OF SAFETY MEASURES TOWARDS PREVENTION OF HEALTHCARE-ASSOCIATED INFECTIONS AMONG PRIMARY HEALTHCARE WORKERS IN NORTH-CENTRAL ZONE, NIGERIA’’ by Ibrahim Ismaila KPEROGI meets the regulations governing the award of the degree of Doctor of Philosophy in Health Education of the Ahmadu Bello University and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to Almighty Allah (Subhanahu Wa Taallah) for giving me life, sound health and the wisdom to comprehend my supervisors' relentless guidance from the beginning, to this successful end of my programme.

ACKNOWLEDGEMENT

The researcher thanks Almighty Allah (S.W.T) for giving him life, strength and wisdom to undergo this programme and for all the guide and protection through his life. His sincere gratitude goes to his supervisor, Dr. Umar Musa who did not only stand as a thorough supervisor, but also as a father who put him through the completion of his programme. May Allah (SWT) continue to shower him and his entire family abundant blessings. The researcher also appreciates Prof. V. Dashe, a member of his supervisory team, who thoroughly check of his work and gave constant guidance. May Allah (SWT) continue to shower blessings on her and her entire family. His gratitude also goes to Prof. T.N, Ogwu a member of his supervisory team, who also stood by him and guided him through his research work. May Allah (SWT) continue to bless her.

The researcher's unquantifiable gratitude goes to Prof. M.A. Suleiman who acted as God-sent, through critical period of this work, by giving necessary moral support when it becomes necessary. May Allah (SWT) be with her, grant her heart desires and that of her entire family. His gratitude also goes to Dr. U. Yunusa from the Department of Educational Psychology and Counselling, Faculty of Education and Dr. B.M. Tukur from Department of Nursing sciences in Faculty of Allied Health Sciences, Ahmadu Bello University Zaria, who gave him attention whenever issues arose from his work requiring their professional guidance. May Allah (SWT) bless and grant them wisdom in their career. The researcher's gratitude also goes to all academic and non-academic staff of the Department of Human Kinetics and Health Education, Ahamadu Bello University Zaria. His appreciations will be incomplete without duly recognising the angelic role of his Mentor, Prof. R.A. Shehu from the Department of Health Promotion and Environmental Health Education, University of Ilorin, Ilorin, Nigeria, who stood by him, beyond

the stretch of a teacher, from his undergraduate days to this present moment. May Allah (SWT) guide and protect him and his entire family from all odds and grant him all his heart desires. The researcher wishes to acknowledge the management of University of Ilorin, for approving his study leave with pay, which helped the course of this accomplishment. May the University continue to grow from strength to strength. Long live University of Ilorin, Ilorin, Nigeria.

The researcher's profound gratitude will be incomplete without due recognition to his parents Mallam Ismaila Kperogi and Mrs. Sarah Kperogi, who have being wonderful in their care, they have being source of inspiration right from his birth, as well as their constant prayers towards his success throughout his programme. May Allah (SWT) grant them all their heart desires with sound health and long life. His heart felt gratitude goes to his wife Mrs. Hannatu Kperogi, and children, Miss Aminat Kperogi; Miss Nafisat Kperogi; Miss Saudat and Miss Mariam, for their supports and endurance from inconveniences resulting from this programme. May Allah (SWT) give them long life and good health to reap the fruits of this labour.

The researcher's sincere appreciation goes to his brothers and Sisters in Kperogi family to include: Ahmed; Farooq; Shehu; Hauwa and Wasila among others to mention a few. He thanked them so much for their moral supports and prayed that Allah (SWT) bless them all. He also want to express his profound gratitude to Dr, A.I. Aliyu and his family for the care, moral and spiritual support he enjoyed throughout his stay with them in Zaria. May Allah (SWT) continue to bless them. His sincere gratitude also goes to Yusuf Mohammed, Mrs. Nafisat Onagun, Mr. Yakub Ishiak, Mr. Danlami Mohammed, Mr. Yakub Ishiak, among others, who for limited space could not be mentioned here, for their words of encouragement that affected the course of this study positively. He say a big thank you and pray that may Allah (SWT) bless them all. Amen.

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ABBREVIATIONS

ANOVA	-	Analysis of Variance
CDC	-	Center for Disease Control
CRBSI	-	Catheter Related Blood Stream Infections
HBV	-	Hepatitis B Virus,
HAIs	-	Healthcare-Associated Infections
HCV	-	Hepatitis C Virus
HCWs	-	Health-Care Workers
HEPA	-	High Efficiency Particulate Air
HIV	-	Human Immune Virus
ICUs	-	Intensive Care Units
MRSA	-	Methicillin Resistant Staphylococcus Aureus
NI	-	Nosocomial Infection
PEP	-	Post Exposure Prophylaxis
PHC	-	Primary Health Care
PHCWs	-	Primary Health-Care Workers
SARS	-	Severe Acute Respiratory Syndrome
SPSS	-	Statistical Package for Social Sciences
TB	-	Tuberculosis
UTI	-	Urinary Tract Infections
VAP	-	Ventilated Associated Pneumonia
WHO	-	World Health Organization
YOE	-	Years of Experience

OPERATIONAL DEFINITION OF TERMS

Attitude: Feelings, willingness and affinity among primary healthcare workers, towards the prevention of healthcare associated infections.

Knowledge: Awareness and understanding among primary healthcare workers, towards the prevention of healthcare associated infections.

Healthcare-Associated Infections: Diseases contracted by healthcare workers during the course of their duty in the hospital.

Practice: The daily routine carried out by primary healthcare workers, to prevent healthcare-associated infections.

Prevention: This is the process of averting possible occurrence or spread of healthcare-associated infections among primary healthcare workers.

Primary Health Care: Healthcare that is available to all and affordable by every citizen especially the low income earners and rural dwellers.

Primary Healthcare Facilities: Theses are hospitals owned by Local Government, where primary healthcare workers carry out their daily duties.

Primary Healthcare Workers: These are healthcare professionals in Government primary healthcare facilities who work as community health workers, nurses, cleaners and laboratory technicians.

Safety Measures: These are medical procedures and devices put in place to be complied and used by primary health care workers towards the prevention of healthcare-associated infections.

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ABSTRACT

This study assessed knowledge, attitude, practice and availability of safety measures towards prevention of Healthcare-Associated Infections (HAIs) among primary healthcare workers in North-central zone Nigeria. HAIs are acquired unknowingly by healthcare workers during treatment of patients in healthcare facilities. These infections can be Hepatitis B, or C, HIV, Tuberculosis among others, hence the need to find out why the alarming trend among Primary Healthcare Workers (PHCWs), in this study. The study used Ex-post facto research design. The population comprises of all PHCWs in Government primary healthcare facilities across North-central zone Nigeria (with 24,741 PHCWs). A total of 760 respondents were sampled from the above population, using multistage sampling techniques. A total of 760 questionnaire of Likert measuring scale format. Validity and reliability test were administered and returned, with 100% retrieval rate (the instrument was administered and retrieved on the spot in each of the sections formed to ease the collection). Descriptive statistics of frequency counts and percentages were used to describe demographic information of respondents, mean and standard deviation were used for the research questions, while inferential statistics of one sample t.test and independent t.test statistics were used to analyse the significance of knowledge, attitude, practice and availability and differences between male and female PHCWs' attitude and practice of safety measures towards preventing HAIs in North-central zone, Nigeria respectively. Results revealed that PHCWs have significant knowledge, attitude and practice (all at P-value of 0.00) but there were no adequate available safety measures provided for PHCWs to use. There were significant differences between male and female PHCWs' attitude and practice of safety measures towards the prevention HAIs in North-central zone, Nigeria (at P-values of 0.009 and 0.00 respectively). Conclusively, PHCWs have significant knowledge, attitude, practice but inadequate availability of safety measures while female PHCWs were found to have more positive significant attitude and practice towards safety measures in preventing HAIs in North-central zone, Nigeria. On the bases of the conclusion drawn, it was recommended that government should maintain training of PHCWs through seminars and workshops. It was further recommended that Government should make available adequate equipment to be used by PHCWs as safety measures and ensure enforcement of global best practices towards the prevention of healthcare-associated infections in North-Central Nigeria.

Key Words: Healthcare-Associated Infections, Primary Healthcare workers, Primary Healthcare

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Healthcare Associated Infections (HAIs) are transmittable diseases like AIDs, Tuberculosis, Ebola and Lassa fever among others that are acquired unknowingly by healthcare workers from their patients during care processes in their respective healthcare facilities. Healthcare workers by their profession are expected to ensure that sick people recover from their illnesses however, it is worrisome that they contract some of these infections called healthcare-associated infections (HAIs) in the course of discharging their professional services to the sick. The unwanted consequences of these infections have been known for several decades and continue to escalate at an alarming rate (Oli, Okoli, Ujam, Adje & Ezeobi, 2016). The term healthcare-associated infections (HAIs) implies infections that affect healthcare workers during healthcare delivery processes in healthcare facilities. These infections by implications are occupationally contracted by healthcare workers (World Health Organisation-WHO, 2016). Brussaferro, Am oldo, Cattani, Fabbro, Cookson, Gallagher, Hartemann and Holt (2015), reported that until recently, these Nosocomial Infections were earlier called ‘‘Hospital Acquired Infections’’ but now termed as ‘’Healthcare-Associated Infections’’and that these infections account for a major health risks causing high mortality among healthcare workers.

According to Malewezi, Omer, Mwagomba and Araru, (2013), healthcare workers are at an increased risk of contracting Hepatitis B virus (HBV) in the workplace due to their potential contact with infected body fluid, such as blood, saliva, or vaginal fluid. World-wide HBV is estimated to have infected over two billion people and causes

0.5% million deaths annually. Prevalence of HBV infection among healthcare workers depends upon the rates of HBV infection in the region where they work, but studies reported rates between 0.8% and 74%. Despite the fact that health workers are accessible and easily identifiable population to implement vaccination strategies, many countries (including Nigeria) could not address it as 24% of the health workforce worldwide remain unvaccinated against HBV. Osungbemiro, Adejumo, Akinbodewa and Adelosoye (2016), reported that in Nigeria, majority of the government healthcare workers in Ondo State are prone to occupational hazard resulting from poor compliance to safety measures despite high awareness of safety measures to prevent healthcare-associated infections among healthcare workers.

Safety measures includes complying with healthcare environmental hygiene, use of protective equipment, vaccination, sterilization of equipment, safety injection practice and rapt attention and concentration during care process. Khan, Baig, and Mehboob (2017), reported that unhygienic environment serves as the best source for the pathogenic organism to prevail. Air, water and food can get contaminated and transmitted to the patients under healthcare delivery. There must be policies to ensure the cleaning and use of cleaning agents on walls, floor, windows, beds, baths, toilets and other medical devices. Properly ventilated and fresh filtered air can eliminate airborne bacterial contamination. Regular check of ventilation systems of general wards, operating theatres and ICUs must be maintained and documented. Infections attributed to water are due to failure of healthcare institutions to meet the standard criteria. More so, World Health Organization (WHO) has recommended that high-risk groups, including health workers,

be targeted for routine provision of HBV vaccine to protect them from infection (Malewezi, et, al, 2013).

Considering knowledge of primary healthcare workers towards the prevention of healthcare-associated infections (HAIs), education on safety measures plays an integral part in the prevention of the infections. Studies of Vaz, Mcgrowder, Alexander, Gordon, Brown and Irving (2010), explored the knowledge, perceptions and attitudes of healthcare personnel towards the transmission of healthcare-associated infections in different patient groups, found that knowledge played an important role in the prevention and spread of (HAIs). Furthermore, Parmeggiani, Abbate, Marinelli, paolo and Angelillo, (2010); Ogoina, Pondei, Chima, Isichei, and Gidado, (2015); Habib, Khan, Shan-E-Abbas, Bhatti and Zafar (2011); Gadzama, Bawa, Ajinoma, Saidu and Umar, (2014) reported that there are disparities in knowledge of infection control among the cadres of Healthcare workers (HCWs). Their studies also revealed differences in terms of actual knowledge of infection transmission and control, its interpretation and application by Healthcare Workers.

The knowledge of many infection control measures, such as appropriate hand hygiene and the correct application of basic precautions during invasive procedures are simple and of low-cost safety measures, but requires staff accountability and behavioural change (Bouallègue, Naija, Said, Nouria, Jaidane, Dhidah, & Boujaafar, 2013). Additionally, Mannava, Durrant, Fisher, Chersich and Luchters (2015), documented that a broad range of negative Maternal Healthcare Practice (MHCP) attitudes and behaviours affecting patients' well-being and satisfaction with care was reported during patients' interactions, as far outweighing their positive conducts. The nature of factors which

influence healthcare workers' attitudes and practices suggested that strengthening healthcare systems, and workforce development, including communication and counselling skills, are important. Greater attention is required to the attitudes and behaviour of healthcare workers towards preventing healthcare-associated infections.

Attitude of healthcare workers on safety measures remains an issue in the prevention of healthcare-associated infections. The risk of transmission of pathogens when providing medical care and the rates of the incidence of HAIs can be kept low through positive zeal of healthcare workers to appropriate standardized preventive procedures (Harbarth, Sax, Gastmeier, 2009 & Ferguson, 2009). However, it has been documented that the attitude towards safety measures against HAIs by healthcare workers (HCWs) has been observed to be poor. Among the different strategies, healthcare workers' willingness to adherence to the guidelines for disinfection is an essential ingredient for activities aimed at preventing the HAIs. Several reports indicated lackadaisical approach by HCWs (Sessa, Giuseppe, Luciana & Angelillo, 2011).

The practice of primary healthcare workers towards safety measures in preventing healthcare-associated infections is another consideration in this study to determine its role in curbing the spread of these infections. D'Agata, Horn, Ruan, Webb and Wares (2012), Chen, Sheng, Wang, Chang, Lin and Tien, (2011), Hanmore, Maclaine, Garin, Alonso, Leroy and Ruff (2013), reported that several studies have shown the benefits of practicing effective infection control measures in decreasing the morbidity and mortality of healthcare-associated infections and prevent the spread of the infections among healthcare workers. Improved compliance in hand hygiene with standard alcohol-based rub can reduce the rate of HAIs by as much as 40%. Standard precautions are defined as

"group of infection prevention practices that apply to all patients, regardless of suspected or confirmed diagnosis or presumed infection status" (Center for Disease Control, 2012).

Availability of safety measures in the prevention HAIs among primary healthcare workers is an essential aspect, as posited by Verbeek, Ijaz, Mischke, Ruotsalainen, Makela, Neuvonen and Edmond, (2015), that for health care workers, the main strategy for reducing physical exposure to highly infectious diseases is through personal protective equipment (PPE). These equipment includes and not limited to: coveralls, gowns, hoods, masks, eye shields and respirators to prevent skin and mucous membranes from becoming contaminated. In this context, we will not only concentrate on PPE for highly infectious diseases that have serious consequences for health like Ebola and Lassa. Other infections also implicated here are: HBV, HCV, Tuberculosis, HIV, among others, with health consequences so different that we expect the effect of PPE will also be different.

In the context of this study, the scope will be incomplete without the understanding of primary healthcare and the workers involved. According to White and Halifax (2015), Primary Health Care (PHC) implies essential health care made accessible at a cost that a country can afford, with methods that are practical, scientifically sound and socially acceptable. Everyone is expected to have access to healthcare and be involved in it, like other sectors of the society. PHC components includes: education on prevailing health problems, health promotion and disease prevention; provision of adequate food and nutrition; safe water supply; basic sanitation; maternal, child health care and family planning; prevention and control of endemic diseases; immunization against vaccine-preventable diseases; appropriate treatment of common diseases and

injuries and provision of essential drugs. Herman (2012) listed primary health care workers to include: Health Educators; Community Health Extension Workers; Nurses; Pharmacists; Laboratory Technicians; Environmental Health Technicians; Nutritionists; Attendants and Cleaners.

The alarming rate of healthcare-associated infections among healthcare workers and issues surrounding the scourge across Nigeria and particularly in North Central Nigeria, provoked the thoughts, which questions the place of healthcare workers' training hence, the need for this study to assess knowledge, attitude, practice and availability of safety measures towards prevention of healthcare-associated infections among Primary Healthcare Workers in North-Central Zone, Nigeria.

1.2 Statement of Problem

Preventive programmes of healthcare-associated infections' in North-Central Zone Nigeria seems to be a serious challenge among primary healthcare workers (PHCWs). The recurrent cases of various forms of healthcare-associated infections contracted by PHCWs during handling of patients is worrisome. In line with this, Gordon (2016), reported that healthcare workers get exposed to infections like Hepatitis B, HIV/AIDS, Tuberculosis, Syphilis; Pneumonia, Ebola, Lasa fever among others, as they attend to their patients in healthcare facilities and unconsciously transferring same to their family hence its spread. Most healthcare facilities in North-Central Zone Nigeria seem not have adequate safety measures in place for the prevention of healthcare-associated infections hence questioning the knowledge, attitude, practice and availability of safety measures against these infections among primary healthcare workers.

Knowledge of safety measures towards preventing healthcare-associated infections among primary healthcare workers seems to be a problem in North Central Zone Nigeria. It was a disturbing experience for the researcher who was informed by a junior staff during one of his hospital visits that patients were found with chronic infections not isolated from those with mild infections and their superiors are not even bothered about possible spread even among them. Stone, Herzig, Pogorzelska-Maziarz, Carter, Bjamadottir and Semeraro (2015), reported that infections' prevention and control guidelines have been developed by Centre for Disease Control but implementation by health care workers is not yet known. These preventable infections are mostly caused by several pathogens in healthcare facilities. Therefore, the need to find out if PHCWs were knowledgeable, that sources of these infections are various healthcare procedures to include: Labour; Blood transfusion; Injections; collection of fluid as specimens for laboratory procedures among others, becomes pertinent hence the need for this study.

Attitude of some primary healthcare workers as observed by the researcher, towards safety measures in the prevention of healthcare-associated infections remains a serious concern particularly in some rural areas of North-Central Zone, Nigeria. Apparently, PHCWs seem to feel use of injection safety boxes and screening of patients' blood before transfusion is an added duty to their routine therefore not enthusiastic which leads to the thriving of HAIs. The researcher was in some rural healthcare facilities where primary healthcare workers do not like wearing protective devices such as nose masks and aprons when handling patients. In defense of their attitudes, they put the blame on shortage of staff in the hospitals. These shortfalls apparently are attributed to numerous patients with few staff and facilities to use.

It was worrisome as the researcher observed, many primary healthcare workers in some parts of North-Central Zone Nigeria, practice without safety measures like foot wears, wearing of hand gloves and observing hand hygiene during handling of patients. Ogoina, Pondei, Chima, Isichei and Gidado (2015), reported in a study that poor practice of hand hygiene was exhibited despite good knowledge among some healthcare workers in two tertiary hospitals in Nigeria. Insufficient water supply, antiseptics among others, has been shown to affect the practice of hand hygiene among health care workers in Nigeria. Apparently, these issues of seemingly poor practice which may not be unconnected with Government's insensitivity to the provision of basic amenities, may have affected availability of safety measures, for the prevention of HAIs among PHCWs in North-Central Zone, Nigeria.

Considering all the above issues of knowledge, attitude, practice and availability of safety measures for primary healthcare workers towards the prevention of healthcare-associated infections vis-a-vis the task of attaining a safe healthcare delivery devoid of healthcare-associated infections in North-Central Zone, Nigeria, still remains a big challenge. All the above issues triggered the interest of the researcher to find out the cause of the alarming rate of HAIs among HCWs hence, the need to assess knowledge, attitude, practice and availability of safety measures towards prevention of healthcare-associated infections among primary healthcare workers in North-Central Zone, Nigeria.

1.3 Purpose of the Study

The main purpose of the study was to assess knowledge, attitude, practice and availability of safety measures towards prevention of healthcare-associated infections among Primary Healthcare Workers in North-Central Zone, Nigeria. This study seeks to specifically assess:

1. Knowledge of primary healthcare workers on safety measures towards prevention of healthcare-associated infections in North-Central Zone, Nigeria.
2. Attitude of primary healthcare workers to safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.
3. Practice of primary healthcare workers on safety measures towards prevention of healthcare-associated infections in North-Central Zone, Nigeria.
4. Availability of safety measures and devices for primary healthcare workers towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.
5. Difference between male and female primary healthcare workers' attitude towards safety measures in the prevention of healthcare-associated infections in North-Central Zone.
6. Difference between male and female primary healthcare workers' practice towards safety measures in the prevention of healthcare-associated infections in North-Central Zone.

1.4 Research Questions

This study was conducted to answer the following specific research questions:

1. What is the knowledge of primary healthcare workers on safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria?
2. What is the attitude of primary healthcare workers to safety measures towards prevention of healthcare-associated infections in North-Central Zone, Nigeria?
3. What are the practices of primary healthcare workers on safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria?
4. What is the availability of safety measures for primary healthcare workers towards the prevention of healthcare associated-infections in North-Central Zone, Nigeria?

5. What is the difference between male and female primary healthcare workers' attitude towards safety measures in the prevention of healthcare-associated infections in North-Central Zone, Nigeria?

6. What is the difference between male and female primary healthcare workers' practice towards safety measures in the prevention of healthcare-associated infections in North-Central Zone, Nigeria?

1.5 Significance of the Study

Findings from this study would be of significance in the following ways:

Guide government through health educators in the provision of training programmes designed to improve the knowledge of healthcare workers (who are the respondents in this study) on universal safety measures towards the prevention of healthcare-associated infections. The loss of HCWs from healthcare-associated infections can undermine development in the health systems hence, the need to minimize risks by safety measures against HAIs among HCWs.

Guide healthcare management in designing strategies to motivate healthcare workers towards improving their attitudes on safety measures when handling patients so as to ameliorate the risk of healthcare-associated infections not only among healthcare workers alone but to the general public. Once the patients are treated safely and the healthcare workers are prevented from acquiring infections from the hospitals to their families and friends outside, the spread of the infectious diseases among the public would have been prudently curtailed.

Assist legislators and other policy makers in developing institutional policy to enforce best preventive practices among healthcare workers in handling sharps and post-

exposure management, provision and use of protective equipment, Hepatitis Vaccines received by all Hepatitis healthcare workers coupled with a sound occupational health policy.

Revive the consciousness of the Government towards providing safety devices for the prevention of healthcare-associated infections among health care workers thereby, reducing preventable deaths resulting from such infections. Availability of safety measures in healthcare facilities play vital roles in the implementation of infection control policies among healthcare workers towards preventing the spread of healthcare-associated infections.

The findings of this study will also add to the existing body of knowledge which will stimulate further research on knowledge, attitude, and practice of primary healthcare Workers on safety measures towards the prevention of healthcare-associated infections.

1.6 Basic Assumptions

The following basic assumptions are made by the researcher to guide the course of this study:

1. Knowledge of primary healthcare workers on safety measures may help in preventing healthcare-associated infections in North-Central Zone, Nigeria.
2. Attitude of primary healthcare workers to safety measures may be positive towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.
3. Practice of primary healthcare workers on safety measures may be positive towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.

4. Availability of safety measures for primary healthcare workers would help towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.

5. Differences between male and female primary healthcare workers would not be a barrier to attitude of safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.

6. Differences between male and female primary healthcare workers would not be a barrier to practice of safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.

1.7 Hypotheses

On the basis of the research questions, one major hypothesis and six sub-hypotheses were formulated for the purpose of this study as follows:

1.7.1 Major Hypothesis

Knowledge, attitude, practice and availability of safety measures towards the prevention of healthcare-associated infections among primary healthcare workers in North-Central Zone, Nigeria is not significant.

1.7.2 Sub-Hypotheses

Based on the above major hypothesis the following sub-hypotheses were formulated:

1. Primary healthcare workers do not have significant knowledge of safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.
2. Primary healthcare workers do not have significant attitude to safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.
3. Primary healthcare workers do not have significant positive practice of safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.
4. Availability of safety measures towards the prevention of healthcare-associated infections among primary healthcare workers in North-Central Zone, Nigeria is not significant.
5. There is no significant difference between male and female primary healthcare workers' attitude to safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.
6. There is no significant difference between male and female primary healthcare workers' practice of safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.

1.8 Delimitations of the Study

This study was delimited as follows:

1. Primary healthcare workers' Knowledge of safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.

2. Primary healthcare workers' attitude to safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.
3. Primary healthcare workers' practice of safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.
4. Availability of safety measures for primary healthcare workers towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.
5. Differences between male and female primary healthcare workers' attitude towards safety measures in the prevention of healthcare-associated infections in North-Central Zone, Nigeria.
6. Differences between male and female primary healthcare workers' practice towards safety measures in the prevention of healthcare-associated infections in North-Central Zone, Nigeria.
7. Primary healthcare workers were delimited to the: Nurses; Community Health Extension Workers (CHEW); Laboratory Technicians and Cleaners, in Government owned healthcare facilities of North-central Zone Nigeria.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

Information regarding assessment of knowledge, attitude, practice and availability of safety measures towards prevention of healthcare-associated infections among Primary Healthcare Workers is discussed under the following sub-headings.

2.2 Concept of Healthcare-Associated Infections (HAIs)

2.3 Concept of Primary Healthcare (PHC)

2.4 Theoretical Frame work

2.5 Knowledge of Primary Healthcare Workers (PHCWs) on safety measures towards the prevention of HAIs

2.6 Attitude of PHCWs on safety measures towards the prevention of HAIs

2.7 Practice of PHCWs on safety measures towards the prevention of HAIs

2.8 Availability of Safety Measures in the prevention of HAIs

2.9 Gender differences among PHCWs towards the prevention of HAIs

2.10 Causes of Healthcare-Associated Infections

2.11 Prevalence of HAIs among Healthcare Workers

2.12 Strategies Focused on Prevention of Specific HAIs

2.13 Infection Control Policy in the Prevention of HAIs

2.14 Injury Surveillance Programme

2.15 Safety Engineered Devices (SED)

2.15.2 Features to be considered in the selection of SEDs

2.16 Empirical Studies

2.17 Summary

2.2 Concept of Healthcare-Associated Infections (HAIs)

Healthcare-Associated Infections formerly referred to as Hospital Acquired Infections, are those infections contracted by health care workers due to occupational hazards resulting from non-compliance with safety measures during handling of patients in healthcare facilities (Biberaj, Gega & Bimi, 2014). Hospitals provide a favourable transmission path-way for the spread of healthcare-associated infections, owing partly to poor infection control practices among health workers on one hand and overcrowding of

patients in most clinical settings on the other. The importance of healthcare-associated infections goes beyond its impact on morbidity and mortality figures in any country, but accompanied with profound economic implications.

Khan, Ahmad, and Mehboob (2015), reported that healthcare-associated infections (HAIs) appeared before the origin of hospitals and became a health problem during the miraculous antibiotic era. These infections not only increased the cost of healthcare, but also an extended hospitalization. This result to elevated morbidity and mortality of health workers from various infections. Health is the level of functional or metabolic efficiency of a living being. Health is both responsibility as well as right. It is the responsibility of those with power and right of those without power. The promotion of health is social and political as well as individual responsibility. Health does not mean only physical well-being of the individual but also include social, emotional, spiritual and cultural well-being. This is a whole of life view and includes the cyclical concept, of life-death-life. The fore mentioned explained the World Health Organization's definition of health as the complete state of physical, mental, social wellbeing and not merely the absence of diseases or infirmity (D'Souza & Umarani, 2014).

Some of these healthcare workers (HCWs) according to Verbeek, Ijaz, Mischke, Ruotsalainen, Mäkelä, Neuvonen, Edmond, (2015), are at risk of developing life threatening infectious diseases due to contact with patients, patients' blood or body fluids such as mucus or vomitus. The risk of infection and its consequences vary, but the 2013-2014 Ebola epidemic in Africa puts health care workers at high risk of a disease with a very high fatality rate in the epidemic areas. Not only nurses and doctors are at risk but also staff engaged in transportation, cleaning and burial of casualties. Also elsewhere,

HCWs can be at risk when seeing patients arriving from the epidemic areas. Due to the high risk of infection and the high fatality rate hundreds of HCWs have died in the epidemic areas. Just a decade earlier, healthcare workers lost their lives due to the Severe Acute Respiratory Syndrome (SARS) epidemic. Even though the transmission routes are different, Ebola and SARS do have in common that they are highly infectious, can have fatal consequences and especially affect healthcare workers.

Olajubu, Festus, Olubunmi, Lawal, Obadina, Deji and Anota (2012), opined that it has not been possible to create an environment that is absolutely free of microorganisms which have the potential for causing diseases in our healthcare facilities. This explains why some healthcare workers develop infections in the process of handling patients as they carry out diagnosis and administer various treatments in the healthcare facilities. These healthcare-associated infections are contracted by healthcare workers, either by needle injuries during injection of patients, setting of catheter, blood transfusion or cross matching among others. The most common sites of healthcare-associated infections are surgical wounds, burns, urinary tract, respiratory system, skin, blood and the gastrointestinal tract. Pseudomonas aeruginosa is commonly associated with wound and burns infections while Escherichia coli is predominantly isolated in urinary tract infections. Olajubu, et, al, (2012), postulated that, healthcare associated infections includes: Hepatitis B Virus, Hepatitis C Virus, Tuberculosis, Tetanus, and HIV among others. These infections are commonly acquired from immune-compromised patients, needle stick injuries, contaminated equipment, poorly ventilated healthcare facilities and non-compliance with proper hand hygiene among others.

Urinary tract infection is among the most common type of healthcare-associated infections, which healthcare workers contract through the process of setting catheter or sharing of toilets with patients of the infection without observing the required safety measures. In the United States, surgical site infections, bloodstream infections, and pneumonia are the other most common types (WHO, 2012). The location of healthcare associated infection depends on the nature of a patient's hospital procedure. Healthcare-associated infections (HAIs) are considered as a serious problem in the healthcare system, as they are common causes of illness and mortality among healthcare workers (Salah, Alnoumas, Fayda . Enezi, Meshal . Isaeed, Gamal Makboul & Medhat 2012).

According to Bello, Asiedu, Adegoke, Quartey, Appiah-Kubi and Owusu-Ansah (2011), acquisition of healthcare-associated infections among healthcare workers increase the costs of healthcare and places a serious economic burden for the country. Furthermore, it was found that the causative pathogens and their modes of transmission most frequently are those infections of needle stick injuries, the respiratory tract, blood stream, contamination from surgical wounds and urinary tract. Healthcare-associated infections take a major toll on society and the overall morbidity and mortality associated with these infections are enormous with particular concern for healthcare workers who are expected to treat other patients who visit the healthcare facilities. Complications from healthcare-associated infections often result in extended lengths of stay in the hospital and increased cost of healthcare, with reduced number of healthcare workers to handle the ever increasing patients' patronage.

Khan, Baig and Mehboob, (2017), postulated that with increasing infections, there is an increase in long term disability, increased antimicrobial resistance, increase in

socio-economic disturbance, and increased morbidity and mortality rate. Several information also exists on burden of healthcare-associated infections among healthcare workers because of poorly developed surveillance systems and inexistent control methods. These infections get noticed only when they become epidemic, yet there is no institution or a country that may claim to have resolved this endemic problem. Khan et al, (2017), further reported that pathogens responsible for healthcare- associated infections are bacteria, viruses and fungal parasites. These microorganisms vary depending upon different patient populations, medical facilities and even differences in the environment in which the care is given.

2.3 Concept of Primary Healthcare (PHC)

Vaishnavi and Priyadarshini (2015), reported World Health Organization's Alma-Ata Conference of 1978 definition of primary health care (PHC), as an essential healthcare made universally accessible to individuals and acceptable to them, through their full participation and a cost the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination. The attributes of PHC are: essential health care, universally accessible, acceptable, community based, first point of contact, affordability, adaptability, appropriateness, community participation, continuity, comprehensiveness, coordination. Components of PHC, therefore, includes: Education concerning prevailing health problems and the methods of preventing and controlling them; Promotion of food supply and proper nutrition; Adequate supply of safe water and basic sanitation; Maternal and child health care including family planning; Immunization against major infectious diseases;

Prevention and control of locally endemic diseases; Appropriate treatment of common diseases and injuries; Provision of essential drugs.

Primary health care professionals are practitioners of disease prevention, treatment, rehabilitation and preservation of health. They include: physicians, community health workers, nurses, health educators, dentists, laboratory technicians, cleaners, nutritionists, midwives, environmental health technicians, pharmacists and health information technicians. It is an umbrella designation that applies to wide range of people involved in healing occupations. However, this primary healthcare workers are exposed to a lot of infections hence the need to take certain precautionary measures or safety practices as they discharge their functions to patients or clients in various healthcare facilities towards preventing health-associated infections among their selves (Okafor, 2010). Precautions here includes: use of hand gloves, hand hygiene, sanitation, and use of injection safety boxes among others.

2.4 Theoretical Framework

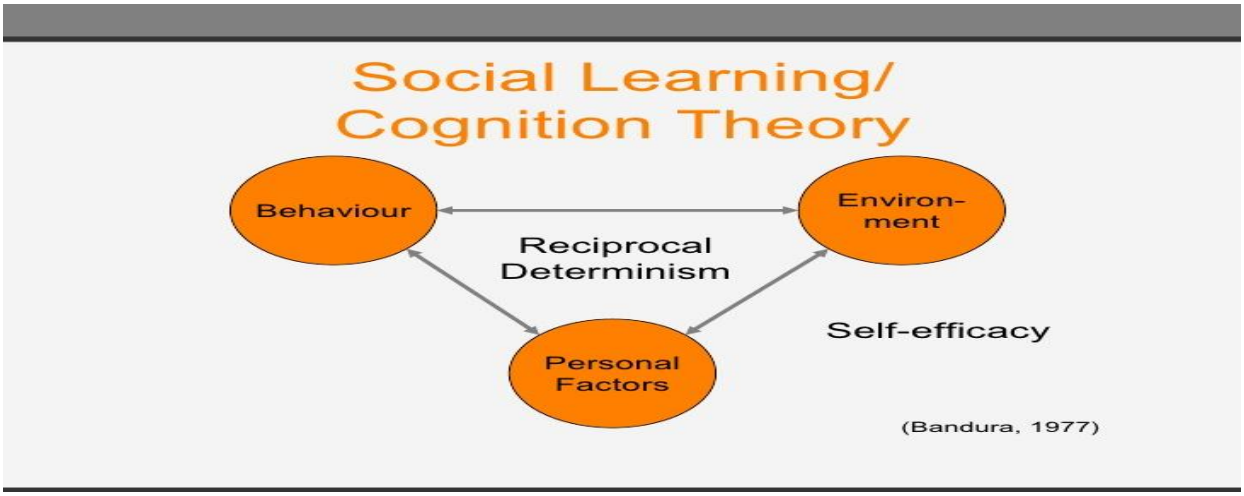
This study reviewed three related theories which explained knowledge, attitude and practice of healthcare workers respectively, on safety measures towards the prevention of Healthcare Associated Infections (HAIs). These theories includes: Social Cognitive Theory, Health Belief Model (HBM) and Theory of Reasoned Action/Theory of Planned Behavior (TRA/TPB).

Bandura's Social Cognitive Theory (1991) was used in this study to explain determinism of the influence of knowledge of safety measures towards the prevention of Healthcare-Associated Infections (HAIs) among primary healthcare workers. The Social Cognitive Theory (SCT) stems from the Social Learning Theory and was proposed by

Alfred Bandura in 1986. This theory is based on the notion of a triad model that takes into account the interactions (reciprocation) between three factors: environment, personal cognition and behaviour (outcome in practice). A central tenet of the Social Cognitive Theory asserts that behaviour is uniquely determined by each of the three factors and that response consequences mediate behaviour. Further, the theory asserts that people are most likely to learn and model behaviour observed in persons with whom they identify through a phenomenon commonly referred to as "vicarious capacity". Vicarious capacity is defined as an observational learning mechanism governed by attention span, retention process, motor reproduction process and motivational processes (Bandura, 1991 and Glanz, Rimer, & Lewis, 2002). This implies that the subordinate primary healthcare workers are expected to learn by observing their superior ones in the practice of safety measures towards the prevention of healthcare-associated infections (HAIs).

Bandura asserted that people learn by modelling behaviours from significant others; and that behaviour is determined by symbolizing capability, forethought, self-regulation, self-reflection, and vicarious capability. The theory also states that a bi-directional interaction (reciprocal determination) occurs between the environment and personal characteristics and is thus central to the development of human expectations, beliefs, and cognitive competencies (Bandura, 1991 and Glanz, Rimer, & Lewis, 2002). By implication, the subordinate primary healthcare workers should emulate the practice of their superiors through observations. Example is hand hygiene with antiseptics before and after handling patients, sterilization of equipment among others.

Figure 2.4: Illustration of Cognitive Theory by Bandura 1977.



In the context of Bandura's social-cognitive theory, personal factors in this study includes the professional values, ethics, skills and the knowledge of the superior primary healthcare workers who impart same to their subordinates in the healthcare facility (environment), towards an expected behaviour (positive practice). The healthcare facility plays the environment where directional and personal interactions (reciprocal determinism) between the healthcare workers such as the experienced primary healthcare workers interacts with the novice primary healthcare workers to shape their behaviour towards the practice of safety measures in the control of healthcare-associated infections. It is therefore possible to postulate that the primary healthcare workers with less experience might model the behaviours of the more experienced primary healthcare workers with respect to knowledge and practice of safety measures.

However, Bandura's social cognitive theory could not clearly describe the place of healthcare workers' attitude in the reciprocal determinism between the personal factor, environment and behavior, rather he described Knowledge clearly using personal cognitive factors interacting with behaviour, which portrays practice of safety measures

in the healthcare facility being the environment without a clear description of HCWs attitude. In view of the shortfall, Theory of Health Believe Model was also reviewed below, to explain the importance of HCWs' attitude to safety measures, towards the prevention of HAIs. Health believe model relates well with the attitude of HCWs to safety measures in the healthcare facilities hence its relevance in this study.

Health Belief Model (HBM) according to (Glanz et al., 2002), explains the pertinence of healthcare workers' attitude towards the prevention of healthcare associated infections (HAIs). HBM is a psychological model that explains and predicts health behaviors by focusing on the attitudes and beliefs of individuals. Health Belief Model was first developed in the 1950s by social psychologists Hochbaum, Rosenstock and Kegels. The model uses constructs that represent perceived threats and net benefits such as perceived susceptibility,

perceived severity, perceived benefits, perceived barriers, cues to action and self-efficacy. The

model asserts that these constructs account for a person's "readiness to act" (Rosenstock, Stretcher & Becker, 1988).

The literature reviewed suggests that it is possible to apply the constructs of the Health Belief

Model to studies that explore health attitude such as disease prevention and health promotion towards compliance with recommended guidelines for infection control. The behaviors of health care professionals and in particular nurses, are also regulated by social and moral standards. Through foresight, the individual can think through the consequences of a behavior without actually performing the behavior oneself (Bandura,

1989). It is documented in some studies that positive health behaviors by healthcare workers may decrease the occurrence of the unabated HAIs (Aly, Edrad-Ebel, Wray, Muller, Kozytska & Hentshel, 2005; Pittet, Simon, Hugonnet, Pessoa-Silva, Sauvan, & Perneger, 2004). For example, if a nurse internalizes and feels that prevention of nosocomial infections is essential, he/she will take precautions in order to improve on the outcomes of the admitting disease or condition, and improve the delivery of quality standard of care.

Furthermore, a study that examined compliance with hand-hygiene practices among medical staff showed that the frequency of healthcare workers' hand-hygiene was greatly influenced by role models (Lankford, Billerbeck & Conover, 2001). In this observational study, the researcher noted that healthcare workers were less compliant with hand hygiene protocols when a high ranking person such as physician or nurse did not carry out hand hygiene practices. This observation implied that the effect of role model is significant in negatively influencing healthcare workers' compliance with recommended guidelines.

Benefits of health belief model is that it helps healthcare workers to develop educational and social awareness programmes that can change behaviour. However, the model does nothing to advance knowledge of how to prevent these infections among HCWs, by using safety measures. In view of the above limitations, Theory of Reasoned Action/Theory of Planned Behavior (TRA/TPB) was reviewed to further explain the attitude and practice of HCWs towards safety measures which were earlier described.

Theory of Reasoned Action/Theory of Planned Behavior (TRA/TPB) is another theory with tenets applicable to attitude and practice of safety measures in this area of study. TRA/TPB was developed by social psychologists Ajzen and Fishbein in 1967 (Ajzen, 1980). This theory explains how attitude and motivation influences human behavior, here in translated in to practice of safety measures. The theory proposes that "intent' is the most important determinant of a person's "behavior" (practice); and furthermore, that an individual's intention to perform a behavior is dependent upon the "attitude" towards the performance of the behavior. The theory also contends that behavioral beliefs and normative beliefs influence the individual's motivation to comply with performance of a certain behavior (practice of safety measures).

According to Ajzen (1980), behavioral beliefs (attitude) link the behavior to an expected outcome which is practice of safety measures here while normative beliefs are considered as the perceived behavioral expectations of individuals within a group. Altogether these referents lead to actual behavior beliefs control and may drive the individual's intention to perform the behavior (Ajzen, 1980). Another assumption of the TRA/TPB theory is that human beings are rational: they make systematic use of information available to them and consider the implications of their actions before they decide to engage or not engage in certain behaviors. They (human beings) have normative beliefs which arise from perceived behavioral expectations of individuals such as co-healthcare workers; for example, nurses. Therefore, the stronger a person's intention to perform a particular task (behavior) the more likely the person will perform the behavior (Ajzen, 1980).

In the context of this study, it is possible to speculate that registered nurses could be influenced by colleagues or friends and peers towards practice at the work settings. What is unclear is whether they are actually influenced in a positive or negative practice. Additionally, it is possible to speculate that the healthcare workers would be influenced by cognitive factors such as decrease in knowledge. Any decrease in knowledge might lead to healthcare workers' poor attitude and non-compliance (poor practice) with recommended guidelines and protocols while performing patient-care activities. What is also unclear is whether the decline in the knowledge and skills gained during their course of study or whether these workers become non-compliant over time due to modeling other noncompliant peers or superior colleagues during their performance of patients' care activities. This non-compliance (poor practice) would lead to the spread of HAIs among healthcare workers.

The theory of Reasoned Action/Planned Behavior provide useful information for predicting health behaviors of health workers and for planning/implementing health promotion and disease prevention practice like the use of safety measures. Subjective norms can also be used to describe the behaviors of healthcare workers in the practice of safety measures towards the prevention of HAIs. These theories have been used to guide health promotion, disease prevention, asthma counseling, treatment compliance, tobacco use interventions, and anti-drug media campaigns, among other topics of health practice (Rural Health Information Hub, 2015).

2.5 Knowledge of Primary Healthcare Workers on safety measures towards the prevention of Healthcare-Associated Infections (HAIs)

Knowledge according to United States Agency for International Development-USAID (2014), is the capacity to act effectively (in short: "know-how"). Knowledge is generated in many ways, ranging from the immediate experience of individuals to methodical processes that generate widely-recognized evidence. Hassan, Afolaranmi, Nathaniel, Yushau, Tangkar, Chomo and Chirdan (2017), reported that the spread of nosocomial infections is partly due to poor knowledge and practices of infection control among healthcare workers on one hand and overcrowding of patients in most clinical settings on the other hand. The magnitude of the problem of poor knowledge of the transmission and prevention of healthcare-associated infection is particularly relevant in our environment where basic infection control measures are usually lacking or non-existent in most health facilities.

The prevention of infection according to Pittet, Allegranzi, Storr, Bagheri Nejad, Dziekan and Leotsakos (2010), is reliant on knowledge of complex factors of safety measures to include the skills and motivation of health providers, access to drugs and supplies, information feedback and other building blocks of the health system. Most nursing interventions requires touching the patient or close contact and frequently they come in contact with contaminated fluid. This can become an opportunity for transferring infection once hand hygiene is not done effectively. The members of the healthcare team are primarily responsible in the prevention of the incidences of these HAIs. Transmission of healthcare-associated pathogens generally occurs via the contaminated hands of healthcare workers and hand hygiene is the simplest most effective way to prevent it (Jonas, Charlie & Abdullah, 2015).

Wattal (2014), reported that lack of knowledge to include: improper use of injection techniques, poor knowledge of basic infection control measures, inappropriate use of invasive devices (catheters) and lack of control policies among primary healthcare workers have increased the spread of Healthcare-Associated Infections. However, in low income countries these risk factors are associated with poverty, lack of financial support, understaffed healthcare settings and inadequate supply of equipment for healthcare procedures is militating against the prevention of healthcare-associated infections. Wattal (2014), again, reported that the importance of education as a measure to prevent HAIs is implied in numerous studies like one exploring the knowledge, perceptions and attitudes of healthcare personnel towards the transmission of nosocomial infections in different patient groups, among others, suggest that education plays an important role in the prevention and spread of nosocomial infections.

Healthcare-associated infections among Healthcare Workers (HWCs) have been recognized as a problem affecting the quality of healthcare and a principal source of adverse healthcare outcomes. It has been documented in the literature that within the realm of HCWs and patient safety, these infections have serious impact. Increased hospital stay days, increased costs of healthcare, economic hardship to patients and their families and even deaths, are among the many negative outcomes (Kaye, Anderson, Sioanne, Chen, Choi, Link, Sexton, & Schmader, 2009).

Temesgen and Demissie, (2011) reported that knowledge of healthcare workers should encompass effective Tuberculosis Infections Control (TBIC) measures to include opening of windows; Isolation of patients; Minimizing hospital stays, Use of respirator by the health workers; educating patients; prioritizing TB suspects in treatment;

healthcare workers practice of hand hygiene; Most health workers were found to have good preventive knowledge however, very few of them knew that respirators can provide protection from inhaling mycobacterium tuberculosis (MTB) bacilli and that use of a fan (ventilator) minimizes the risk of TB infections among HCWs. Training on TBIC appears to be a strong determinant of knowledge of TBIC because knowledge of TBIC is a strong predictor of good TBIC practice. Training healthcare professionals with emphasis on skills rather than theory is vital to strengthening the implementation of TBIC activities. The relatively low level of knowledge regarding respirators and fans/ventilators is probably due to the unavailability of these supplies, hence the availability of these supplies can improve their utilization and TBIC practice overall (Temesgen & Demissie, 2011).

Ajibola, Akinbami, Elikwu, Odesanya and Uche (2014), postulated that providing relevant information on Post Exposure Prophylaxis (PEP) for the healthcare professionals would help to prevent the transmission of HIV, provide epidemiological data, identify unsafe practices, and reduce anxiety, increase staff retention and productivity. Hassan, et al, (2017), again reported that prior attendance of infection prevention and control training by the healthcare workers, was very low in Plateau state Nigeria. However attendance of such training was found to be much lower in a similar study conducted in Sri Lanka. It is therefore imperative to organize and promote attendance of infection control training regularly for health care workers as this will impact positively on the knowledge of infection prevention and control among healthcare workers.

Years of experience according to Alessandra, Gabriella, Luciana and Italo (2011), reported that Years of practice in the hospital significantly correlated to increased

knowledge, of infection prevention among the various categories of healthcare workers. However, they reported again that the ward aids (with less number of years of practice), in the hospitals who were more under direct supervision of a hospital supervisors, complied best with precautions. This is contrary to the expectations from healthcare workers who by several years of practice should be knowledgeable about hospital acquired infections, as such exhibit practices that complies with universal precautions.

Studies by Alessandra, Gabriella, Luciana and Italo (2011) showed effects of years of practices among health workers with respect to the spread of healthcare-associated infections. The researchers reported that the implication of years of experience varies, as some who had many years in the service had knowledge of precautions than those who had lesser years. While in the other hand, workers with lesser years were reported to have complied with precautions more than those with more years. So, the study investigated varying knowledge of health workers and their practice on the prevention of healthcare- associated infections.

2.6 Attitude of Primary Healthcare Workers on safety measures towards the prevention of Healthcare-Associated Infections (HAIs)

Attitude as described by Okafor (2010), are the outward manifestation of your inner values and believes that develop over time. As you grow you watch the significant people around you behaving in a particular way, you are being told to cherish certain things over others and you learn from your teachers and peers and come to value certain things over others thus, forming your value system. Attitude in this study means the manners by which healthcare workers take safety measures (positively or negatively) towards the prevention of healthcare-associated infections. Attitude has a very strong

tendency to influence or determine practice. Attitude is a predisposition to act in a certain way towards some aspect of one's environment, including other people, object and event. Attitude can be positive or negative and can affect the behaviour of healthcare workers. Essentially, attitudes are formed through learning process, which can occur in a number of ways, classical conditioning, operant conditioning, observational learning and imitation (Okafor, 2010).

Considering healthcare workers' varying attitudinal conduct to safety measures towards the prevention of healthcare-associated Infections, several studies have reported healthcare workers' approach towards the prevention of the infections. Costello, Graham, Morrow, Morrow, Potter-Bynoe, Sandora, Pigula, and Lausse, (2010), reported that epidemiological studies revealed that healthcare workers such as physicians, dentists and nurses are implicated in the transmission of nosocomial infections because of their negligence of safety measures. It has also been reported that transmission frequently occurs during the performance of medical procedures, when these healthcare workers fail to imbibe a positive attitude towards aseptic precautions. Thus, noncompliance with recommended guidelines by healthcare workers expose patients to an abundance of pathogens.

Ward (2012) exemplified perfectly in a study conducted 2012 reporting the findings of a series of interview exploring the attitudes of student nurses and their mentors towards infection control. In that report, students were reported to have constant negative attitudes, in which taking safety measures for infection prevention is largely seen as 'an additional workload burden rather than an integral aspect of patient safety and quality of care'. A student described a conversation between a ward sister and a

consultant thus: ‘I can either practice infection control or I can treat the patients, you choose’.

Majority of healthcare workers are aware of causes and transmission of Nosocomial Infections, but with a bad attitude towards reporting of Nosocomial Infections (healthcare-associated infections) (Olajubu, et al, 2012). This calls for regular monitoring and mentoring of health workers, most especially by concerned authority to ensure routine universal precautions and regular hand washing practices. The poor attitude to compliance of hepatitis B vaccination among health workers calls for concern because the only way to prevent HBV infection among health workers is through effective vaccination program and adherence to universal precaution which often times is not provided. Poor compliance of health workers to hepatitis B vaccination is an issue that deserves serious attention for which some authors have advocated for mandatory vaccination program. There is a need for health education campaigns for health workers to remind them of risks that they are exposed to base on the nature of their work (Soad, Ghadeer, Afaf, Al-otaibi, Ghizayel, Gamal & Medhat, El-Shazly, 2012).

It has been documented in several epidemiological studies that healthcare workers such as physicians, dentists and nurses are more implicated in the transmission of nosocomial infections (Imad, Ahmad, Faeda, & Lubna, 2015). Healthcare-associated infections are results of health workers’ continuous exposure in the care of patients with infectious diseases. Healthcare workers with Professional disciplines like Doctors, Nurses, Community Health Workers and Laboratory technicians are most at risk compared to other health workers, in acquiring hepatitis B virus (HBV) occupationally through percutaneous or mucosal exposure to contaminated blood and body fluids.

Protection of healthcare workers requires their immunization against hepatitis B virus. Hepatitis B immunisation, using plasma derived vaccine, is a safe and effective means of protecting against hepatitis B infection in individuals at risk particularly from occupational–related exposures (Imad, Ahmad, Faeda, & Lubna, 2015). Current recommendations in most developed countries are for vaccination against HBV particularly in high risk groups including Surgeons, Laboratory Technicians, Nurses and Theatre Attendants among the healthcare workers (United States of America Public Health Service, 2001).

Vaz, Mcgrowder, Alexander-Linda, Gordon, Brown, Irving, (2010), reported that Nurses in particular are often exposed to various infections during the course of carrying out their nursing activities however, they don't adhere to best practices that will reduce the scourge of the infections. The result of Healthcare workers infection is that they further transmit same to patient who were admitted for different treatment. Various studies carried out by Vaz, Mcgrowder, Alexander-Linda, Gordon, Brown, Irving, (2010), among different categories of health care workers found that exposure to blood or other body fluid was approximately 9.3%. A recent survey among doctors and dentists in a tertiary health institution in Ibadan Nigeria indicated a high HBV prevalence and low hepatitis B immunity.

Jonas, Charlie and Abdullah (2015), reported, that differences among professional cadres (doctors, nurses and other members of the health care team) has an impact on their varying practices of preventing healthcare-associated infections. The researchers also reported that in Saudi Arabia, adherence (practice) to hand hygiene was seen in 70% of medical students, 18.8% of nurses, and 9.1% of senior medical staff, but the technique

was below standard in all (showing a short fall in the attitude of Medical Doctors to the precaution). Transmission of healthcare-associated infections generally occurs via the contaminated hands of healthcare workers, who do not practice hand hygiene as the simplest and most effective way to prevent it (Jonas, Charlie & Abdullah, 2015).

2.7 Practice of Primary Healthcare Workers on Safety Measures towards the Prevention of Healthcare-Associated Infections (HAIs)

Practice according to Okafor (2010), simply means action and that the meaning of an idea or concept is established when put into use or applied. An individual who has been exposed to health information is better disposed to adopt positive health practices than one who is ignorant of it. It was further opined that the goal of health education is positive health practice and not mere health knowledge. In this present study practice implies the implementation or adherence to universal precautions to reduce the transmission of healthcare-associated infections among healthcare workers in the healthcare facilities.

Tenna, Stenehjem, Margoles, Kacha, Henry, Blumberg and Kempker (2013) reported that training of healthcare workers about the importance of practicing hand hygiene by improving hand sanitizer options may improve their safety thus preventing the spread of infections. Additionally, enhanced infrastructure is needed to improve Tuberculosis (TB) infection control practices and allay Healthcare Workers' concerns about acquiring Tuberculosis (TB) in the hospital. Tada, Watanabe and Senpuku (2015), reported in a study, that a longitudinal study such as identifying factors that could contribute to improvement of Infection Control Practices (ICPs) compliance and observing successive changes in ICP compliance towards a universally acceptable

precautionary standard (Global Best Practices) and elucidation of factors influencing compliance with Infection Control Practices (ICPs) especially ones concerning attitude or knowledge will be useful for improvement in ICP compliance.

According to Tenna, et al, (2013), Mmutle, Morake, Moea and Jacobs (2011), Kanjee, Catterick, Moll, Amico and Friedland, 2011), regardless of the knowledge of healthcare workers, there is poor safety practice on tuberculosis infection control in the health facilities. Studies also showed that practice of health workers towards TB infection control (TBIC) is associated with working units which include: TB ward, laboratories, general medicine wards and emergency rooms. Most healthcare workers almost (71%) are at higher risk of occupational acquisition of TB (Tennaet al, 2013). Health workers also have to educate TB patients and the community about adequate ventilation (FMOH, 2013). Poor practice according to Abdraboh, Milaat, Ramadan, Al-Sayes, & Bahy, (2016), was associated with the fact that, the hospital was flooded with patients and thus outnumbering the facilities and healthcare workers available in the hospital.

Zaiyad, Abdulwasiu, Salisu, Mohammad, Abdulrazaq, Garba and Farouq**,** (2016), reported in a study of safety measures among health workers in a Tertiary Hospital in North-Eastern Nigeria, that training on standard precautions was predictive of correct knowledge and practice of standard precautions. Kristof (2012), reported WHO's ''Clean Your Hands" initiative which was declared to accentuate the role of hand washing in preventing healthcare-associated infections. For the sake of standardizing the optimum application of hand wash procedure, an approach was applied to audit and address adherence to hand hygiene. The standard was formulated as "My five moments for hand hygiene" which recognizes the basic points for healthcare providers and enforce them

when there is need for hand washing to breakdown the infection chain when handling patients.

In a study conducted by Sharma, Ramani, Mavalankar, Kanguru, and Hussein, (2015), respondents perceived that specific practices on safety measures had improved after awareness programme on prevention of infections. The positive changes on safety measures took place in different hospitals across the study area. The second finding reported improvements in staff compliance included regularity of hand washing, use of gloves, masks and hospital gowns, and changing footwears between operation theatres and labour rooms. They also found that usage of disposable gloves was performed only once in a day. They again reported an increased use of gloves and changed hand washing practices to include use of a disinfectant. Their Sterilization practices also improved. Health workers set schedules or began strict implementation of procedures for fumigation of rooms and for autoclaving equipment. Changes such as using separate baby feeding tubes for each baby and cleaning of baby warmers with antiseptic were also reported in the study (Sharma, Ramani, Mavalankar, Kanguru, & Hussein, 2015).

Compliance with all Infection Control Practices (ICPs) items by subjects improved from 2008-2011 in Japan, with significant increases in the compliance rates of precautionary measures. This improvement could in part, be explained by the significant increase in the proportion of subjects with Infection Control Practices (ICPs) associated with factors such as specialization in oral surgery, willingness to treat HIV and AIDS patients with precaution and knowledge about universal and standard precautions (Tada, Watanabe & Senpuku, 2015). Tuberculosis (TB) infection control is an essential, but often-overlooked, component of a comprehensive infection control program in resource-

limited settings. In healthcare settings with high HIV prevalence and poor TB infection control practices, Mycobacterium tuberculosis can be rapidly transmitted to patients and HCWs; immunocompromised are at greatest risk for the development of active TB disease (Gandhi, Weissman, Moodley, Ramathal, Elson, Kreiswirth, Mathema, Shashkina, Rothenberg, Moll & Friedland, 2013).

One of the major reasons for these high rates of healthcare-associated infections is lack of infection control programs, which have been neglected due to limited resources, competing priorities, and other barriers (Borg, 2010). Findings of a study by Omuga (2011), indicated that there is still sub-optimal level of infection prevention and control and injection safety practices among nurses at Kenya National Hospital, whereby the practices were mainly influenced by personal and organizational factors. He also reported that compliance to universal precautions among health care workers, showed different levels of compliance. The study showed that compliance was maximum among nurses, intermediate for technicians and the least for Doctors (as against a finding reported earlier). Their observational study on hand washing practices reveals that in spite of the educational programs, Doctors were less compliant.

Adebimpe, Asekun, Bamidele, Abodunrin and Olowu (2011) reported in their studies that good knowledge and attitude, but poor practices characterize health workers towards the prevention of healthcare-associated infections among tertiary and secondary level healthcare workers in Osogbo. These difficulties appears to have increased the level of nonchalant attitudes and bad practices of health personnel to precautions against healthcare-associated infections. They also reported that a high load of work is associated with poor compliance to hand washing. This compliance here means practice towards the

prevention of healthcare-associated infections. Low compliance during the care of patients in intensive care units may also be a reason for the spread of multi-drug resistant organisms.

Compliance with guidance on correct Personal Protective Equipment (PPE) use in healthcare is historically poor. HCWs sometimes distrust infection control and the stress on PPE (Zelnick, Gibbs, Loveday, Padayatchi, O'Donnell, 2013). For respiratory protection, such as masks and respirators, compliance has been reported to be around 50% on many occasions. Due to lack of proper fitting and incorrect use, real field conditions almost never match laboratory standards (Coia, Ritchie, Adisesh, Makison, Booth, Bradley & Bunyan, 2013). It was also reported that even hand hygiene show there is still large room for improvement therefore, guidelines recommend education and training in combination with other measures. A reports of HCWs, shows it clearly that most appropriate PPE are not user friendly in tropical conditions because it is not made of breathable material. A common reason for a breach in the barrier of the PPE is the worker sweating and then instinctively wiping their face. Staff are being trained on arrival to the epidemic or treatment site by repeatedly practicing donning and doffing PPE and running through drills of what they should do if the protocol is breached while in the "red zone" (for example the Ebola patient area) (Verbeek, et al 2015).

2.8.1 Availability of Safety Measures in the Prevention of Healthcare-Associated Infections (HAIs)

Safety measures reviewed in this work according to Occupational Safety and Health Administration (2011), are expected to be provided by employers, managers and administrators of healthcare facilities towards effectively protecting the HCWs during care delivery procedures. These measures includes both safety medical procedures and safety devices and equipment in the

healthcare facilities towards the prevention of HAIs. Basically safety procedures implies compliance to the use of all the safety equipment, facilities, tools, devices and materials, compliance to standard precautions, infection control checklist, rapt attention and concentration to avoid accidents, Isolation of patients, among others. Safety equipment, facilities, tools, devices among others in the other hand, include: Personal Protective Equipment; hand gloves; antiseptic or disinfectants, water supply, autoclaves for sterilization, Injection safety boxes and other safety engineered devices.

Just like every other professional, health care workers, too, have a right to a safe workplace, and the hospital/medical facility must provide a safe and healthful workplace hence the need for adequate availability of these measures. While it is true that health care professionals face various safety hazards from the first time they step into a medical facility, there are ways to prevent or at least minimize the risks. The hospitals and the medical facilities must take responsibilities to make the workplace as safe as possible for the workers. The medical professionals also must follow the guidelines provided by the health care administration and be vigilant; after all, a hospital/medical facility is a constantly variable environment, and you never know what you will see next (Oliver, 2015).

The term “standard precautions” according to Amoran and Onwube (2013), is replacing “universal precautions”, as it expands the coverage of universal precautions by recognizing that any body fluid may contain contagious and harmful microorganisms. The level of practice of universal precautions by HCWs may differ from one type of HCW to another. The differences in availability of precautions for HCWs may be influenced by the Government or the hospital management either making it adequate or inadequate. The absence or inadequate availability of safety measures in the health institution, such as lack of constant running water or a shortage of

personal protective equipment (PPE), Lack of disinfectants would lead to poor compliance with universal precautions. It therefore, becomes important to assess the level of compliance with universal precautions by the various types of HCWs (doctors, trained nurses, pharmacist, laboratory, scientist, other health workers, and domestic staff) who make direct contact with patients, and level of compliance by HCWs in the various types of health facilities (Amoran & Onwube, 2013).

Considering safety procedures, Centre for Disease Control (CDC, 2012), recommended standard precautions to include: handling any patient regardless of their presumed infection status, should be handled with serious safety measure (caution); handling of equipment and devices that are contaminated or suspected of contamination, and in situations of contact risk with blood, body fluids, secretions and excretions except sweat, without considering the presence or absence of visible blood and skin with solution of continuity and mucous tissues should be done with all precautions. They also included precautions against agents that are transmitted by the following routes of transmission: air-borne, droplet and contact routes (CDC, 2012 & Vaz, Mcgrowder, Alexander-Linda, Gordon, Brown & Irving, 2010). Non adherence to these safety procedures (Noncompliance with recommended guidelines) by negligence of healthcare workers expose them and the patients to abundance of pathogens in the healthcare facilities (Costello, et al, 2010).

Olajubu, et al, (2012), reported that adequate availability of control measures which include setting up infection control unit and use of checklist by HCWs in healthcare facilities have proofed to reduce the burden of HAIs. Prabhakar and Naikwadi, (2016), postulated that prevention of healthcare-associated infections is the duty of all

healthcare workers, by complying with safety medical procedures. Infection control professionals require evidence-based educational content that facilitates reduction in nosocomial infections. Clinical and support staff in healthcare institutions are inundated with required training facilitated by accrediting bodies and institutional mandates.

David, and Famurewa (2010), opined that it is imperative to work towards reducing the risk of infection among HCWs therefore, major preventive effort should be geared towards improved and qualitative safety measures in healthcare facilities. These findings support the notion that the management of healthcare facilities and the provision of proper equipment and tools could positively impact healthcare worker's prudence in delivery of quality patient care which avoid the spread of nosocomial infections among workers. Implementation of Standard Universal Precautions (UPs), injury surveillance programmes, provision of personal protective equipment (PPE), routine hepatitis B vaccination, post-exposure prophylaxis (PEP) and engineered safety devices (SEDs) have yielded results. The availability of PPE, hepatitis B immunization, formalized PEP guidelines, safety devices and availability of drugs will go a long way in the prevention of HAIs (Atul & Verman, 2011). It is important that nurses wash their hands and maintain aseptic technique when carrying out health procedures because they are directly involved in providing a biologically safe environment for the patients.

Khan, Baig & Mehboob, (2017), reported that many needle-sticks and other cuts can be prevented by using safer techniques (for example, not recapping needles by hand), disposing of used needles in appropriate sharps disposal containers, and using medical devices with safety features designed to prevent injuries. Using appropriate and adequate safety equipment such as gloves, eye and face protection, or gowns when contact with

blood is expected can prevent possible exposure to the eyes, nose, mouth, or skin. Effective needle-stick prevention measures include hazard elimination, engineering controls (use of safer devices such as retractable needles), administrative controls, work practice controls and use of personal protective equipment. A committed management is essential to ensure occupational health of its employees. Different studies have reported a decline in HAIs rate after implementation of multi-factorial approaches (Khan, et. al, 2017).

Provision of adequate ventilated and fresh filtered air can eliminate airborne bacterial contamination. Regular check of filters and ventilation systems of general wards, operating theatres and ICUs must be maintained and documented. Infections attributed to water are due to failure of healthcare institutions to meet the standard criteria. Microbiological monitoring methods should be used for water analysis. Infected patients must be given separate baths. Improper food handling may cause food borne infections. The area should be cleaned and the quality of food should meet standard criteria. It is the duty of health care professionals to take role in infection control. Personal hygiene is necessary for everyone and so, staff should maintain it. Hand decontamination is required with proper hand disinfectants after being in contact with infected patients. Safe injection practices and sterilized equipment should be used. Use of masks, gloves, head covers or a proper uniform is essential for healthcare delivery (Khan, et. al, 2017).

2.8.2 Isolation of patients at risk of Healthcare-Associated Infections

There are patients, therapy and environmental related risk factors for the development of HAIs. Some of this risk factors include: Age more than 70 years; Shock;

Major trauma; Acute renal failure; Coma; Prior antibiotics; Mechanical ventilation; Drugs affecting the immune system (steroids, chemotherapy); Indwelling catheters; prolonged ICU stay (>3 days) (Center for Disease Control (2014).

2.8.3 Injection Safety Measures in the prevention of Healthcare-Associated Infections

Studies from many developing countries corroborated the poor injection safety practice (Mahfouz, Abdulmoneim, Khan, Daffalla, Diab, Shaban & Al Amri, 2009). Injection safety as defined by WHO, is an injection that is administered using appropriate equipment, without harming or exposing the healthcare worker and the patient to any avoidable risk and without resulting to any waste that is dangerous to other people (WHO 2010).

Today, injection is one of the most common health care procedures in both the formal and informal heath care sector. People in developing countries received an estimated 16 billion injections each year, of which 6.6 billion were given with equipment re-used in the absence of sterilization. The vast majority, about 95%, are given in curative care while immunization accounts for about 3% of all injections, others include use of injections for blood transfusion, blood products and contraceptives. In certain regions of the world, use of injections have completely overtaken the real need, reaching proportions no longer based on rational medicine. In some situations, as many as nine out of ten patients presenting to a primary healthcare providers receive an injection, over 70% of which are unnecessary or could be given in an oral formulation (Mahfouz, Abdulmoneim, Khan, Daffalla, Diab, Shaban & Al Amri, 2009).

Globally, unsafe injection practices are responsible for 5% Human immunodefficient virus infection, 32% Hepatitis B virus infection, 40% Hepatitis C virus infection, viral haemorrhagic fever, ebola, lasa fever abscesses, malaria, tetanus and possibility of emergence of other diseases in the future (13,14). The current global burden due to past and present unsafe injection practices reached 501,000 deaths, with the majority of deaths occurring in Asia and Africa and among persons aged ≥15 years. While there are data on prevalence of injection safety in some developed countries, there is no specific data of the burden in Africa due to poor reporting. In Africa, the awareness of injection safety among health-care workers is poor while less than one third of them has good knowledge of risk associated with injection practices (WHO 2010). Many injections are given for the wrong indications, such as cough, diarrhea, skin infection and urinary tract infection. In some countries children seem to be receiving large number of injections while sterilization techniques are poor and the final disposal of used injection materials present a problem that increases the risk of transmitting diseases to the entire community and not just the healthcare workers (WHO, 2010).

2.8.4 World Health Organization's five moments for hand hygiene

Brisibe, Ordineoha and Gbeneolol (2014), reported WHO's postulation that hands are the most common vehicle for transmission of organisms and "hand hygiene" is the single most effective means of preventing the horizontal transmission of infections among hospital patients and healthcare personnel. The following are five moment for hand hygiene:

- Before touching a patient – to protect the patient from harmful germs carried on your hands
- Before aseptic procedures – to protect the patient against harmful germs, including the patient's own germs
- After body fluid exposure/risk – to protect yourself and the healthcare environment from the harmful patient's germs
- After touching the patient – to protect yourself and the healthcare environment from the harmful patient's germs
- After touching the patient's surrounding – to protect yourself and the healthcare environment from the harmful patient's germs.

2.8.5 How to Observe Hand Hygiene

Brisibe, et. al, (2014), reported that according to WHO, the following are ways of practicing hand hygiene:

- Wash hands with soap and water when they are soiled or visibly dirty with blood or other body fluids. Wet your hands, apply soap and then scrub them vigorously for at least 15 s. Cover all surfaces of the hands and fingers, wash with water and then dry thoroughly using a disposable towel
- Use an alcohol-based hand rub (IA) e.g. 0.5% Chlorhexidine with 70% w/v ethanol, if hands are not visibly dirty. A combination of Chlorhexidine and alcohol is ideal as they cover Gram-positive and Gram-negative organisms, viruses, mycobacteria and fungi. Chlorhexidine also has residual activity.

- During surgical hand preparation, all hand jewelries (e.g. rings, watches and bracelets) must be removed
- Finger nails should be trimmed to <0.5 cm with no nail polish or artificial nails
- Avoid wearing long sleeves, ties should be tucked in, house coats are discouraged and wearing scrubs is encouraged.

2.8.6 Standard Precaution

Centers for Disease Control and Prevention (CDC) developed standard precautions to help protect both HCWs and patients from infections with blood-borne pathogens in the healthcare setting. These recommendations stress that blood is the most important source of HIV, HBV, and other blood-borne pathogens and that infection control efforts should focus on the prevention of exposures to blood as well as the receipt of HBV immunizations. In 1995, the CDC's Hospital Infection Control Practices Advisory Committee (HICPAC) introduced the concept of standard precautions, which synthesizes the major features of universal precautions and body substance isolation into a single set of precautions to be used for the care of all patients in hospitals regardless of their presumed infection status (Amoran & Onwube, 2013).

Blood and other certain body fluids (e.g., semen; vaginal secretions; and amniotic, cerebrospinal, pericardial, peritoneal, and synovial fluids), and tissues of all patients should be considered potentially infectious. Standard precautions apply to blood; all body fluids, secretions, and excretions (except sweat); non-intact skin; and mucous membranes. The core elements of standard precautions comprise (i) hand washing before and after patient contact, (ii) the use of barrier precautions (e.g., gloves, gowns, and facial protection) to prevent

mucoutaneous contact, and (iii) minimal manual manipulation of sharp instruments and devices and disposal of these items in puncture-resistant containers (Amoran & Onwube, 2013).

Standard precautions include prudent preventive measures to be used at all times, regardless of a patient's infection status. These precautions includes the use of the following: Gloves; Hand hygiene; face masks, respirators, sterilization of instrument and gowns (Brisibe, Ordinioha, & Gbeneolol, 2014).

2.8.7 Gloves

Almost half (50%) of reported HAIs are attributable to cross infection from transmission of pathogens via hands of healthcare personnel because of either inadequate and improper gloving or hand hygiene or personnel coming into contact with contaminated fomites such as bed rails or other surfaces in the patients environment. Direct contact among healthcare workers (HCWs) has been shown to be the primary mechanism for transmission of pathogens such as MRSA and VRE, transmission from HCWs coming into contact with contaminated fomites in the patient environment are beginning to play a significant role in transmission of infections caused by VRE, Clostridium difficile, and resistant gram-negative pathogens. CDC has published guidelines for hand hygiene and gloving, which is a major focus of some public health and infection control programs (Reitzel, Rosenblatt, Jiang, Hachem & Raad, 2014).

According to Centre for Disease Control, (2017), wearing gloves is not a substitute for hand hygiene. Dirty gloves can soil hands. Always clean your hands before and after using gloves.

Steps for Glove Use:

1. Choose the right size and type of gloves for the task
2. Put on gloves before touching a patient's non-intact skin, open wounds or mucous membranes, such as the mouth, nose, and eyes
3. Change gloves during patient care if the hands will move from a contaminated body-site (e.g., perineal area) to a clean body-site (e.g., face)
4. Remove gloves after contact with a patient and/or the surrounding environment (including medical equipment) using proper technique to prevent hand contamination
5. Failure to remove gloves after caring for a patient may lead to the spread of potentially deadly germs from one patient to another
6. Do not wear the same pair of gloves for the care of more than one patient

Sterile gloves should be worn after hand hygiene procedure while touching mucous membrane and non-intact skin and performing sterile procedures e.g. arterial, central line and Foley catheter insertion: Clean, non-sterile gloves are safe for touching blood, other body fluids, contaminated items and any other potentially infectious materials; Change gloves between tasks and procedures in the same patient especially when moving from a contaminated body area to a clean body area; Never wear the same pair of gloves for the care of more than one patient; Remove gloves after caring for a patient; Practice hand hygiene whenever gloves are removed (Brisibe, et al, 2014).

2.8.8 Mask, Eye Protection/Face Shield and Gown

Wear a gown to prevent soiling of clothing and skin during procedures that are likely to generate splashes of blood, body fluids, secretions or excretions: The sterile

gown is required only for aseptic procedures and for the rest, a clean, non-sterile gown is sufficient. Remove the soiled gown as soon as possible, with care to avoid contamination (Brisibe, et al, 2014). Wear a mask and adequate eye protection (eye glasses are not enough), or a face shield to protect mucous membranes of the eyes, nose and mouth during procedures and patient care activities that are likely to generate splashes/sprays of blood and body fluids, etc., Patients, relatives and healthcare workers (HCWs) presenting with respiratory symptoms should also use masks (e.g. cough) (Brisibe, et al, 2014).

Verbeek, et, al, (2015), also reported that in Europe, there is standard for clothing, specifically coveralls that protect workers against biological hazards from microorganisms. Clothing compliant with the standard is classified into the same six clothing types as chemical protective clothing. Type one provides most protection by complete encapsulation. Type three clothing protects against liquid penetration. Type six provides only protection against minor splashes. There is no requirement for the type of clothing whether it be a coverall or a gown. In addition, the clothing material should have passed the ISO 16604 test against viral penetration. Materials can also pass the test at six levels. Level 6 is the most protective and indicates that the test bacteriophage particles do not pass through the fabric at a hydrostatic pressure of 20 kPa (2.9 psi) but for level 1 this is protective only at a pressure of 0 kPa. There is a separate standard for surgical gowns, but this is designed to protect the patient and it has no requirements against viral penetration.

2.8.9 Patient-care equipment

- Used patient-care equipment soiled with blood, body fluids, secretions, or excretions should be handled carefully to prevent skin and mucous membrane exposures, contamination of clothing and transfer of microorganisms to HCWs, other patients or the environment.
- Ensure that reusable equipment are not used for the care of another patient until it has been cleaned and sterilized appropriately
- Ensure that single use items and sharps are discarded properly (Brisibe, et al, 2014).

2.8.10 Transmission Based Precautions

In addition to standard precautions, the following should be observed in those patients known or suspected to have airborne, contact or droplet infections (Brisibe, et al, 2014):

2.8.11 Airborne Precautions

- Disease-causing microorganisms may be suspended in the air as small particles, aerosols, or dust and remain infective over time and distance, for example, *Mycobacterium tuberculosis* (pulmonary/laryngeal), varicella zoster virus (chickenpox), herpes zoster (shingles), rubella virus and measles
- Isolate with negative-pressure ventilation
- Respiratory protection must be employed when entering the isolation room

Use the disposable N-95 respirator mask, which fits tightly around the nose and mouth to protect against both large and small droplets. This should be worn by all persons entering the room, including visitors (Brisibe, et al, 2014).

2.8.12 Contact Precautions

Infections can be spread by usual direct or indirect contact with an infected person, the surfaces or patient care items in the room, for example, para-influenza virus infection, respiratory syncytial virus infection, varicella (chickenpox), herpes zoster, hepatitis B and rotavirus infections (Brisibe, et al, 2014).

- Isolation is required
- Non-critical patient-care equipment should preferably be of single use. If unavoidable, then clean and disinfect them adequately before using to another patient
- Limit transport of the patient (Brisibe, et al, 2014).

2.8.13 Droplet Precautions

- Microorganisms are also transmitted by droplets (large particles >5 μm in size) generated during coughing, sneezing and talking, or a short-distance travelling, for example, influenza virus, Bordetella pertussis, Hemophilus influenzae (meningitis, pneumonia), Neisseria meningitidis (meningitis, pneumonia and bacteremia), Mycoplasma pneumoniae, Severe acute respiratory syndrome-associated coronavirus, Group A Streptococcus, adenovirus and rhinovirus (Brisibe, et al, 2014).
- Isolation is required
- Respiratory protection must be employed when entering the isolation room or within 6-10 ft of the patient. Use the disposable N-95 respirator mask, which fits tightly around the nose and mouth to protect against both large and small droplets. This should be worn by all persons entering the room, including visitors

- Limit transport of the patient (Brisibe, et al, 2014).

Post-exposure management should include the immediate management of the site of exposure by evaluation of the exposure, source patient evaluation, base-line and follow up testing, counselling and PEP (Bader & Mckinsey, 2013). Immediately following an exposure, needle-stick injury should be washed with water, splashes to the nose, mouth or skin be flushed with water and eyes irrigated with clean water. Jonas, Charlie and Abdullah (2015) reported that there is a varying degree of knowledge and attitude between disciplines in primary healthcare, towards hand hygiene in the prevention of HAIs.

Employers are required to establish exposure control plans that include post-exposure follow up for their employees and to comply with incident reporting requirements mandated by the 1992 Occupational Health and Safety Administration (OSHA) blood borne pathogens standard. Access to clinicians who can provide post-exposure care should be available during all working hours, including nights and weekends. Hepatitis B vaccine and antiretroviral drugs for HIV PEP should be available for timely administration, either by providing access on site or by creating linkages with other facilities or providers to make them available off-site (OSHA) (CDC, 2012).

Bader & Mckinsey (2013), reported the following recommendation by Centre for Disease Control for immediate activity after exposure: Provide immediate care to the exposure site, Wash wounds and skin with soap and water, flush mucous membranes with water; Irrigates eyes with clean water, saline or sterile irrigants. The use of hepatitis B vaccine is considered to be most important intervention for the prevention of infections with hepatitis B (De Schryver, Claesen & Meheus, van-Sprundel, & Francois 2011).

Healthcare professionals who have received hepatitis B vaccine and have developed immunity to the virus are at virtually no risk for infection (Werner, Abdalla & Gara, 2013).

2.9 Gender differences among Primary Healthcare Workers in the prevention of Healthcare-Associated Infections (HAIs)

Gender of healthcare workers becomes an important factor too in this study, to consider towards finding out healthcare workers' knowledge and attitudes about healthcare-associated infections. Haile, Engenda and Abdo (2017), reported in their study, that female HCWs were more likely to always comply with safety measures as compared to male HCWs. The female HCWs' better compliance might be due to a natural tendency of female workers to obey organizational rules and regulations most often and also to their extra caution against infections. Moreover, in Ethiopia since females take the lion's share in taking care of children and being responsible for cooking meals for their family, they might be more concerned about their health in order not to bring infectious disease to their family.

Alessandra, Gabriella, Luciana and Italo (2011) reported in their study again supporting the fact that a more positive attitude and practice has been observed in female nurses, in those with a lower number of years of activity (experience in healthcare delivery), and in those needing additional information about disinfection procedures. In a study conducted by Adedigba, Ogunbode, Fajewonyomi and Naidoo, (2006), which determined the gender differences on the attitude and practice of healthcare workers in Osun State, Nigeria, it was revealed that there is significant gender difference in attitude

and practices of healthcare workers with males having positive attitude towards PLWHA and also complied more to safety practices than females.

Furthermore, gender may influence hand washing rates in healthcare workers in the Critical Care Units, although this difference appears to be modified in particular professional groups. Their findings implied that gender is a factor to be considered when reviewing health care workers' attitude and behaviours regarding Healthcare-Associated Infections. According to WHO (2011), gender refers to the socially constructed roles, behaviours, activities, and attributes that a given society considers appropriate for males and others for females. Gender differences include both socio-cultural factors as well as male-female differences in access and control over resources.

WHO (2011), also reported that there are two important predominantly female groups in healthcare settings, namely healthcare workers and pregnant women. Healthcare workers are included because the majority of them are females; there are high levels of occupational sex segregation among healthcare workers; they play a major role in controlling emerging diseases; and they have heightened risks of exposure. Pregnant women are included because they form a sizable group of patients, are entirely females, and are particularly vulnerable to some infectious diseases during pregnancy. In addition, nosocomial outbreaks in maternity settings have occurred for previous emerging diseases, such as Ebola and SARS.

More so, the proportion of females were more than 90%, which showed dominance of female among Primary Health Care Workers (PHCW). This corroborated the actual situations of most Primary Health Care (PHC) facilities in Nigeria where nursing professions and other nursing related professions like Community Health Officers (CHO) and Community Health

Extension Workers (CHEW) are basically women. Expectedly, the Registered Nurse and Midwife (RN/RM) and CHEW respondents have the highest proportion, accounting for more than 60% of all respondents in the study. This is important because these are the cadre of Healthcare workers that are required for effective PHC deliveries in Nigeria.

Gender differences among primary healthcare workers is also a factor implicated in the prevalence of healthcare-associated infections. Quiros, Lin and Larson (2007) revealed in a study that female staff scored higher than male staff members in attitudes regarding clinical practice guidelines in general including hand hygiene meant to prevent healthcare-associated infections. Also, positive attitude was significantly higher among female personnel on hand decontamination in a study that evaluated the knowledge, attitudes, and behaviour regarding hand decontamination in personnel of Intensive Care Unit in Italy. Implication of gender to this study now is, why should a gender be more inclined to the precautions against healthcare-associated infections than the other?

2.10 Causes of Healthcare Associated Infections (HAIs)

Nurses may harbor micro-organisms that are harmless to them but potentially harmful to patients if they find a route of entry which in turn affects the PHCWs. Micro-organism exist everywhere, in water, soil, air, body surface like the skin, intestinal tract, vagina, respiratory tract and urinary tract. Some micro-organisms are normal resident's flora, while others invade the body and cause infection and disease that could either be asymptomatic, subclinical or clinical. These features make them vary in their virulence, pathogenicity and sepsis (Ojong, Etim, Nlumanze & Akpan, 2014).

Verbeek, et al (2015), reported that Healthcare Workers can get infected through various routes of transmission depending on the pathogen. Infection can occur through splashes and droplets of contaminated body fluids on non-intact skin or via needle stick injuries through intact skin. Infection can also occur when splashes or droplets of contaminated body fluids land on the mucous membranes in the eyes, mouth or nose, or when the same mucous membranes come into contact with contaminated skin such as when rubbing the eyes with a hand carrying pathogens after shaking hands with a patient. For Ebola, this is the main route of transmission even though there is doubt about transmission of virus particles through aerosols. For SARS, the highest risk of infection was due to inhalation of aerosols but the disease was also transmitted through droplet infection.

Healthcare workers (HCWs) are at direct risk of exposure to blood and other body fluids during the course of their job. Amoran and Onwube, (2013), postulated that consequent upon healthcare workers' exposure to immune compromised patients, they are at risk of infection of blood borne viruses including hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV). Occupational exposure to blood can result from percutaneous (needle stick or other sharps injury) and mucocutaneous injury (splash of blood or other body fluids into the eyes, nose, or mouth), or blood contact with non-intact skin. Needle stick injury (NSI) is the most common form of occupational exposure to blood which results in transmission of blood borne infection. Healthcare-associated infections (HAIs) have been reported to be a serious problem in the healthcare services as they are common causes of illness and mortality among hospitalized patients including HCWs (Amoran & Onwube, 2013).

The causative agents of nosocomial infections are commonly present in hospitals and other healthcare facilities and may be transmitted from one source to susceptible hosts by more than one route. For example, some of the pathogens are transmitted by "direct contact between the healthcare workers and patients or by "indirect contact with environmental surfaces and inanimate objects, or by air. The most common method of transmission of healthcare-associated infections from infected patients to healthcare workers, is often via contaminated hands of healthcare workers, by "direct contact" resulting from poor hand hygiene.

Epidemiological studies carried out by Kamunge, (2013), have documented that healthcare-associated infections (HAIs) are commonly caused by pathogens such as bacteria, fungi, parasites and viruses transmitted from one patient to another through indirect or direct contact. The most common pathogens are the bacteria. In 1938, Price established that bacteria recovered from the human body could be divided into two categories: the resident flora (microbiota), or transient flora. Transient microbiota colonizes the superficial layers of the skin and is more amenable to removal by routine hand hygiene and such bacteria are often acquired by healthcare workers during direct contact with patients, or contaminated environmental surfaces, within the patient's surroundings (Kamunge, 2013).

Healthcare workers could contaminate their hands or gloves with various microorganisms while performing procedures that involve touching the intact skin of patients. There exists a strong association between poor compliance with the recommended infection control guidelines by healthcare workers on one hand and the transmission of pathogens some of which become resistant to antibiotics and other chemotherapeutic agents. Khan, Baig and Mehboob (2017), reported that Infections can be transferred among healthcare workers in the healthcare facilities as well. More so, unhygienic environment serves as the best source for the pathogenic organisms in transmission of diseases particularly most of the HAIs. Air, water and food can get contaminated and be transmitted to healthcare workers during healthcare delivery. There must be policies to ensure the cleaning and use of cleaning agents on walls, floors, windows, beds, baths, toilets and other medical devices (Khan, et. al, 2017).

2.10.2: Source and Transmission of Healthcare-Associated Infections (HAIs)

Table 2.10.2: Source and transmission of HAIs

Source	**Transmission**
Microbial floral of colonized infected patients.	Direct contact via staff hands and devices
Inanimate hospital environment	Direct contact via staff hands
Hospital Equipment	Inadequately disinfected endoscope, stethoscope, sphygmomanometer, weighing scale, surgical instruments.
Infected patients	Respiratory droplets or nuclei, blood borne.

Source: (David & Famurewa 2010).

Invasive devices such as catheters and ventilators employed in modern health care practices, blood screening and transfusion among others, expose healthcare workers to these infections (Centre for Disease Control-CDC, 2016). Blood borne pathogens are any

pathogenic microorganism found in the blood or other bodily infectious material that can cause disease in humans. Examples of blood borne pathogens includes: hepatitis B virus; hepatitis C virus; human immunodeficiency virus (HIV); malaria; syphilis; viral haemorrhagic fever; arboviral infections; creutzfeldt-Jakob disease and relapsing fever. The three blood borne pathogens that are the most commonly involved in occupation exposure in healthcare workers are hepatitis B, hepatitis C and HIIV (Weber, Rutala & Eron, 2012; Deuffic-Burbank, Delaroccque-Astagneau, Abitedoul, Bouvet & Yazdanpanah, 2011). The human cost after an exposure are immeasurable. Employees may experience stress, anger, depression, fear, anxiety, difficulty with sexual relations, trouble sleeping, problems concentrating and doubts regarding their career choice. The emotional effect can be long lasting, even in a low risk exposure that does result in infection (Green & Griffiths, 2013; Zhiang & Yu, 2013).

An experience to a blood borne pathogen is defined as (1) a percutaneous injury, such as a needle stick or laceration from a sharp object, or (2) contact with mucous membrane or non- intact skin (i.e., skin that is abraded, chapped, or has dermatitis) with blood tissues or other fluid that are potentially infectious (Kuhar, Henderson, & Struble, 2013). Also any direct contact to concentrated HIV, Hepatitis B, or hepatitis B (Direct contact meaning the healthcare worker was not using barrier protection) should be considered an exposure. Exposure occurs through needle sticks or cuts from other sharp instruments contaminated with an infected patient's blood through contact of eye, nose, mouth or skin with a patient's blood. Percutaneous injuries and splash exposure appears to be equally involved (Richard, 2011). The most common cause of percutaneous injuries appears to be punctured wounds from hollow bore needles (Camacho-Ortiz, Diaz-

Rodriguez, Rodriguez-Lopez, Martinez-Palomares, Palomare-De la Rosa & Garza-Gonzalez, 2013).

However, no scientific evidence shows that using antiseptics or squeezing the wound will reduce the risk of transmission of a blood borne pathogen but may be used as first aid measure. Using a caustic agent such as bleach is not recommended (Bader, McKinsey, 2013; Samaranayake & Scully, 2013). The number of healthcare workers acutely infected with hepatitis B, decreased from 10,000 in 1989 to 100 in 2009 (Kaltsas, & Sepkowitz, 2013), and the decline in hepatitis B infection in healthcare workers is 1.5 fold higher than the decline in the general population (Weber, Rutala & Eron, 2012).

2.11.1 Prevalence of Healthcare-Associated Infections (HAIs) among Healthcare workers

The prevalence of healthcare-associated infections is so alarming among primary healthcare workers worldwide. Gordon, (2016), reported that the risk of acquiring healthcare-associated infections, particularly tuberculosis (TB), was higher among healthcare workers than the general population. In 2014, a European study reported a wide prevalence of healthcare-associated infections (4.6% - 9.3%) (European Centre for Disease Prevention and Control, 2014). Iliyasu, Dayyab, Habib, Tiamiyu, Abubakar, Mijinyawa and Habib, (2016) reported that the prevalence of healthcare-associated infections in developing countries is somewhat higher than developed countries, with up to 19% prevalence of healthcare-associated infections among primary healthcare workers and hospitalized.

In Sub-Saharan Africa including Nigeria, Malewezi, Omer, Mwagomba and Araru, (2013) reported the highest HBV rates of healthcare-associated infections, ranging

from 5% to 8%, with high human immunodeficiency virus (HIV) and HBV co-infection (15%) rate. The region also faces critical shortages of healthcare workers; despite shouldering (24%) of global disease burden, it has only 3% of global workforce. Morbidity and mortality related to chronic diseases, such as HIV and potential HBV, contribute to high attrition among health workers. The knowledge of spread and indices of healthcare-associated infections among healthcare workers will help the search for the prevention of the scourge.

Dokubo, Odume, Lipke, Muianga, Onu, Olutola, Ukachukwu & Igweike, (2016), reported that Tuberculosis (TB) is the leading cause of infectious disease mortality worldwide, accounting for more than 1.5 million deaths in 2014, and is the leading cause of death among persons living with human immunodeficiency virus (HIV) infection. Nigeria has the fourth highest annual number of TB cases among countries, with an estimated incidence of 322 per 100,000 population, and the second highest prevalence of HIV infection, with 3.4 million infected persons. In 2014, 100,000 incident TB cases and 78,000 TB deaths occurred among persons living with HIV infection in Nigeria. Nosocomial transmission is a significant source of TB infection in resource-limited settings, and persons with HIV infection, healthcare workers are at increased risk for TB infection because of their routine exposure to patients with TB in health care facilities. A lack of TB infection control in healthcare settings has resulted in outbreaks of TB and drug-resistant TB among patients and healthcare workers, leading to excess morbidity and mortality.

Gordon (2016) reported that globally about three million, healthcare workers are exposed to healthcare-associated infections each year, with 2 million exposed to Hepatitis

B Virus, 0.9 million to Hepatitis C Virus and 170,000 to HIV. Healthcare-associated infections if not checked, may result in 15,000 HCV, 70,000 HBV and 1000 HIV cases with more than 90% of these infections occurring in developing countries among healthcare workers. According to Vaz, Mcgrowder, Alexander-Linda, Gordon, Brown and Irving (2010), World Health Organization in 2009 estimated that about 2.5% of HIV cases and 40% of Hepatitis B virus (HBV) and Hepatitis C Virus (HCV) cases among healthcare workers worldwide were attributable to non-adherence to the practice of universal precautions. Hence, it is believed that one third of nosocomial infections are considered preventable and that as many as 92% of deaths from healthcare-associated infections could be prevented (Ricks, Germ & Arlinton, 2014).

Lavoei, Boulton and Dwyer (2011) reported that worldwide, over 1.4 million people got Healthcare-Associated Infections (HAI) annually, health workers being most prone. Such infections included Hepatitis B, Tuberculosis and HIV. Nosocomial infection continues to be burden to the world health care system through increased risk to patient and employees. These infections have tremendous health and financial costs with an estimate incidence of 2,000,000 infection per year, 20,000 death per year and added costs of billion dollars per year. Effective infection control program are essential to controlling and preventing HAIs (Al-Jubouri, 2014).

Sharp injuries and other exposure to health workers like blood according to Lavoei, et. al, (2011), carry a risk of transmission of blood borne infections including hepatitis B virus. Healthcare workers are at risk of acquiring hepatitis B virus (HBV) occupationally through percutaneous or mucosal exposure to contaminated blood and body fluids. Protection of healthcare worker requires their immunization against hepatitis

B virus. Hepatitis B immunisation, using plasma derived vaccine, is a safe and effective means of protecting against hepatitis B infection in individuals at risk particularly from occupational–related exposures. Current recommendations in most developed countries are for vaccination against HBV particularly in high risk groups including healthcare worker.

However despite the long-standing recommendations for high risk group vaccination, hepatitis B vaccination remains unavailable to healthcare workers in most resource-limited settings in Sub-Saharan Africa and even when available, the coverage remains low. HBV vaccination status is very low among healthcare workers in Nigeria and the prevalence of needle stick injuries is high. A recent survey among doctors and dentists in a tertiary health institution in Ibadan Nigeria indicated a high HBV prevalence and low hepatitis B immunity. Prevalence of hepatitis B virus infection in Nigeria among the rural population groups is high and the risk of contamination of healthcare workers in the course of their work by HBV from exposure to patient's blood and body fluids is generally high (Lavoei, et al, 2011).

Hepatitis C virus (HCV) is a small RNA virus previously known as non-A non-B hepatitis, belonging to family flaviridae. Hepatitis C Virus was discovered in 1989 (Choo, Ku, Weiner, Overby, Bradly & Houghton, 1989). Hepatitis C Virus infects approximately 170 million individuals worldwide. Infection by HCV is the most common chronic blood-borne infection in the United States; approximately 3.2 million persons are chronically infected. Sixty to 70% of persons newly infected with HCV are usually asymptomatic or have a mild clinical illness. The incubation period for acute HCV infection ranges from 2 to 24 weeks, with an average of 6 to7 weeks. Hepatitis C virus

RNA can be detected in blood within 1-3 weeks after exposure. Chronic HCV infection develops in 70% to 85% of HCV infected persons; 60% to 70% of chronically infected persons have evidence of active liver disease. Hepatitis C Virus is most efficiently transmitted through large or repeated percutaneous exposure to infected blood. The infection is common in injection drug users. A study found that sexual transmission of HCV is possible but inefficient (Strasser, Aigner & Schmidt, 2013).

Patient care is provided in facilities which range from highly equipped clinics and technologically advanced University hospitals to front-line units with only basic facilities. Despite progress in public health and hospital care, infections continue to develop in hospitalized patients, and may also affect hospital staff. Many factors promote infection among hospitalized patients: decreased immunity among patients; the increasing variety of medical procedures and invasive techniques creating potential routes of infection; and the transmission of drug-resistant bacteria among crowded hospital populations, where poor infection control practices may facilitate transmission (Strasser, Aigner & Schmidt, 2013).

Approximately 39% of all hepatitis C infections in healthcare workers are considered to be occupational (Strasser, et al, 2013). The risk for hepatitis C infection after a needle stick or sharp exposure to HCV-positive blood is approximately 1.8% (range: 0-10%) (Strasser, et al, 2013). For HIV, the average risk of HIV transmission after a percutaneous exposure to HIV-infected blood has been estimated to be approximately 0.3% HIV: There is no vaccine against HIV. Post-Exposure Prophylaxis is not recommended for all occupational exposures to HIV because most exposures do not lead to HIV infection and because the drugs used to prevent infection may have serious

side effects. Based on the level of risk of HIV transmission of the exposure, a two or more drug PEP may be recommended (Hoffman, Bucholz & Schnitzler, 2013). The incidence is high enough in high income countries always between 3.5% and 12% whereas it varies between 5.7% and 19.1% in middle and low income countries. The frequency of overall infections in low income countries is three times higher than in high income countries (Nejad, Syed, Ellis & Pittet, 2011).

Atata (2008), observed that healthcare-associated infections may also be considered either as endemic or epidemic. Endemic infections are defined as sporadic infections that constitute the background rate of the infection at the healthcare facility; the rate of such infections usually fluctuates from month to month but overall, it is not statistically significantly different from the background rate of these infections. Out of all healthcare-associated infections, endemic infections account for the majority of infections, meaning that they are at the level of usual occurrence within the setting and are the focus of most infection control activities of the National Nosocomial Infections Surveillance. Epidemic infections are defined as the occurrence of infection at a rate statistically significantly higher than the background rate of such infections or when there is an unusual increase in infection above baseline for a specific infection or organism. Four sites of nosocomial infections recognized are; urinary tract, surgical site, blood stream and respiratory nosocomial infections (Atata, 2008).

2.12.1 Strategies Focused on Prevention of Specific Healthcare-Associated Infections (HAIs)

In addition to the standard and transmission-based precautions, there are several strategies focused on prevention of specific healthcare-associated infections in critically

ill patients. These HAIs includes: Ventilator-Associated Pneumonia (VAP), Catheter-Related Bloodstream Infection (CRBSI) and Urinary Tract Infection (UTI). Anthony, Iwuafor, Ogunsola, Oladele, Oduyebo, Desalu, Egwuatu, Agwu, Nnachi, Comfort, Akujobi, Ita, Godwin, (2016), postulated that strategies to reduce the rate is dependent on accurate and adequate data however, there is paucity of local data on intensive care unit ICU acquired infections in our setting, thus, there is an overdependence on data from other climes which do not necessarily reflect the local realities. Also, Healthcare-Associated Infections (HAIs) are known to vary in terms of aetiology, resistance pattern and risk factors even in different units in the same hospital setting. To initiate necessary policies that are critical to effective treatment of ICU-acquired infections and prevent antibiotic resistance development, there should be surveillance of bacterial aetiologies and infection patterns.

2.12.2 Strategies to Reduce Ventilator-Associated Pneumonia (VAP)

Avoid intubation whenever possible Maselli and, Restrepo, (2011), reported the following strategies:

- Consider noninvasive ventilation whenever possible
- Prefer oral intubations to nasal unless contraindicated
- Keep head elevated at 30-45° in the semi-recumbent body position
- Daily oral care with chlorhexidine solution of strength 0.12%
- Daily sedation vacation if feasible and assessment of readiness to extubate
- Avoid re intubation whenever possible
- Routine change of ventilator circuits is not required

- Monitor endotracheal tube cuff pressure (keep it >20 cm H_2 O) to avoid air leaks around the cuff, which can allow entry of bacterial pathogens into the lower respiratory tract
- Prefer endotracheal tubes with a subglottic suction port to prevent pooling of secretions around the cuff leading to micro-aspiration
- The heat moisture exchanger may be better than the heated humidifier
- Closed endotracheal suction systems may be better than the open suction
- Periodically drain and discard any condensate that collects in the tubing of a mechanical ventilator.

2.12.3 Strategies to Reduce Catheter Related Bloodstream Infections (CRBSI) by Centre for Disease Control (2011)

- Prefer the upper extremity for catheter insertion. Avoid femoral route for central venous cannulation (CVC)
- If the catheter is inserted in a lower extremity site, replace to an upper extremity site as soon as possible
- Use maximal sterile barrier precautions (cap, mask, sterile gown and sterile gloves) and a sterile full-body drape while inserting CVCs, peripherally inserted central catheters, or guidewire exchange
- Clean skin with more than 0.5% chlorhexidine preparation with alcohol (usually 2% chlorhexidine with 70% w/v ethanol) before CVC, arterial catheter insertion, etc.,
- Use chlorhexidine/silver sulfadiazine or minocycline/rifampin-impregnated CVCs when the catheter is expected to remain in place for more than 5 days and only if the

bloodstream infection rates are high in the unit despite successful implementation of measures to reduce CRBSI

- Use ultrasound-guided insertion if technology and expertise are available
- Use either sterile gauze or sterile, transparent, semipermeable dressing to cover the catheter site. Replace the catheter site dressing only when the dressing becomes damp, loosened, or visibly soiled
- Evaluate the catheter insertion site daily and check if a transparent dressing is present and palpate through the dressing for any tenderness
- Insertion date should be put on all vascular access devices
- Use 2% chlorhexidine wash daily for skin cleansing to reduce CRBSI
- Use needleless intravascular catheter access systems and avoid stopcocks. Closed catheter access systems should be preferred to open systems
- Clean injection ports with an appropriate antiseptic (chlorhexidine, povidone-iodine, an iodophor, or 70% alcohol), accessing the port only with sterile devices. Cap stopcocks when not in use
- Assess the need for the intravascular catheter daily and remove when not required
- Peripheral lines should not be replaced more frequently than 72-96 h. Routine replacement of CVCs is not required
- Replace administration sets, including secondary sets and add-on devices, every day in patients receiving blood, blood products, or fat emulsions
- If other intravenous fluids are used, change no <96-h intervals and at least every 7 days
- Needleless connectors should be changed frequently (every 72 h)
- Replace disposable or reusable transducers at 96-h intervals (CDC, 2011).

2.12.4 Strategies to Reduce Urinary Tract Infections (UTI) by Centre for Disease Control (2011)

- Insert catheters only for appropriate indications
- Follow aseptic insertion of the urinary catheter
- Maintain a closed drainage system
- Maintain unobstructed urine flow. At all times the urinary catheter should be placed and taped above the thigh and the urinary bag should hang below the level of the bladder
- The urinary bag should never have floor contact
- Changing indwelling catheters or drainage bags at fixed intervals is not recommended. Change only if there are clinical indications such as infection or obstruction, or when the closed system is compromised
- Remove the catheter when it is no longer needed (CDC, 2011).

2.12.5 Consideration of Environmental Factors

Cleaning and disinfection by CDC (2010)

- High-quality cleaning and disinfection of all patient-care areas is important, especially surfaces close to the patient (e.g. bedrails, bedside tables, doorknobs and equipment)
- Some pathogens can survive for long periods in the environment, particularly Methicillin-Resistant Sataphylococcus Aureus (MRSA), Vancomycin Resistant Enterococcus (VRE), Acinetobacter species, Clostridium difficile and norovirus
- EPA-registered disinfectants or detergents that best meet the overall needs of the ICU should be used for routine cleaning and disinfection

- Frequency of cleaning should be as follows: Surface cleaning (walls) twice weekly, floor cleaning 2-3 times/day and terminal cleaning (patient bed area) after discharge or death.

According to Center for Diseases Control (2011), architecture and layout, especially while designing a new Intensive Care Unit (ICU) must adhere to the following:

- The unit may be situated close to the operating theatre and emergency department for easy accessibility, but should be away from the main ward areas.
- Central air-conditioning systems are designed in such a way that recirculated air must pass through appropriate filters
- It is recommended that all air should be filtered to 99% efficiency down to 5 μm
- Suitable and safe air quality must be maintained at all times. Air movement should always be from clean to dirty areas
- It is recommended to have a minimum of six total air changes per room per hour, with two air changes per hour composed of outside air
- Isolation facility should be with both negative- and positive-pressure ventilations
- Clearly demarcated routes of traffic flow through the ICU are required
- Adequate space around beds is ideally 2.5-3 m
- Electricity, air, vacuum outlets/connections should not hamper access around the bed
- Adequate number of washbasins should be installed
- Alcohol gel dispensers are required at the ICU entry, exits, every bed space and every workstation
- There should be separate medication preparation area

- There should be separate areas for clean storage and soiled and waste storage and disposal
- Adequate toilet facilities should be provided

Center for Disease Control, (2011) proffered the following Organizational and administrative measures

- Work with hospital administration for better patient to nurse ratio in the ICU
- Policies for controlling traffic flow to and from the unit to reduce sources of contamination from visitors, staff and equipment
- Waste and sharp disposal policy
- Education and training for ICU staff about prevention of nosocomial infections
- ICU protocols for prevention of nosocomial infections
- Audit and surveillance of infections and infection control practices
- Infection control team (multidisciplinary approach)
- Antibiotic stewardship
- Vaccination of healthcare personnel (CDC, 2011).

2.13.1 Infection Control Policy in the prevention of Healthcare-Associated Infections (HAIs)

Infection control policy has however been shown to reduce the burden of healthcare-associated infections in several healthcare institutions, and has since become a constant feature in most health facilities in developed countries (Brisibe, et al, 2014). Hospital infection control policy can be defined as the systematic measures taken by the management of a hospital to reduce the incidence and the adverse effects of

healthcare-associated infections on patients and health workers. The policy sets guidelines on adequate sanitary conditions of operation rooms, use of sterile instruments, active treatment of patients infections, removal of hair immediately before surgeries, adequate preparation of surgical site with antiseptics, preoperative showering, effective patient-caregiver barriers, good operation technique and prophylactic antimicrobial treatment among others (Brisibe, et al, 2014). Healthcare Institutions should devise control programs against these infections among them. Administration, workers and individuals

admitted or visiting hospital must take into account such programs to play their role in preventing spread of these infections to the general public (Khan, Baig & Mehboob, 2017).

Amoran and Onwube (2013), stated that the significance of infection control policies in healthcare settings cannot be overemphasized as both the patients and HCWs are capable of spreading microorganism if adequate infection control measures are not strictly adhered to. In addition, healthcare is increasingly being provided outside hospitals facilities such as nursing homes, free standing surgical and outpatient centers, emergency care clinics, and in patients' homes or during pre-hospital emergency care. The importance of airborne transmission of microorganisms in the hospital setting and the risk of cross infection between patients and HCWs especially with respect to blood-borne pathogens are widely documented. Hospital-based personnel and personnel who provide healthcare outside hospital may acquire infections from or transmit infections to patients, other personnel, household members, or other community contacts.

2.13.2 Sterilization of Instruments

Any instruments used for procedures on sterile tissue or that come into contact with the vascular system must be sterilized. Instruments used for lid procedures, for example, must be properly sterilized. The most efficient and cost-effective method of sterilization for the optometric office is via a small table top steam autoclave unit. Items sterilized should be properly prepared by wrapping in peel pouches before sterilization to maintain instrument sterility after processing. Manufacturer guidelines must be followed to properly maintain each system. Recommendations for steam sterilization require a minimum of 15 minutes at 121 C. Instruments should be cleaned before sterilization and should be dry upon removal from the autoclave. Weekly monitoring of sterilization with a known biologic indicator is advised to ensure proper sterilization (Keith, et al, 2009).

Needles are disposed of after use, and as such, are purchased sterile. To prevent infection, an injection site should be disinfected before injection with an alcohol wipe. Although recommendations vary, the consensus for hospital or clinical injection protocol is that the injection site should be cleaned for 30 seconds with an alcohol wipe and allowed to air dry for another 30 seconds. Not allowing the injection site to air dry completely can contaminate the needle and will increase pain upon injection (Keith, et al, 2009).

2.13.3 Guidelines for Infection Control in the Special Subsets – Immune-compromised Patients

Immune-compromised patients are those patients whose immune mechanisms are deficient because of immunologic disorders (e.g. human immunodeficiency virus (HIV) infection or congenital immune deficiency syndrome), chronic diseases (e.g. diabetes,

cancer, emphysema, or cardiac failure), or immunosuppressive therapy (e.g. radiation, cytotoxic chemotherapy anti-rejection medication, or steroids) (Linden, 2009).

2.13.4 Hand Hygiene

Centre for Disease Control (CDC, 2017), postulated that practicing hand hygiene is a simple yet effective way to prevent infections particularly among healthcare workers during handling of patients in healthcare facilities. Cleaning of hands can prevent the spread of germs, including those that are resistant to antibiotics and are becoming difficult, if not impossible, to treat. On the average, healthcare providers clean their hands less than half of the times they should. Hand Hygiene according to CDC, (2017), means cleaning your hands by using either hand washing (washing hands with soap and water), antiseptic hand wash, antiseptic hand rub (i.e. alcohol-based hand sanitizer including foam or gel), or surgical hand antiseptics.

Cleaning your hands reduces the spread of potentially deadly germs to patients. Alcohol-based hand sanitizers are the most effective products for reducing the number of germs on the hands of healthcare providers. Antiseptic soaps and detergents are the next most effective while, non-antimicrobial soaps are the least effective. When hands are not visibly dirty, alcohol-based hand sanitizers are the preferred method for cleaning your hands in the healthcare setting. Soap and water is recommended for cleaning visibly dirty hands (CDC, 2017).

Hand hygiene according to Maingi (2015), is the single most effective infection prevention and control measure for preventing healthcare-associated infections. Strict observance and adherence to hand hygiene guidelines has been found to reduce these

infections by up to 80% in some settings. The methods used for hand hygiene during routine patient care include hand washing with either plain or medicated soap and using an alcohol-based hand gel (WHO, 2009). These latter preparations are most effective at alcohol concentrations of 75 – 85% and have germicidal activity against most bacteria, viruses and fungi. Inadequate or omitted hand washing with hand gel use by healthcare workers allows spread of the micro-organisms among healthcare workers in the facilities (Ndegwa, 2014).

- The most important intervention is hand hygiene. When hands are visibly dirty, contaminated with proteinous material, or visibly soiled with blood or body fluids, wash hands with either a non-antimicrobial soap and water or an antimicrobial soap and water (Dyskewiccz, Jaffe & Spira, 2014).
- If hands are not visibly soiled, or after removing visible material with non-antimicrobial soap and water, the preferred method of hand decontamination is with an alcohol-based hand rub (Dyskewiccz, Jaffe & Spira, 2014), (Boyce & Pittet, 2014) (Nishimura, Kagehira, Kono, Nishimura & Taenaka, 2014).

2.13.5 Isolation

The spread of infection between patients in our in-patient services can be reduced by physical isolation of either those patients at risk (Protective Isolation) or those patients with infection (Source Isolation). Isolation precautions can be applied to a patient in a multi-bedded area, a cohort of patients suspected to have the same infection or to a patient in a single room. It will also ensure compliance with the Health and Social Care

Act 2008: Code of Practice for the NHS for the Prevention and Control of healthcare-associated infections (Health Information and Quality Authority, 2015).

The decision to isolate a patient or a clinical area should always be taken after assessing the risk to the individual, other patients and staff with the support and advice from the Infection Prevention and Control Team. When isolation precautions are required they should be tailored to meet the needs of each patient and reflected in their care plan. Once the decision has been made to isolate a patient or a clinical area, the necessary precautions must be introduced immediately so as not to put other patients, visitors or staff at risk. While it is acknowledged that strict implementation of isolation precautions in the mental health and learning disability environments may be difficult for reasons such as poor patient understanding, compliance and the need to maintain as 'normal' a lifestyle as possible, it remains important that the principles of good infection control practice are not compromised and in all cases the care plan must include any specific precautions required. This measure is to make sure that patients who are isolated in a single room do not feel dejected or ostracized. The reason for isolation should be explained to the patient as best as possible and to their close family contacts and carers (Health Information and Quality Authority, 2015).

- Simple protective isolation offered no advantage over routine care for most immune-compromised patients.
- Immune-compromised individuals should never be placed in the same room or adjacent to people with mild infections.

Isolation of potentially contagious patients within the ICU should be attempted if practical to reduce the chances of cross infection. Although isolation is recommended for control of airborne spread of pathogens, cross-colonization with organisms predominantly spread by contact such as Methicillin-Resistant Staphylococcus Aureus (MRSA), infection may only be reduced by changing behavior of staff. In the absence of adequate isolation rooms, barrier precautions with gloves and gown combined with good hand hygiene is paramount (Health Information and Quality Authority, 2015).

2.13.6 Room Ventilation

- Patient should be placed in rooms with >12 air exchanges/h and point-of-use High Efficiency Particulate Air (HEPA) filters that are capable of removing particles >0.3 μm in diameter
- Inspection and preventive maintenance of duct and filter systems should occur on a routine, scheduled basis
- Patient room should have positive room air pressure when compared with any adjoining hallways, toilets and anterooms, if present
- The use of single rooms with HEPA filtration may reduce the risk of healthcare-associated infections by airborne fungi, in particular the Aspergillus genus. This is especially true where refurbishment, building or demolition are in progress in the hospital or nearby.

2.13.7 Cleaning by (Centre for Diseases Control, 2011)

- Rooms should be cleaned >1 times/day with special attention to dust control
- Exhaust vents, window sills and all horizontal surfaces should be cleaned with cloths and mop heads that have been premoistened with disinfectant.
- Prohibit exposures of patients to such activities as vacuuming or other floor or carpet vacuuming that could cause aerosolization of fungal spores (e.g. Aspergillus species)
- Moisture problems (i.e. rainwater or plumbing leaks) should be promptly reported and repaired.
- Organic materials that become moist must be dried or removed within 24-48 h to prevent fungal growth.
- Medical devices and other equipment should be decontaminated according to existing guidance. The role of cleaning and decontamination should not be underestimated. At times of local epidemics or outbreaks, the closure of part of or the whole unit should be considered to allow thorough cleaning.

Hydrogen peroxide vapor decontamination has been shown to be superior to conventional cleaning but can only be used in enclosed rooms as it is toxic to humans. Interestingly, Methicillin Resistant Staphylococcus Aureus (MRSA) may not be completely cleared with a conventional solution containing 5-15% non-ionic surfactant and 5-15% cationic surfactant, diluted 1:500 (Centre for Disease Control, 2011).

Guidelines exist for floor space in Intensive Care Unit (ICUs). The transmission of micro-organisms will occur more readily in cramped conditions. There are

recommendations for the number of isolation cubicles that should be available for patients with resistant organisms and for immune-compromised patients.

2.13.8 Protective clothing

Verbeek et al, (2015), reported that biohazard areas require protective clothing meant to protect healthcare workers against biohazards. For biohazards, these standards are based on laboratory tests that evaluate to what extent the fabric and the seams of protective clothing are leak tight, that is impermeable for liquids or viruses or both at certain pressure levels. The standards in Europe and the US are different.

- Protective clothing must, as a minimum, be used to prevent contact with bodily fluids or other sources of contamination and when in contact with broken skin or mucous membranes. Any protective clothing should be removed promptly when no longer required and disposed of as clinical waste (Center for Disease Control (2014).
- Keith, Tyhurst, Debbie & Hettler, (2009), reported that gowns and masks are normally unnecessary for routine optometric procedures. In those cases in which optometrists or their staff may be in close contact with a patient with a known or suspected pathogen that may be transmitted by airborne means, masks should be used. If an optometrist or a staff member is infected with a pulmonary or other disease that is transmittable via airborne means, masking is necessary to protect the patient. Gowns and masks should be used as a barrier precaution whenever the possibility of splattering or splashes of blood or other body fluids contaminated with blood or other infectious materials may occur.

2.13.9 Food and Drink

- Hospital food is normally very safe. However, the immune-compromised patient is at increased risk of food-borne illness and the acquisition of harmful micro-organisms from some food and drink. Therefore immune-compromised individuals are advised to avoid certain high-risk foods, for example soft cheeses and foods made with raw egg, such as mayonnaise (Center for Disease Control (2014).
- All drinking water for immune-compromised patients (including bottled water) should be chemically sterilized or boiled.

Visitors who might have communicable infectious diseases (e.g. Upper Respiratory Tract Infections (URTIs), flu-like illnesses, recent exposure to communicable diseases, an active shingles rash whether covered or not, a VZV-like rash within 6 weeks of receiving a live-attenuated VZV vaccine, or a history of receiving an oral polio vaccine within the previous 3-6 weeks) should not be allowed to visit immune-compromised patients (Green & Griffiths, 2013). Vaccination in Immune-compromised patients should be done in accordance with the published guidelines (Advisory Committee on Immunization Practices, (2010).

2.13.10 Hospital waste management

Waste from hospitals can act as a potential reservoir for pathogens that needs proper handling. Khan, Baig and Mehboob, (2017), reported that 10–25% of the waste generated by healthcare facility is termed as hazardous. Infectious healthcare waste should be stored in the area with restricted approach. Waste containing high content of heavy metals and waste from surgeries, infected individuals, contaminated with blood and sputum and that

of diagnostic laboratories must be disposed off separately. Healthcare staff and cleaners should be informed about hazards of the waste and it's proper management.

In handling of Sharp Instruments according to Keith, et al, (2009) precautions must be taken to prevent injuries caused by needles, syringes, or other sharp instruments. To prevent needle-stick injuries, used needles should not be bent, broken or recapped by hand. After they are used, disposable syringes, needles, and other sharp items must be placed in appropriate infectious waste containers for disposal. Non disposable sharps should be placed in puncture-resistant containers for sterilization. These containers must be readily accessible.

Keith, et al, (2009) again, postulated that the Environmental Protection Agency (EPA) and Centre for Disease Control, as well as many state, countries and city governments have developed guidelines that govern the disposal of hazardous or infectious waste. Infectious waste has been defined by the EPA as ‘‘wastes that in all probability contain pathogenic agents that because of their type, concentration, and quantity, may cause disease in persons exposed to the waste.’’ Although a number of categories of infectious waste exists, optometric practices would most likely need to be concerned with the following items:

1. All used disposable gloves need to be discarded as hazardous waste.

2. All sharp instruments used in patient care should be considered potentially infectious waste and placed in appropriate infection control containers for disinfection or disposal.

3. All disposable items (e.g., tissues, gauze) contaminated with blood or other infectious materials should be disposed of using clearly marked infectious waste receptacles.

4. All infectious waste must be placed in appropriate containers and disposed of according to federal, state, and local regulations (Keith, et al, 2009).

2.14 Injury Surveillance Programme

About 5.8 million people including healthcare workers, die each year as a result of injuries. This accounts for 10 % of the world's deaths, 32 % more than the number of fatalities that result from malaria, tuberculosis and HIV/AIDS combined. Approximately 90 % of the global injury-related deaths occur in low and middle income countries (Injuries and violence 2010). All work environments, according to Saskatchewan Work safety, (2012) are required to have at least an informal health and safety program that will help prevent injuries and other incidents. In some cases, hospitals may require a formal program and Regulations.

Ling, Apisarnthanarak, and Madriaga, (2015), observed that initiatives in developed countries, such as the United States and Australia, have leveraged the use of national HAI surveillance data to improve patient safety by enforcing hospital participation through monetary penalties (eg, the US National Healthcare Safety Network and the Centers for Medicare and Medicaid Services' value based purchasing programs) or accreditation (eg, Australia's National Safety and Quality Health Service Standards program). Furthermore, both countries also publicly disclose hospital HAI rates through online websites to aid consumer decision making in hospital choice (eg, Hospital Compare for Medicare–certified hospitals in the United States and public and private

hospitals in Australia). Hence, based on surveillance data, healthcare policies and programs have been developed with success for the prevention and control of HAIs to improve quality of healthcare

Saskatchewan Worksafety, (2012), further described eight steps that you can use to establish an effective health and safety program for your workplace: **s**tate your goals and expectations; orient new and young workers; educate and train workers; hold regular meetings; conduct regular inspections; report and investigate incidents; maintain records and statistics; keep your program current. Most of the sections listed above include blank forms that will help you establish your program. These forms will also serve as records that you can refer back to when you need documentation of your health and safety activities.

According to Lakshmi, Tripathy, Tripathy, Singh, Bhatia, Jagnoor, and Rajesh, (2016). Medical Officers in the hospitals were trained to collect information from the patients who visited the emergency department with an injury on a structured proforma. Upon arrival of a patient in the emergency department, routine admission procedures and management as per the treatment protocols were followed. No changes were made to the usual care of the patient. The trained emergency medical officer after stabilizing the patient collected information on socio-demographics and injury history from the attendant or the patient, if able, after informed consent.

Systematic and scientific efforts in injury prevention and control have gained little momentum, largely due to lack of data on the epidemiology of injuries.

Data on injuries is essential to prioritize evidence based safety strategies and prevention efforts. Reliable estimates on injury burden and pattern will also aid in

organization and delivery of acute trauma care. Thus, there is greater emphasis on the need to generate reliable and consistent information on the pattern and distribution of injuries so as to design effective prevention strategies. Consequently, injury surveillance systems are widely gaining ground as a tool for collecting such systematic data on injuries (Lakshmi, Tripathy, Tripathy, Singh, Bhatia, Jagnoor, & Rajesh, 2016).

Although the aim of infection prevention and control program in this context, is to eradicate healthcare-associated infections, Khan, Baig and Mehboob, (2017), reported that epidemiological surveillance for demonstration of performance improvement is still required to accomplish the aim. The efficient surveillance methods include data collection from multiple sources of information by trained data collectors; information should include administrative data, demographic risk factors, patients' history, diagnostic tests, and validation of data. Following the data extraction, analysis of the collected information should be done which includes description of determinants, distribution of infections, and comparison of incidence rates. Feedback and reports after analysis should be disseminated by infection control committees, management, and laboratories keeping the confidentiality of individuals. The evaluation of credibility of surveillance systems is required for effective implementations of interventions and its continuity. Finally, the undertaking of data at regular intervals for maintenance of efficiency of surveillance systems should be made compulsory.

2.15.1 Safety Engineered Devices (SEDs)

Healthcare workers may frequently be exposed to blood and body fluid-borne pathogens during the course of their work. When a sharp object such as a needle or scalpel blade is contaminated with blood or body fluid, there is potential for direct inoculation and transmission of infection through injury to a healthcare worker during its use or disposal, with consequent psychological health effects as well. There are an estimated 70000 sharp object injuries per year, an average of 192 per day in Canada hence the need for effective safety-engineered devices towards reducing sharp object injuries among healthcare workers (Lu, Senthilselvan, Joffe & Beach, 2014). Safety Engineered Devices (SEDs) are devices that have built in sharps injury protection mechanism such as an attached sheath covering the needle or scalpel after use or needles that retract after use. Other types of safety devices include blunt needles or needle-less systems (Saskatchewan Worksafety, (2012). SEDs protect the user from exposure to blood borne pathogens or chemical hazards (i.e. cytotoxic medications).

To minimize the risk of occupational exposure to blood-borne pathogens through sharp object injuries to healthcare workers, Lu, Senthilselvan, Joffe & Beach, (2014) opined that a number of safeguards have been suggested including concentration and rapt attention during administration of injections towards preventing needle injuries to healthcare workers. A key component of a recent updating of the Occupational Health and Safety Code of Alberta, Canada, was the required use of 'safety-engineered devices'. These are medical sharp devices that have been designed to include safety features or mechanisms to eliminate or minimize the risk of injury to the user or others. Safety-engineered devices potentially provide a high degree of control of risk because they eliminate or control the hazard at its source and to date, have been considered to work well in preventing sharp object injuries in healthcare settings. Their use is now widespread throughout the European Union (EU) following the EU Directive on prevention

of sharp injuries in the hospital and healthcare sector and in the USA beginning with the OSHA Bloodborne Pathogens standard and culminating in the Needlestick Safety and Prevention Act of 2000 (Council of the European Union (2010).

The greatest danger of infections in hospitals comes from procedures using hollow-bore needles, such as blood collection, IV cannulation and percutaneously placed syringes. It was on that note that European Union's Directive (2010/32) on the prevention of sharps injuries was ensured to come into force in May 2013 and will require all healthcare organisations to introduce measures to prevent needle stick injuries to their staff, as well as reduce the incidence and prevalence of occupational injuries to NHS staff every year.

According to Buzzhealthcare, (2011) Safety Engineered Devices products for health care and their meanings with functions in protecting users (Healthcare workers) are listed and discussed below:

- Hypodermic safety needles
- Safety syringes
- Insulin safety systems
- Tuberculin safety syringes
- IV cannulae & infusion safety systems
- Blood collection safety systems
- Safety lancets

- Huber needles
- Safety scalpels
- Scalpel disarmers
- Sharps transfer & disposal
- Ampoule breaker devices.

Hypodermic safety needle is a hinged safety device designed to protect healthcare workers from exposures to needle stick injuries. It has simple locking mechanism which reduces needle stick injuries to healthcare workers. Hypodermic safety needles do not contain Natural Rubber Latex; No Solid Surface Required; Simple Finger Stroke Activation; Protective arm keeps fingers behind the needle; One-Handed Activation; An audible "click" as well as tactile feel and a visual indicator confirm safety mechanism engagement; Needle remains locked inside activated cover; Fits any brand syringe; Safety shield can be pushed back comparative to the needle, allowing a clear view of the injection site (Exelint, 2018).

Safety syringes have a safety mechanism built into syringe. The needle on a safety syringe can be detached or permanently attached. On some models a sheath is placed over the needle or the needle retracts into the barrel following injection to protect healthcare worker and others from accidental needle stick injuries. BD safety injection solutions address the issue of needle sticks and protect healthcare workers from bloodborne pathogens and hazardous drug exposure. The portfolio includes BD Integra

retracting syringes, BD Eclipse pivoting needles and BD Safety Glide shielding needles, and other safety-engineered hypodermic products (Medline, 2018).

Insulin safety syringes are priority for both patients and healthcare professionals. Insulin syringes are engineered with features that help reduce the risk of needle stick injuries to healthcare providers. The safety syringes are designed with a safety feature which retracts the needle back into the barrel and breaks the plunger to prevent needle stick injury. Insulin safety syringe with permanently attached needle are designed to protect patients and healthcare professionals and minimize medication waste. The safety syringes are designed with a safety feature which retracts the needle back into the barrel and breaks the plunger to prevent needle stick injury; Hands and fingers remain away from the needle during injection and activation of safety mechanism; Needle is secured into barrel of syringe, cannot be reused; Available in .5cc and 1cc; Permanent attached needle; Not made with natural rubber latex; Non-Toxic; Sterile.

Tuberculin safety syringes has permanently attached needle with safety shield with locking mechanism which helps to protect healthcare workers against accidental needle stick injuries. Tuberculin safety syringes offer proven technology that provide optimal protection and help reduce the risk of needle stick injury healthcare workers. Tuberculin Syringes are small syringes with fine needles that hold up to one half to one cubic centimeter of fluid, used to administer medication (antigen) under the skin and perform a tuberculosis test called PPD. Different models of Tuberculin Needles may come permanently attached to the syringe or they may be separate and require assembly. The width of the needle is known as the needle gauge. The higher the number of the needle gauge, the thinner the needle. These syringes are marked in increments of 0.01 cc.

And the needles are often 26 to 27 gauge in diameter and 1/2 to 5/8 inch in length (Medline, 2018).

Intravenous cannulae & infusion safety systems involves techniques in which a cannula is placed inside a vein to provide venous access. Venous access allows sampling of blood as well as administration of fluids, medications, parenteral nutrition, chemotherapy, and blood products (Shlama, 2017). Intravenous therapy (IV) is a therapy that delivers liquid substances directly into a vein. The intravenous route of administration can be used for injections (with a syringe at higher pressures) or infusions (typically using only the pressure supplied by gravity). Peripheral intravenous (IV) cannulation is an invasive procedure which predisposes the patient to an increased risk of local and systemic infection from micro-organisms introduced either at the time of insertion or when insitu. Peripheral Intravenous Cannula (PIVC) related infections are associated with increased morbidity, prolonged hospitalisation and increased cost. Infections are most commonly caused by Staphylococci. The predominant source of these micro-organisms is likely to be from the patient`s endogenous flora colonising the skin or from the hands of the healthcare practitioner (Newcastle, 2018).

Blood collection safety systems is a safety winged blood collection set with multiple sample adapter allowing specimen collection from a closed system to prevent injury to the healthcare worker. After completion of the blood collection, safety needle shield is slided over the needle until it is in locked position. The needle is completely isolated and securely locked into a closed system. Easier and safer blood collection with no compromise to healthcare workers. Safety needle shield minimizes the risk of needle stick injuries with attendant infections (Polymed, 2018). The greatest danger of infection

comes from procedures using hollow-bore needles, such as blood collection, IV cannulation and percutaneously placed syringes.

Safety lancets are single-use devices for capillary blood sampling dedicated to healthcare professionals. They are integral component of sharp injury prevention programs in hospitals, clinics, laboratories, doctor's offices and where both patients and professionals need to feel safe. The use of safety lancet will reduce needle-stick injuries and infections to a bearable minimum. Safety lancets is technologically designed simple and safe for both the healthcare professional and the patient. Needle retracts automatically and locks out for extra safety, protecting against needle stick injuries, and it also helps prevent cross-contamination. Three styles mechanisms available are: Pressure-Activated, Push Button, Side Button (Medline, 2018).

Huber needle is a safety engineered needle for accessing implanted intravenous ports. The non-coring and angled needles are suitable for power injections. The safety needle has a manually activated safety mechanism that is designed to deploy upon needle removal and to shield the tip, to reduce injuries and infections to the Health professional (Braun, 2018). Huber needles are used to administer chemotherapy and antibiotics, through an implanted IV port. These Needles may be in the port for many days at a time. It can sometimes be difficult to de-access, or extract the needle safely. The current method of removing the needle from the implanted port is simply to pull it out with the clinician's fingers. The difficulty of pulling the needle out often creates a recoil action with the clinician often getting a needle stick into the stabilizing hand. A Huber needle removal device removes the Huber needle without putting the clinician at risk for a needle stick injury (International Sharps Injury Prevention Society, 2018).

Safety scalpel is a colour coded for ease of blade shape recognition the scalpels now feature a stronger temporary forward lock position to prevent uncontrolled retraction when contacting with bone during use, an additional notch to hold the blade more securely in the passing position and a rear permanent lock to be engaged prior to final disposal in a sharps container. The range has been recently extended with the addition of the Safety Stitch Cutter scalpel. Safety scalpels satisfies regulatory guidelines for safe handling of sharps, Blade retracts with one simple motion and can be permanently locked inside the handle for safe disposal and Sheffield stainless steel blade for exacting performance (Swann-Morton, 2018).

Scalpel disarmers are single use disposable scalpels with a shield that is advanced forward over the blade after use, containing and removing the hazard. Saves money and reduces medical waste; Allows the use of surgeon preferred blades; Covers blade when not in use and during passing; Confirms lock and unlocked positions. Easy one hand removal of blade for replacement or disposal using the integrated blade removal. This scalpels are fast, easy blade disarmers with protective covering when closed, with halve detachable adhesive on each to allow the box to be used in separate locations and a snap fit box for secure closure (AliMed, 2018).

Sharps transfer & disposal, is a process that requires sharps container, which is a single-use container that is filled with used medical needles and then disposed of safely. These can be purchased from pharmacies, medical supply stores or ordered through the mail. If you do not have access to a sharps container, place sharps in a puncture resistant container such as a rigid plastic bottle or coffee can with a secure cap. These items must be disposed of at a drop off site or through a medical mail back service (Massachusetts Government, 2018). Used needles and

other sharps are dangerous to people and pets if not disposed of safely because they can injure people and spread infections that cause serious health conditions. The most common infections are:

- Hepatitis B (HBV),
- Hepatitis C (HCV), and
- Human Immunodeficiency Virus (HIV).

Safe sharps disposal is important whether you are at home, at work, at school, traveling, or in other public places such as hotels, parks, and restaurants (U.S. Food and Drug Administration, 2018).

Ampoule breaker device is a unique tool fully encapsulates the tip of a glass ampoule as it is being opened. This encapsulation protects the health care provider from lacerations while saving money by preventing the loss of pharmaceutical product and health care provider downtime. Ampoules are small glass vessels in which liquids for injections are hermetically sealed. A typical pharmaceutical ampoule has a narrow neck between a cylindrical body and a conical tip. They are opened by snapping off the glass top at the neck. The scoring at the neck does not always break where it is intended. This is due to the glass re-melding to some degree at the score line. When the cap is snapped off, glass chips can fly off and a jagged or sharp edge can cut the hands of the healthcare worker. Safer products exist that remove the risk of broken glass cuts when breaking off the glass top (International Sharps Injury Prevention Society, 2018).

2.15.2 Features to be considered in the selection of Safety Engineered Devices:

The device must not compromise healthcare workers' safety and patients' care; The device must perform reliably; The safety mechanism must be an integral part of the safety device, not a separate accessory; It should be easy to use and require little change of technique; Activation of the device must be convenient and allow the care-giver to maintain appropriate control over the procedure; The device must not create other safety hazards or sources of blood exposures; Single-handed or automatic activation is preferred; Activation must manifest itself by means of an audible, tactile or visual sign; Not reversible once activated (Safer Needle Network, 2010).

The changes required towards the prevention of healthcare-associated infections among healthcare workers for evaluation according to Ashleigh, Goris, Jerry, Glotzer, Chec, Nancy, Gemeinhart, et al. (2014), calls for inclusion of safety medical devices, such as devices with engineered controls designed to eliminate or minimize the risk of occupational exposure to blood borne pathogens through needle stick and other percutaneous injuries. In addition, employers were required to review and update exposure control plans to reflect changes in technology that eliminate or reduce exposures and implement effective safer medical devices when commercially available for injury prevention. More than 18 million healthcare workers (HCWs) in the United States work in hospitals and other healthcare settings. However, precise national data are not available on the annual number of needle stick and other percutaneous injuries among HCWs.

2.16 Empirical Studies

This section reviewed empirical studies on knowledge, attitude, practice and availability of safety measures, towards the prevention of healthcare-associated infections among primary healthcare workers.

Knowledge of safety measures for the prevention of healthcare-associated infections is paramount to curb the spread among healthcare workers. Studies by Gordon (2016), reported that over 80% PHCWs in static immunization unit in Nigeria were observed to have poor knowledge of safe injection while similar proportion was also observed among health workers in other sections in PHC centers in Nigeria undermining the significant role that PHC centers played in healthcare delivery in Nigeria. This is because of lack of information and poor knowledge among health worker, the administration of injections in developing countries often leaves much to be desired. More so, studies by Ajibola, Akinbami, Elikwu, Odesanya and Uche, (2014), revealed that there is an information gap in the health care setups. For instance a study done in Governmental Health Institutions in Jimma zone and Jimma City in Ethopia in 2008 indicated 81.6% of HCWs exposed to healthcare-associated infections did not use post-exposure prophylaxis. Tebeje and Hailu, (2010), reported that a national study in Kenya also showed, among healthcare workers who were knowledgeable, only 45% sought HIV PEP. The main reasons for not seeking PEP among this group was lack of sufficient information (35%) followed by fear of the process and what could follow (28%).

However, Jayasinghe and Weerakoon (2014), reported that knowledge of standard precautions would help in designing measures to reduce the risk of acquiring infections from both known and unexpected sources in the healthcare setting. Strict adherence by healthcare workers to standard infection control precautions may prevent a percentage of

these risks. In view of the fore going, healthcare workers should have adequate knowledge and practice standard infection control precautions.

Studies on attitude by Tenna, Stenehjem, Margoles, Kacha, Henry, Blumberg, and Kempker (2013), reported that the majority of both physicians (93%) and nurses (92%) felt they would be less likely get infected or transmit infections to their patients if they performed hand hygiene; however, only 50% of Health Care Workers were reported to be receiving hand hygiene training and only 30% thought their supervisors stressed the importance of hand hygiene. The majority of Healthcare Workers felt hand hygiene agents (alcohol based sanitizer or soap and water) are not readily available (77%) and 67% of all Healthcare Workers reported that available alcohol based hand sanitizers caused irritation and dryness therefore they don't like using it. Significantly more physicians than nurses reported that they often perform hand hygiene (52% vs. 21%, respectively, $p < .01$). Forty-four percent of Healthcare Workers reported that gloves were not always available (Tenna, et al 2013). Soad, et al. (2012), also reported in their study that most of the respondents (healthcare workers) (80.5%) felt that their jobs puts them at risk of contracting HBV infection, 68.9% believed that their lifestyle puts them at risk of infection, 87.1% believed that they need to be protected from hepatitis B infection, 68.4% believed that a health workers may infect patients if he is a carrier of HBV, 86.3% believed that it necessary to be protected by vaccination, and only 69.7% stated that their children received hepatitis B Vaccine. It was however recorded in another finding that the attitudes towards the prevention of HBV infections were encouraging, since a high percentage of respondents reported positive specific beliefs considered their attitude.

In practicing prevention against healthcare-associated infections, Jonas, Charlie and Abdullah (2015), reported that doctors showed highest practice towards hand washing compared to nurses and housekeepers. Most nursing interventions requires touching the patient or close contact and frequently they come in contact with contaminated articles. This can become an opportunity for transferring infection once hand hygiene is not done effectively. The members of the healthcare team are primarily responsible in the prevention of the incidences of these healthcare-associated infections. However, Obinna (2011), reported that records shows that on the average of practice, in most public hospitals, one Doctor may attend to up to 200 patients making him more vulnerable to infections. Most of the facilities are often overstretched as a result of the overwhelming crowd requiring medical services from those facilities. President of Nigerian Medical Association noted that there are 39,000 medical Doctors serving 140 million Nigerians against the World Health Organization's ratio of 1 to 600 persons (Obinna, 2011). More so, Abdraboh, Milaat, Ramadan, Al-Sayes and Bahy, (2016), reported that a good baseline compliance with safety measures was observed with a striking improvement after educational intervention on healthcare-associated infections, those who were non-compliant turned to be compliant (adopting best practices for prevention). Unfortunately, this compliance was reduced after three months of educational intervention (from 83.5% to 72%). This was explained to be a result of work overload, numerous visitors' inflow.

On availability of safety measures for the prevention of healthcare-associated infections, Toure, Traore, Sako, Delamo, Tonguino, Sylla, Bangoura, et al (2015), reported that five hundred and six HCWs (96.6%) reported not taking safety measures

like systematically wearing gloves during the routine actions such as punctures, installation of catheters, dressings etc. This was lower in midwives (92.2%) and residents (92.3%) compared to nurses (98.4%) (P = 0.06). Eleven percent reported having had an exposure to the patient biological fluids. To the question "Have you received specific training on Ebola Virus Disease?" 29% responded having received no specific training. Kanamori, Weber, DiBiase, Karen, Pitman, Consoli, et al, (2016), reported that employers are to provide healthcare workers with safety-engineered devices and to document needle stick injuries. Legislative actions and advanced technologies, especially dissemination of safety-engineered devices, have aided in protecting HCWs from occupational exposures to infections. Currently, a variety of safety-engineered devices are commercially available, including more than 300 safety-engineered devices on the US market and more than 1,700 needle stick prevention devices with US patents. During an 11-year period (1995–2005), percutaneous injuries were estimated to be reduced by approximately 40% as a result of implementation in 2001 of the Needle stick Safety Prevention Act. However, injuries associated with safety engineered devices now account for a substantial proportion of percutaneous injuries (Kanamori, et al., 2016).

Furthermore, Allengranzi (2011), launched a study to determine the availability of safety measures like disinfection and sterilization practices used in hospital operation units and at the same time evaluated the knowledge and attitudes of 216 nurses from 16 hospitals over a three month period. Only 39% of clinics had dedicated rooms for decontamination and many of the clinics lacked regulations on sterilization of instruments. Worse still, some clinics lacked sterilization equipment such as autoclaves. Also assessed was the knowledge, attitudes and behaviour of 33 dental personnel toward

infective practices. Allengranzi (2011), also revealed in that study, a high rate of infection with Hepatitis-B Virus among dental health workers. The above signifies that the administration did not provide the dental facilities with the equipment necessary to decontaminate their instruments, and healthcare workers failed to comply with the recommended guidelines and to practice the procedures aimed at controlling the transmission of HAIs.

2.17 Summary

The literature review started with a conceptualization of the term healthcare-associated infections (HAIs). HAIs was conceptualized to mean the infections which are contracted by healthcare workers during the process of caring for patients in the healthcare facilities. It was further stated that the most common infections are: HBV, HCV, HIV, Lasa fever, gastrointestinal tract among others. It was further reported that healthcare associated infections are considered as a serious problem in the healthcare services as they are common causes of illness and mortality among patients and healthcare workers. The concept of primary healthcare been part of scope of the study was also reviewed owing to it role in diseases prevention and control.

The theoretical frame work looked at theories relevant to the study's independent variables which are health workers' knowledge, attitude, practice and availability of safety measures towards the prevention of healthcare-associated infections. Bandura (1991), social cognitive theory which is a triad model formed the bases of the theoretical frame work for this study. Bandura's (1997), illustration of the triad model includes the Personal factor in this context, the knowledge of superior HCWs, the environment which

in this context is the healthcare facilities and safety measures, while the third is behavior in here used as attitude and practice. Each of these points reciprocate and determines the effect of the other in the prevention of HAIs. While Bandura, and Glanz, co asserted that people learn by modelling behaviours from significant others (superior HCWs); and that behaviour is determined by symbolizing capability (modelling superiors).

Knowledge of Healthcare Workers towards the prevention of Healthcare-Associated Infections (HAIs) was also considered in the review. It was documented that healthcare-associated infections are commonly caused by pathogens such as bacteria, fungi, parasites and viruses transmitted from one patient to HCWs either by indirect or direct contact. Healthcare workers could contaminate their hands or gloves with various microorganisms while performing procedures that involve touching the intact skin of patients. The knowledge of the prevention of infections is relevant on complex factors which includes the skills and motivation of healthcare providers, access to drugs and supplies, information feedback and other building blocks of the health system. The importance of education as a measure to prevent HAIs is implied in numerous studies.

Attitude of healthcare workers towards the prevention of healthcare-associated infections (HAIs) was equally reviewed in this work. It was also reported that the majority of both physicians (93%) and nurses (92%) felt they would be less likely to transmit infections to their patients if they performed hand hygiene; however, only 50% of healthcare workers were reported to be observing hand hygiene. It was reported that majority of healthcare workers are aware of the causes and transmission of healthcare-associated infections but with a poor attitude towards reporting the infection and heeding to universal precautions.

On practice of healthcare workers towards the prevention of Healthcare-Associated Infections (HAIs), it was reported that identifying factors that could contribute to improvement in Infection Control Practices (ICPs) compliance towards a universally acceptable precautionary standard (Global Best Practices) will be imperative for the prevention of the infections. Practices like changes such as using separate baby feeding tubes for each baby, cleaning of baby warmers with antiseptics and injection safety practices among nurses need more improvement in the practices among healthcare workers. More so, the use of new glove, syringes and needles per patient as well as proper disposal is pertinent to the prevention of HAIs among HCWs.

Availability of safety measures against healthcare-associated infections (HAIs) was discussed where report had it that adequate provision of all protective devices and solutions (antiseptics, Alcohol based among others) for healthcare workers to adhere to standard infection control and global best practices towards preventing HAIs. Therefore Government should make available adequate safety measures for HCWs to enhance improved practice of standard infection control precautions towards HAIs among healthcare workers.

Health care workers' Gender differences and the prevention of healthcare-associated infections (HAIs) was reviewed as reports had it that a more positive attitude has been observed in female nurses, especially among those with a lower number of years of activity and in those needing additional information about disinfection procedures, while some had contradicting result to that.

The prevalence rate of healthcare-associated infections' among healthcare workers globally was reported to be about three million, each year, with 2 million

exposed to Hepatitis B Virus, 0.9 million to Hepatitis C Virus and 170,000 to HIV. More so, across the world, over 1.4 million people got healthcare-associated infections (HAI) annually, health workers being the most prone. Such infections included Hepatitis B, Tuberculosis and HIV. Approximately, 39% of all hepatitis C infections in healthcare workers are considered to be occupational.

General safety measures in the prevention of healthcare-associated infections, Strategies focused on prevention of specific healthcare-associated infections, Infection control policy in the prevention of healthcare-associated infections, injury surveillance programme, engineered safety devices (SED) were also discussed with relevant literature.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The purpose of this study was to assess knowledge, attitude, practice and availability of safety measures towards prevention of healthcare-associated infections among primary healthcare workers in North-Central Zone, Nigeria. To achieve this purpose, the research design, population of the study, sample and sampling techniques, instrument for data collection, validity of the instrument, pilot study, procedure for data collection and procedure for data analyses were described and presented in this chapter.

3.2 Research Design

Ex-post facto research design was used to conduct this study. The researcher chose this design because, the information required already existed with the respondents therefore, cannot be manipulated. According to Simon & Goes (2013), Ex-post facto research design means after the fact design which implies that it studies the fact that had already existed. Ex-post facto research design is ideal for conducting a social research when it is not possible or acceptable to manipulate the independent variables under study. This design explains consequences based on antecedent conditions; determine the influence of a variable on another variable and test a claim using statistical hypotheses testing procedures. The justification of the choice of this design is based on the researcher's interest in assessing the knowledge, attitude, practice and availability of safety measures towards the prevention of healthcare-associated infections among primary healthcare workers in North-Central Zone, Nigeria.

3.3 Population of the Study

Population of this study comprise of 24,741, being all primary healthcare workers in Government owned primary healthcare facilities across the North-Central States of Nigeria (being the summation from North-central states' ministries of health reported below). The following is the breakdown for each of the state in North-Central Zone, Nigeria: Kwara State has a total of 2,760 primary healthcare workers (Kwara State Ministry of Health, 2016); Kogi state has 1,650 primary healthcare workers (Kogi State Strategic Health and Development Plan, 2010-2015); Federal Capital Territory (FCT) Abuja has 931 primary healthcare workers (National Primary Healthcare Development Agency, 2016); Niger State has 6,615 primary healthcare workers (Niger State Ministry of Health, 2015); Plateau state has 1,772 primary healthcare workers (Plateau State Ministry of Health, 2015); Benue state has 6,613 primary healthcare (Benue State Ministry of Health, 2016); while Nasarawa State has 4,400 primary healthcare workers (Nasarawa State Ministry of Health, 2015).

3.4.1 Sample and Sampling Technique

The sample size for this study consisted of seven hundred and sixty (760) primary healthcare workers across twenty (20) local government areas in three selected states (Kwara, Niger and Nasarawa State) from North-Central Zone, Nigeria. Denscombe, (2010) postulated that in a population of ≥10,000 a sample size of three hundred and seventy (370) is enough to adequately conduct a research, with sample size confidence level of 95% and 5% marginal error. The researcher however, decided to use seven

hundred and sixty (760) primary healthcare workers out of the total of 24,741 for the entire population, using multistage sampling technique. Multistage sampling technique refers to sampling plans where the sampling is conducted in stages using smaller and smaller sampling units at each stage (Researchgate, 2015).

Stratified random sampling technique was first used for the already existing seven states as strata (Kwara state, Kogi state, Niger state, Benue state, Plateau state, Nasarawa state and FCT). Secondly, the strata were then subjected to simple random sampling technique to select three states (Kwara, Niger and Nasarawa State) from the seven states in North Central Zone Nigeria. Lucky deep was used to conduct the simple random sampling technique where by, three containers were prepared with papers having names of each of the seven states in each containers thoroughly shuffled, while three people were made to pick from each of the containers without looking inside them.

Thirdly, quota sampling technique was used on the already existing three senatorial districts in each of the three selected states in North-Central Zone Nigeria, to select twenty (20) L.G.As. These senatorial districts and the sampled L.G.As includes: Kwara North (Baruten and Patigi); Kwara Central (Asa and Ilorin West); Kwara South (Ekiti and Ifelodun); Niger East (Bossa, Muya and Suleja); Niger North (Borgu, Mariga and Wushishi); Niger South (Agaie, Lapai and Mokwa); Nasarawa North (Akwanga); Nasarawa West (Keffi and Nasarawa) and Nasarawa South (Lafia and Doma).

Proportionate sampling technique was used as the fourth stage, using 7.12% of the total number of Primary healthcare facilities in the sampled states, to get one hundred and ninety (190) primary healthcare facilities across the twenty (20) L.G.As. The breakdown is as follows: Kwara got thirty three (33); Niger got ninety four (94) and Nasarawa State got sixty three (63) primary healthcare facilities respectively for the study.

Purposive sampling technique was used as the fifth stage to select four (4)

primary healthcare workers to include: one laboratory technician, one nurse, one cleaner and one community health worker, from each of the sampled healthcare facilities in North-Central Zone Nigeria. The breakdown of the sampling was as follows: Kwara had one hundred and thirty two (132); Niger had three hundred and seventy sixty (376) and Nasarawa State had two hundred and fifty two (252) to get a total of seven hundred and sixty (760) Primary healthcare workers who will be respondents for this study.

Table 3.4.2: Sampled States, Local Government Areas, Primary Healthcare Facilities and Primary Healthcare Workers (PHCWs) in North-Central Zone, Nigeria

States in North Central Zone	Sampled States	Sampled LGAs by Quota	No. of PHC Facilities	Sampled PHC Facilities (7.12%)	Pop. of PHCWs	Total Sampled PHC Workers
Kwara State Kogi State FCT Abuja	Kwara State (16 LGAs)	Baruten; Patigi; Asa; Ilorin West; Ekiti; Ifelodun; (Total = 6)	464	$\frac{464 \times 190}{2,667} = 33$	2,760	132
Niger State Plateau State	Niger State (25 LGAs)	Bosso; Muya; Agaie; Lapai; Suleja; Marig	1,323	$\frac{1323 \times 190}{2,667} = 94$	6,615	376

Benue State		a; Mokwa; Borgu and Wushishi Total =9				
Nasarawa State	Nasarawa State (13 LGAs)	Lafia; Keffi; Doma; Nasarawa; Akwanga (Total = 5)	880	$\frac{880 \times 190}{2,667} = 63$	4,400	252
Total 7	3	20	2,667	190	13,775	760

Sources: (Kwara State Ministry of Health 2016); (Niger State Ministry of Health 2015); (Nasarawa State Ministry of Health 2015); (Kogi State Strategic Health and Development Plan, 2010-2015); (FCT Abuja National Primary Healthcare Development Agency 2016); (Plateau State Ministry of Health 2015); (Benue State Ministry of Health 2016).

3.5 Instrumentation

This study employed researcher-developed close-ended questionnaire which was administered on respondents to elicit information regarding 'Assessment of knowledge, attitude, practice and availability of safety measures towards prevention of healthcare-associated infections among primary healthcare workers in North-Central Zone, Nigeria'. The questionnaire was divided into five sections. Section A contained four (4) items on demographic characteristics of the respondents. Section B contained eight (8) statements on knowledge of safety measures among primary healthcare workers towards the prevention of healthcare-associated infections, Section C contained eight (8) statements on attitude of primary healthcare workers towards safety measures in the prevention of

healthcare associated infections**,** Section D contained eight (8) statements on practice among primary healthcare workers on safety measures towards prevention of healthcare-associated infections and Section E contained eight (8) statements on availability of safety measures for primary healthcare workers towards the prevention of healthcare-associated infections. Thus, Sections B-E of the questionnaire, elicited a total of thirty two (32) statements drawn from each of the postulated research questions.

To score the respondents' responses, per statement raised, 4-point Likert rating scale was used as follows:

Strongly Agreed (SA) - 4 points

Agreed (A) - 3 points

Disagreed (D) - 2 points

Strongly Disagreed (SD**)** - 1 point

Hence, mean score of responses was accepted or said to be positive when it is 2.5 and above. However, any mean score of response which is less than 2.5 was not accepted or is said to be negative.

3.6 Validity of the Instrument

To ensure the content and face validity of the instrument, drafted copies of the researcher's developed questionnaire were given to five (5) jurors from the Departments of Human Kinetics and health Education and Nursing sciences Ahmadu Bello University Zaria, who vetted the questionnaire. The professional comments, criticisms and corrections of the Jurors were strictly adhered to, in the final draft produced.

3.7 Pilot Study

In order to further ascertain the reliability of the instrument, a pilot study was conducted using thirty (30) healthcare workers from Yagba West and Okene local government area of Kogi State in North-Central Zone, Nigeria. Kogi state is a state in North-central Nigeria but not part of the sampled States for the main research work. Six (6) primary healthcare facilities were purposively selected from Yagba West and Okene L.G.As of Kogi State (3 facilities each). Five (5) primary healthcare workers were selected from each of the six (6) selected primary healthcare facilities hence a total of thirty (30) respondents were used. The 30 copies of questionnaire were filled and returned the same day.

To determine the reliability of the instrument, the data obtained from the pilot study was statistically analyzed for the purpose of reliability using Cronbach Alpha Reliability Coefficients, Gutman split half and Spearman-Brown Split half reliability coefficients. The results of Spearman-Brown Split Half, Gutman Split Half and Cronbach Alpha reliability are 0.729; 0.713 and 0.773 respectively. The split half was done by serially numbering the questionnaire and sorting the odd numbers from the even numbers before subjecting it to analysis. According to Stevens (2006), an instrument is considered reliable if the reliability coefficient lies between 0 and 1, and that the closer the calculated reliability coefficient is to zero, the less reliable is the instrument, and the closer the calculated reliability co-efficient is to 1, the more reliable is the instrument. Therefore, based on the stated results above, the instrument for this study was reliable for data collection.

3.9 Procedure for Data Collection

To collect data for this study, the officers in charge of healthcare facilities were contacted to seek for permission using a letter of introduction obtained from the Department of Human Kinetics and Health Education, Ahmadu Bello University, Zaria. The necessary explanation regarding the purpose of the study and its procedure was given to the respondents, as well as assurance of confidentiality of information they gave. A total of seven hundred and sixty (760) copies of the questionnaire were distributed to the same number of respondents sampled, across the one hundred and ninety (190) primary healthcare facilities selected across the 20 local government areas in the selected states in North-Central Zone, Nigeria. To administer the questionnaire to the respondents, the researcher and three instructed research assistants purposively administered the questionnaire to the primary healthcare workers. The researcher went to meet one research assistant each in Kwara State, Nasarawa and Niger State who were instructed prior to the administration of the questionnaire. The instructions given to the research assistants was to enable copies of questionnaire to be administered to the targeted population and be collected at the point of response to maintain high retrieval rate. The instrument was administered and retrieved on spot from each of the sections formed to ease the collection, which resulted to 100% retrieval rate. Eight weeks were used for the administration and retrieval of the questionnaire.

3.10 Procedure for Data Analysis

The data collected for this study was coded and subjected to Statistical Package for Social Sciences (SPSS) version 20, for appropriate analysis. To analyse the data collected, the following statistical tools were used: Descriptive statistics of frequencies and simple percentages were used to describe the demographic characteristics of respondents; Mean and standard deviations were employed to answer the structured research questions on knowledge, attitude, practice and availability of safety measures towards the prevention of healthcare-associated infections among primary healthcare workers in North-central Zone, Nigeria.

Inferential statistics of one sample t- test was used to test hypotheses 1-4 on: significance of knowledge, attitude, practice and availability of safety measures towards the prevention of healthcare-associated infections among primary healthcare workers. Independent sample t – test, was used to test hypotheses 5 and 6 on differences between male and female primary healthcare workers' attitude and practice of safety measures towards the prevention of healthcare-associated infections. The analysis for the study was conducted with a decision criterion of 0.05 alpha level of significance.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

The purpose of this study was to assess the knowledge, attitude, practice and availability of safety measures towards the prevention of healthcare-associated infections among primary healthcare workers in North-Central Zone Nigeria. To achieve the stated purpose above, the data collected were statistically analysed with Statistical Package for Social Sciences (SPSS) version 20. The questionnaire was based on the 4-point modified Likert scale rating. A total of 760 questionnaire were administered and returned, with 100% retrieval rate. The mean score of responses for each item, was calculated using 4 as the highest and 1 as the lowest score with 2.5 as the mid-point score between the two extreme of Agree and Disagree. The decision criterion for acceptance or rejection of the items was mean score of 2.5. If the relative means of an item is equal to or greater than 2.5, it is considered that the respondents are in agreement with the suggested item, while any mean less than 2.5 implies disagreement. The demographic variables are presented in frequencies, percentages, while all other items were represented by their mean scores as expressed by the respondents. The corresponding standard deviation for each of the items were also shown in the respective tables. One sample t-test statistics and t-test were used to test the hypotheses at 0.05 alpha level of significance. The results are hereby presented

and discussed in this chapter according to the research questions and sub-hypotheses stated in chapter one.

4.2 Results

Demographic variables considered in this study includes: Age range in years; Gender; Work Experience and health cadres. Table 4.2.1: shows demographic information of the Respondents used in this study.

Table 4.2.1: Demographic Information of the Respondents.

Variable	Frequency	Percentage
Age range in years:		
(a) 20-30 years	276	36.3%
(b) 31-40 years	309	40.7%
(c) 41-50 years	131	17.2%
(d) 51-60 years	44	5.8%
Total	760	100%
Gender:		
(a) Male	296	38.9%
(b) Female	464	61.1%
Total	760	100%

Work Experience:		
(a) 1-7 years	107	14.
(b) 8-14 years	277	1%
(c) 15-21 years	152	36.
(d) 22-28 years	162	4%
(e) 29-35 years	62	20.
Total	760	0%
		21.
		3%
		8.2
		%
		100
		%
Health Cadres:		
(a) Nurses	190	25
(b) Community Health Workers	190	%
(c) Medical Laboratory Technologists	190	25
(d) Cleaners	190	%
	760	25
Total		%
		25
		%
		100
		%

Observation of Table 4.2.1 shows that most of the primary healthcare workers who responded were in the age range of 31-40 years 309 (40.7%) and 276 (36.3%) were in the age group of 20 to 30 years. While 131 (17.2%) were in the age group of 41 to 50 years and 44 (5.8%) 51 to 60 respectively. Furthermore, Table 4.2.1 reveals that male 296 (38.9%) and female 464 (61.1%) were used in this study. This implies that female primary healthcare workers responded more than their male counterparts.

More so, item 3 shows that most of the primary healthcare workers 277 (36.4%) who responded to the questionnaire had work experience of 8 to 14 years in health practice and the 162 (21.3%) of them had between 22 to28 years of experience. While

152 (20.0%), 107 (14.1%) and 62 (8.2%) of them had 15 to 21 years, 1 to 7 years and 29 to 35 years respectively.

Item 4 shows respondents across the cadres of primary healthcare workers as follows: 190 (25%) were Nurses; 190 (25%) Community Health Workers; 190 (25%) Medical Laboratory Technologists and 190 (25%) of them were Cleaners respectively.

4.2.2: Answering the Research Questions

Research Question One: What is the knowledge of primary healthcare workers on safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria?

Table 4.2.2: **Mean scores of responses on the knowledge of primary healthcare workers towards safety measures in the prevention of healthcare-associated infections (HAIs)**.

Statement	Mean	Std. Deviation
HIV, Hepatitis, Tuberculosis are HAIs and can be contracted during treatment of patients	2.73	1.098
Cleaning spills of blood and other body fluids on the floor are serious preventive measures against HAIs	2.68	1.066
Transfusion of unscreened blood can cause HAIs	2.72	1.169
Patients with HIV and TB should be isolated from other patients with mild diseases	2.93	1.127
Safety boxes prevents needle injuries there by preventing HAIs	2.62	1.023
Use of hand gloves during treatment prevents the transmission of HAIs	2.87	1.631
Use of disinfected aprons helps the prevention of HAIs	2.62	1.061
Using a new needle on every patient prevents the spread of HAIs	2.92	1.011
Mean scores aggregate	2.76	

N=760

A careful observation of Table 4.2.2 shows that most of the respondents were of the view that patients with HIV should be isolated from other patients with mild diseases (at mean score of 2.93). This then implies that many of the respondents have knowledge of the transmission of HIV hence, see isolation as a safety measures towards preventing healthcare-associated infections. Furthermore, the table shows that all the items from the responses were significant but their mean score were not as high and the aggregate mean score of 2.76 which was found to be greater than benchmark score of 2.5. This implies that primary healthcare workers have knowledge on safety measures towards the prevention of healthcare-associated infections.

4.2.3 Research Question Two: What is the attitude of primary healthcare workers towards safety measures in the prevention of healthcare-associated infections in North-Central Zone, Nigeria?

Table 4.2.3: Mean scores of responses on the attitude of primary healthcare workers towards safety measures in the prevention of healthcare-associated infections (HAIs).

Statement	Mean	Std. Deviation
I like to screen my patients' blood before transfusion so as to avoid transmission of HAIs	2.72	1.060
I feel enthusiastic in further trainings towards effective prevention of HAIs	3.06	.9811
I feel safe using new needle for each patient and not a needle for two patients to prevent spread of HAIs	2.83	1.032
I feel safe wearing hand gloves when treating patients with HAIs	2.98	.9703
I feel secured when it comes to isolation of patients with HAIs towards preventing its spread	2.87	1.114
I like being careful about final disposal of safety boxes into the incinerator so as to prevent HAIs	2.65	1.084
I feel safe from HAIs with disinfectants to wash my hands after attending to a patient	2.71	1.099
I like to disinfect non-disposable equipment like aprons after use, to prevent the spread of HAIs	2.63	1.168

Mean scores aggregate	2.81

N=760

A look at Table 4.2.3 reveals that the attitude of primary healthcare workers towards safety measures in the prevention of healthcare-associated infections was positive. The responses for each item were computed and the highest mean score of responses was 3.06 indicating that the majority of the respondents agreed that they feel enthusiastic in further trainings towards effective prevention of HAIs. The table shows that all the responses from the items were positive, the aggregate mean score of the items is 2.85 was found to be greater than benchmark score of 2.5. This implies that the attitude of primary healthcare workers towards safety measures in the prevention of healthcare-associated infections was positive.

4.2.4 Research Question Three: What is the practice of primary healthcare workers towards safety measures in the prevention of healthcare-associated infections in North-Central Zone, Nigeria?

Statement	**Mean**	**Std. Deviation**
I do disinfect my aprons and other equipment in accordance with global best practices towards the prevention of HAIs	2.72	1.065
I abide by infection control policy check list, to prevent HAIs by properly disposing human parts (amputations, placenta among others).	2.51	1.097
I use new set of needle or scalped blade on each patient to prevent HAIs	2.46	1.107

I dispose needles and sharps in puncture or leak-proof safety boxes to prevent HAIs	2.70	1.079
I use gloves when in contact with body fluids, non-intact skin or mucous membranes to prevent HAIs	2.70	1.069
I wash my hands before and after direct contact with patients to prevent HAIs	2.40	1.088
I separate patients of chronic diseases from those with mild diseases to prevent HAIs	2.47	1.136
I do report cases of HAIs immediately for necessary action to prevent further spread	2.48	1.155
Mean scores aggregate	2.56	

Table 4.2.4: **Mean scores of responses on the practice of primary healthcare workers towards safety measures in the prevention of healthcare-associated infections.**

N=760

A holistic examination of Table 4.2.4 shows that the mean scores of responses, for the aspect of practices of primary healthcare workers towards safety measures in the prevention of healthcare-associated infections, are greater than 2.5 because the aggregate mean was 2.56. Responses for each item were computed and the highest mean score of responses was 2.72 indicating that the majority of the respondents agreed that they do disinfect their aprons and other equipment in accordance with global best practices towards the prevention of HAIs. Although, there were negative practices of safety measures in items 19, 22, 23 and 24 which indicted that healthcare workers don't use new needles for new patients, they don't observe adequate hand washing, they don't isolate highly infectious patients from mild ones and infections are not reported immediately for prompt actions, with mean less than 2.5 (2.46, 2.40, 2.47 and 2.48) respectively. However, the aggregate mean scores of 2.56 is greater than 2.5 above it implies health workers agreed they practice safety measures for prevention of HAIs. Therefore, the

practices of primary healthcare workers on safety measures towards the prevention of healthcare-associated infections was positive.

4.2.5 Research Question Four: What safety measures are available for primary healthcare workers towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria?

Table 4.2.5: **Mean scores of responses on the availability of safety measures for primary healthcare workers towards the prevention of healthcare-associated infections**

Statement	Mean	Std. Dev.
Injection and sharps safety boxes are provided to prevent accidents of injuries and HAIs from sharps	2.20	1.097
Separate safety disposal boxes are provided for proper disposal of medical organic wastes like placenta, amputated human parts, to prevent HAIs	2.49	1.021
Aprons are available towards prevention of HAIs by direct contact with blood.	2.05	.877
Water is available for effective hand washing and cleaning of floors and equipment	2.17	1.039
Disinfectants available for all PHCWs to carry out disinfections towards the prevention of HAIs	2.28	1.063
Hand gloves are available to prevent HAIs	2.18	1.008
Needles are available therefore, a needle is not used for two patients	2.48	.9939
Nose masks are available so, I am protected when attending to Tuberculosis patients	2.	1.031

	Mean scores aggregate	6 3 2 . 3 1

N=760

Table 2.4.5 generally revealed that the safety measures are not available for primary healthcare workers towards the prevention of healthcare-associated infections. The responses for each item were computed, indicating that responses with mean score of 2.05 disagreed that aprons are available towards the prevention of infections which is the lowest mean score while the highest mean score of responses was 2.63 indicating that Nose masks are available so, they are protected when attending to Tuberculosis patients. However, the table shows that most of the items from the responses were negative, as indicated by the aggregate mean score of the items which is 2.31 which was found to be lower than the benchmark score of 2.5. This implies that safety measures are not available for primary healthcare workers towards the prevention of healthcare-associated infections.

4.2.6 Research Question Five

What is the difference between male and female primary healthcare workers' attitude on safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria?

Table 4.2.6: Mean Scores of responses on differences between male and female primary healthcare workers in their attitude towards safety measures in the prevention of healthcare-associated infections

	Gender	**N**	**Mean**	**SD**	Mean diff
Attitude	Male	2 9	2.82	.96091	.0078

towards safety measures	Female	6 4 6	2.83	1.13728	

Table above shows the differences between male and female primary healthcare workers' attitude towards safety measures. It reveal that males have a mean score of 2.82 and standard deviation of .96091 while females have a mean score of 2.83 and standard deviation of 1.13728 in favor of the females with mean differences of 0.0078. So the females showed better attitude towards safety measures in preventing HAIs.

4.2.7 Research Questions Six:

What are the differences between male and female primary healthcare workers' practice towards safety measures in the prevention of healthcare-associated infections in North-Central Zone, Nigeria?

Table 4.2.7: Mean Score on differences between male and female primary healthcare workers' practice towards safety measures in the prevention of healthcare-associated infections

Variables	Gender	N	Mean	SD	Mean diff
Practice towards safety measures	Male	296	1.91	.50266	1.30027
	Female	464	3.21	1.02530	

Table 4.2.6 above shows the differences between male and female primary healthcare workers practice towards safety measures. It revealed that males have a mean score of 1.91 and standard deviation of 0.50266 while females have a mean score of 3.21 and standard

deviation of 1.02530. The positive practice is in favor of the females with mean differences of 1.30027.

4.3 Test of Hypotheses

4.3.1 Major Hypothesis

Knowledge, attitude, practice and availability of safety measures towards the prevention of healthcare-associated infections among primary healthcare workers in North-Central Zone, Nigeria is not significant.

4.3.2 Sub-Hypothesis 1

Primary healthcare workers do not have significant knowledge of safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.

Table 4.3.2: One sample t-test analysis of knowledge on safety measures towards the prevention of healthcare-associated infections.

	Mean	**Std. Deviation**	**t-value**	**t-crit.**	**P-value**
Aggregate mean	2.7	1.4833	47.9	1.9	0.0

Constant mean	62 1 2 . 5 0	0.00	72 1	72	0

t (759) = 1.972 P<0.05 Significant.

Table 4.3.2 shows that the calculated one sample t-test of 47.721 is greater than the critical table value of 1.972 at degree of freedom 759 with P-value of 0.00 which is less than 0.05 alpha level of significance. This implies that primary healthcare workers have significant knowledge of safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria. Thus, the null hypothesis one was therefore rejected.

4.3.3 Hypothesis 2

Primary healthcare workers do not have significant attitude on safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.

Table 4.3.3: One sample t-test analysis of attitude on safety measures towards the prevention of healthcare-associated infections.

	Mean	**Std. Deviation**	**t-value**	**t-crit.**	**P-value**

Aggregate mean	2.8050			69.828	1.972	0.00
Constant mean		1.11367	759			

t (759) = 1.972 P<0.05 Significant.

Table 4.3.3 shows that the calculated one sample t-test of 69.828 is greater than the critical table value of 1.972 at degree of freedom 759 with P-value of 0.00 which is less than 0.05 alpha level of significance. This implies that primary healthcare workers have significant attitude on safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria. Thus, the null hypothesis one was therefore rejected.

4.3.4 Hypothesis 3

Primary healthcare workers do not significantly practice safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.

Table 4.3.4: One sample t-test analysis of primary healthcare workers' practice of safety measures towards the prevention of healthcare-associated infections.

	Mean	**Std. Deviation**	**If**	**t-val**	**t-cri**	**P-val**

				ue	**t.**	**ue**
Aggregate mean Constant mean	2.55 5.49 2.50	1.09995	759	68.437	1.972	0.00

t (759) = 1.972 P<0.05 Significant.

Table 4.3.4 shows that the calculated 68.437 is greater than the critical table value of 1.972 at degree of freedom 759 with P-value of 0.00 which is less than 0.05 alpha level of significance. This implies that primary healthcare workers do significantly carry out practice of safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria. Thus, the null hypothesis 3 was therefore rejected.

4.3.5 Hypothesis 4

Primary healthcare workers do not have significant availability of safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.

Table 4.3.5: One sample t-test analysis on availability of safety measures for primary healthcare workers towards the prevention of healthcare-associated infections.

	Me	**Std. Deviati**		**t-**	**t-**	**t-**

	a n	on	v a l u e	c r i t .	c r i t .
Aggregate mean Constant mean	2 . 3 1 0 1 2 . 5 0	1.0163 1 0.00	1 . 9 4 8	1 . 9 7 2	0 . 0 0

t (759) = 1.972 P<0.05 Significant.

Table 4.3.5 reveals that availability of safety measures for primary healthcare workers towards prevention of healthcare-associated infections in North-Central Zone Nigeria is not significant. This is because the calculated one-sample t-test of 1.948 is less than the table value of 1.972 at 759 degree of freedom with P-value of 0.00 which is less than 0.05 alpha level of significance. This implies that primary healthcare workers do not have significant availability of safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria. Thus, the null hypothesis 4 was hereby retained.

4.3.6 Hypothesis 5

There is no significant difference between male and female primary healthcare workers' attitude on safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria.

Table 4.3.6: Result of t-test Statistics on differences between male and female primary healthcare workers' attitude on safety measure in the prevention of healthcare-associated infections

	Gender	N	Mean	SD	Df	t-value	t.crit.	P-value

Attitude towards safety measures	Male	2.8233	.96091	758	11.102	1.972	0.009
	Female	2.8311	1.13728				

t (758) = 1.972 P<0.05 Significant.

Results of the independent t-test statistic showed that there is significant difference between male and female. This was because the calculated p value of 0.009 is less than the 0.05 alpha level of significance, while the calculated t-value of 11.102 is greater than the 1.972 t critical at df 758. This showed that female primary healthcare workers' attitude on safety measures towards preventing HAIs is more positive than their male counterparts. Therefore, the null hypothesis which states that ''there is no significant difference between male and female primary healthcare workers' attitude on safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria'', was rejected.

4.3.7 Hypothesis 6

There is no significant difference between male and female primary healthcare workers' practice towards safety measures in the prevention of healthcare-associated infections in North-Central Zone, Nigeria

Table 4.3.7: t-test analysis on difference between male and female primary healthcare workers' practice of safety measures towards the prevention of healthcare-associated infections.

	Ge	**Me**	**SD**	**t-**	**P-v**

	n d e r	**a r**		**v a l u e**	**al u e**
Practice of safety measures by PHCWs	M a l e F e m a l e	1 . 9 0 8 8 3 . 2 0 9 1	.50 26 6 1.0 25 30	2 0 . 3 1 3	0. 0 0

t (758) = 1.972 P<0.05 Significant.

Results of the independent t-test statistical analysis in table 4.3.6 above showed that there is significant difference between male and female primary healthcare workers' practice of safety measures towards preventing HAIs. This was because the calculated p value of 0.00 is less than the 0.05 alpha level of significance, while the calculated t-value of 20.313 is greater than the 1.972 t critical at df 758. This showed that female primary healthcare workers practice safety measures towards preventing HAIs more than their male counterparts. Therefore, the null hypothesis which says "there is no significant differences between male and female primary healthcare workers' practice towards safety measures in the prevention of healthcare-associated infections in North-Central Zone, Nigeria", was rejected.

4.4 Discussion

Findings from this study shows that primary healthcare workers have significant knowledge of safety measures towards the prevention of healthcare-associated infections

in North-Central Zone, Nigeria. The researcher noted that majority of the primary healthcare workers in North-Central Zone Nigeria, have the required knowledge of the need to use and comply with various safety measures, towards the prevention of healthcare-associated infections as they carry out handling of patients with various illnesses. This is in line with Pittet, Allegranzi, Storr, Bagheri Nejad, Dziekan and Leotsakos (2010), that the prevention of infection is reliant on knowledge of complex factors of safety measures to include the skills and motivation of health providers, access to drugs and supplies, information feedback and other building blocks of the health system. More so, Wattal (2014), reported that the importance of education as a measure to prevent nosocomial infections (healthcare-associated infections) is implied in numerous studies. Exploring the knowledge, perceptions and attitudes of healthcare personnel towards the transmission of healthcare-associated infections in different patient groups suggest that education plays an important role in the prevention and spread nosocomial infections. In line with the afore said, Temesgen and Demissie (2011), reported that knowledge of healthcare workers should encompasses effective Tuberculosis Infections Control (TBIC) measures to include opening of windows; Isolation of patients; Minimizing hospital stays, Use of respirator by the healthcare workers; educating patients; prioritizing TB suspects in treatment; health workers; Most health workers were found to have good preventive knowledge.

The outcome of this study revealed that primary healthcare workers have positive attitude towards safety measures in the prevention of healthcare-associated infections in North-Central Zone, Nigeria. It was observed in the course of this study that most of the primary healthcare workers in North-Central Zone Nigeria are enthusiastic towards the

use of most safety measures towards the prevention of healthcare-associated infections among themselves if made available in healthcare facilities. This is in line with the view of Okafor (2010), who reported that the outward manifestation of one's inner values and believes develops over time. As healthcare workers grow they watch the significant people around them behaving in a particular way, they are being told to cherish certain things over others and they learn from their superiors, peers and come to value certain things over others, thus forming a cherished value system. Soad, Ghadeer, Afaf, Ghizayel, Gamal, Medhat and El-Shazly (2012), reported in their study that most of the respondents (healthcare workers) (80.5%) felt that their jobs puts them at risk of contracting HBV infection, 68.9% believed that their lifestyle puts them at risk of infection, 87.1% believed that they need to be protected from hepatitis B infection, 68.4% believed that a health worker may infect patients if he is a carrier of HBV, 86.3% believed that it is necessary to be protected by vaccination, and only 69.7% stated that their children received hepatitis B Vaccine. Ward (2012), reported contrary to the finding of this study, that series of interviews he conducted to explore the attitudes of student nurses and their mentors towards infection control, revealed that students had constant negative attitudes. It was found that taking safety measures for infection prevention is largely seen by students as 'an additional workload burden rather than an integral aspect of patients and healthcare workers safety and quality of care'. The cause of the disparity between this study and that of Ward (2012), is the fact that this study used healthcare workers while the other used students.

Findings from this study revealed that primary healthcare workers do significantly carry out practice of safety measures towards the prevention of healthcare-associated infections in

North-Central Zone Nigeria. This is contrary to reports of studies by Tenna, Stenehjem, Margoles, Kacha, Blumberg and Kempker, (2013), Mmutle, Morake and Moea (2011), Kanjee, Catterick, Moll, Amico and Friedland (2011), regardless of the knowledge of healthcare workers, there is poor safety practice on tuberculosis infection control in the health facilities. Studies also showed that practice of health workers towards TB infection control (TBIC) is associated with working units to include: TB ward, laboratories, general medicine wards and emergency rooms. Most health workers are (71%) at higher risk of occupational acquisition of TB. Against the findings of Primary healthcare workers' positive attitude towards safety measures, it was noticed that they actually have poor practice towards measures in the prevention of healthcare-associated infections among themselves. Common use of hand gloves for every new patient becomes a problem among most primary healthcare workers in North-Central Zone Nigeria. The finding is in line with Abdraboh, Milaat, Ramadan, Al-Sayes and Bahy (2016), who reported that a good baseline compliance with (practice of) safety measures was observed with a striking improvement after educational intervention on healthcare-associated infections, those who were non-compliant turned to be compliant (adopting best practices for prevention). More so in line with the findings of this study, Sharma, Ramani, Mavalankar, Kanguru, and Hussein (2015), reported that respondents perceived specific practices on safety measures had improved after awareness programme on prevention of infections and has since improved the situation.

Results from this study shows that primary healthcare workers do not have significant availability of safety measures towards the prevention of healthcare-associated infections in North-Central Zone, Nigeria. This finding is against the findings of CDC (2012), and Henderson, Dembry, Fishman (2010), that healthcare workers infected with hepatitis B,

C or HIV are advised to seek for counselling from infection control professional, have his/her infection monitored and treated by physicians and have periodic measurement of viral loads. For healthcare workers infected with hepatitis B, e-antigen status should be used as monitoring tool. More so, this finding contradict the position of CDC (2012), which postulated that employers are required to establish exposure control plans that include post-exposure follow up for their employees and to comply with incident reporting requirements mandated by the 1992 Occupational Health and Safety Administration (OSHA) blood borne pathogens standard. Access to clinicians who can provide post-exposure care should be available during all working hours, including nights and weekends. In this study it was found that safety measures are either not in place or grossly inadequate in few healthcare facilities where few measures were found. Furthermore, contrary to this finding of inadequate availability of safety measures, De Schryver, Claesen & Meheus, (2011) and Werner, Abdalla & Gara (2013), respectively, reported that use of hepatitis B vaccine is considered to be most important intervention for the prevention of healthcare-associated infections. Healthcare professionals who have received hepatitis B vaccine and have developed immunity to the virus are virtually at no risk of acquiring any healthcare associated infection.

This study also revealed that female primary healthcare workers' attitude towards safety measures for the prevention of healthcare-associated infections, is more than their male counterparts in North-Central Zone Nigeria. This is in line with the findings of Quiros, Lin and Larson (2007), who reported in a study that female staff scored higher than male staff members in attitudes regarding clinical practice guidelines in general including hand hygiene meant to prevent HAIs. Also, positive attitude was significantly

higher among female health personnel on hand decontamination in personnel of Intensive Care Unit. More so, Alessandra, Gabriella, Luciana and Italo (2011), reported in their studies again supported the fact that a more positive attitude and practice has been observed in female nurses, in those with a lower number of years of activity (experience in health care delivery), and in those needing additional information about disinfection procedures. However, contrary to this finding Adedigba, Ogunbode, Fajewonyomi and Naidoo (2006), reported in a study of gender differentiation on the attitude and practice of healthcare workers in Osun State Nigeria, that there is significant gender difference in attitude and behaviour of healthcare workers with males having positive attitude towards PLWHA and also complied more to safety practices than females.

Findings from this study revealed that female primary healthcare workers practice safety measures towards the prevention of HAIs, more than their male counterparts in North-Central Zone Nigeria. WHO (2011), also reported in support of the above, that there are two important predominantly female groups in health care settings, namely healthcare workers and pregnant women. Healthcare workers are included because the majority of them are females; there are high levels of occupational sex segregation among health care workers; they play a major role in controlling emerging diseases; and they have heightened risks of exposure hence their predominant practice of prevention against HAIs. Moreover, Haile, Engenda and Abdo (2017), reported in their study, that more female HCWs always comply with safety measures for infections prevention, as compared to male HCWs. The female HCWs' better compliance might be due to a natural tendency of female workers to obey organizational rules and regulations most often and also to their extra caution against infections. This findings goes contrary to

Tenna, Stenehjem, Margoles, Kacha, Henry, Blumberg and Kempker (2013), who reported that training of Healthcare Workers about the importance of practicing hand hygiene by improving hand sanitizer options may improve their safety thus preventing the spread of HAIs. This involves all healthcare workers and not just a gender, as reported in this study.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The purpose of this study was to assess the knowledge, attitude, practice and availability of safety measures towards the prevention of healthcare-associated infections among primary healthcare workers in North-Central Zone Nigeria. To achieve this purpose, six research questions and one major hypothesis with six sub-hypotheses were formulated. They aimed at assessing knowledge of safety measures, attitude towards

safety measures, practice of safety measure, availability of safety measures and gender differences in attitude and practice of safety measures, towards the prevention of healthcare-associated infections among primary healthcare workers in North-Central Zone Nigeria. Ex-post facto research design was used for this study. The population of the study comprises all Primary Healthcare Workers in Government owned hospitals of North-central Zone Nigeria. Three states were randomly selected for the study from North-Central Zone Nigeria. Seven hundred and sixty (760) primary healthcare workers were purposively selected across the three states using multi-stage sampling techniques. A total of 760 researcher's structured questionnaire were administered and retrieved for the purpose of data collection (100% retrieval rate). The research questions were answered using descriptive statistics comprised of mean and standard deviation. To analyse the formulated sub-hypotheses for this study, inferential statistics of one sample t-test and t-test statistics were used in this study. All the formulated sub-hypotheses were tested at 0.05 alpha level of significance.

Major findings of the study revealed that:

1. There was significant knowledge of safety measures towards the prevention of HAIs among PHCWs in North-Central Zone Nigeria. This is because the calculated t.-value of 47.721 is greater than t.crit. of 1.971. PHCWs have the required knowledge of safety measures to effectively prevent healthcare-associated infections.
2. There was significant attitude towards safety measures in the prevention of HAIs among PHCWs in North-Central Zone Nigeria. This is because the calculated t-value of 69.828 is greater than t.crit. of 1.971. Primary healthcare workers like to use any safety measures that will prevent them from acquiring healthcare-associated infections.

3. There was significant practice of safety measures among PHCWs towards the prevention of HAIs in North-Central Zone Nigeria. This is because the calculated t.-value of 68.437 is greater than t.crit. of 1.971. Primary healthcare workers do practice safety measures as much.
4. There was no significant availability of safety measures towards the prevention of HAIs among PHCWs in North-Central Zone Nigeria. This is because the calculated t.-value of 1.948 is less than t.crit. of 1.971. Primary healthcare workers are not provided with most of the safety equipment needed in their healthcare facilities.
5. Female PHCWs' attitude towards safety measures in the prevention of HAIs, is more positive than their male counterparts in North-Central Zone Nigeria. The calculated t.-value of 11.102 is greater than t.crit. of 1.971.
6. Female PHCWs' practice safety measures towards the prevention of HAIs more than their male counterparts in North-Central Zone Nigeria. This is based on the calculated t.-value of 20.313 is greater than t.crit. of 1.971.

6.2 Conclusion

On the basis of the findings of this study, the following conclusion were drawn:

1. Primary healthcare workers have knowledge of safety measures towards the prevention of healthcare-associated infections in North-Central Zone Nigeria.
2. Primary healthcare workers have positive attitude towards safety measures in the prevention of healthcare-associated infections in North-Central Zone Nigeria.
3. Primary healthcare workers practice safety measures towards the prevention of healthcare-associated infections in North-Central Zone Nigeria.
4. Primary healthcare workers in North-Central Zone Nigeria, are not provided with most of the safety measures needed in their healthcare facilities.

5. Female primary healthcare workers have more positive attitude towards safety measures for the prevention of healthcare-associated infections, than their male counterparts in North-Central Zone Nigeria.
6. Female primary healthcare workers practice safety measures towards the prevention of healthcare-associated infections more than their male counterparts in North-Central Zone Nigeria.

5.3 Recommendations

On the basis of the conclusions drawn from this study, the following recommendations were made:

1. Government in collaboration with NGOs and Health Educators should maintain training and re-training on knowledge of safety measures towards the prevention of HAIs among healthcare workers across North-Central Zone Nigeria to sustain and keep updating the acquired skills of safety measures. This can be done through workshops, seminars and symposia.

2. Government should motivate and encourage healthcare workers to imbibe more positive attitude towards safety measures for the prevention of HAIs by prompt payment of their salaries and allowances. This will encourage healthcare workers not to relent in their positive attitude imbibed and to see safety measures not as extra duties but protection.

3. Legislation should be made to mandate Ministries of Health across the states to establish task force to monitor and enforce global best practices among healthcare workers towards use of safety measures in preventing HAIs with penalties to erring healthcare workers.

4. Government in collaboration with international NGOs should ensure that adequate safety measures are available across healthcare facilities in North-Central Zone Nigeria, towards preventing HAIs among healthcare workers
5. The management of healthcare facilities should remind healthcare workers that infections have no respect for gender therefore, both male and female healthcare workers should be proactive in their attitude and practice towards the prevention of HAIs through task force on compliance.

5.4 Suggestions for Further Studies

Further studies should be carried out to assess the availability and practice of safety measures towards preventing healthcare-associated infections among healthcare practitioners in tertiary healthcare institutions in Nigeria.

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APPENDIX I

DEPARTMENT OF HUMAN KINETICS AND HEALTH EDUCATION, AHMADU BELLO UNIVERSITY ZARIA, NIGERIA.
QUESTIONNAIRE FOR PRIMARY HEALTHCARE WORKERS

The researcher is a postgraduate student of the above Department. In partial fulfilment of the requirement for the award of Doctor of Philosophy Degree in Health Education, he is conducting a research on **''Assessment of Knowledge, Attitude, Practice and Availability of Safety Measures towards Prevention of Healthcare-Associated Infections among Primary Healthcare Workers in North-Central Zone, Nigeria''.**
You are requested to honestly respond to the statement relating to the research topic. All information provided will be used mainly for the purpose of this study and strictly treated confidentially.

Section A: Demographic characteristics of respondents.
Introduction: In this section, you are expected to please tick (√) the options which best describes your opinion.

1. Age Range in Years

(a) 20-30 ( )

(b) 31-40 ( )

(c) 41-50 ( )

(d) 51-60 ( )

2. Gender:

(a) Male ( )

(b) Female ( )

3. Work Experience in years:

(a) 1-7 years ( )

(b) 8-14 years ( )

(c) 15-21 years ( )

(d) 22-28 years ( )

(e) 29-35 years ( )

4. Health Cadre:

(a) Nurse ( )

(b) Community Health Workers ( )

(c) Medical Laboratory Technologist ( )

(d) Cleaner ( )

Please tick (√) the column against each statement in section **B-E** that is most appropriate to you.
KEY: Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD)

Section B: Knowledge of Primary Healthcare Workers (PHCWs) on Safety Measures towards the prevention of Healthcare-Associated Infections (HAIs).

S/N	Statements	SA	A	D	SD
1	HIV, Hepatitis, Tuberculosis (TB) among others are HAIs and can be contracted during the treatment of patients				
2	Cleaning spills of blood and other body fluids on the floor are serious preventive measures against HAIs				
3	Transfusion of unscreened blood can cause HAIs				
4	Patients with HIV and TB should be isolated from other patients with mild diseases				
5	Injection safety boxes prevents needle injuries there				

	by preventing HAIs				
6	Use of hand gloves during treatment prevents the transmission of HAIs				
7	Use of disinfected aprons helps the prevention of HAIs				
8	Using a new needle on every patient will help the prevention of the spread of HAIs				

Section C: Attitude of Primary Healthcare Workers (PHCWs) on Safety Measures towards the prevention of Healthcare-Associated Infections (HAIs).

Please tick (√) the column that is most appropriate to you.

S/N	Statements	SA	A	D	SD
9	I like to screen my patients' blood before transfusion so as to avoid transmission of HAIs				
10	I feel enthusiastic in further trainings towards effective prevention of HAIs				
11	I feel safe using new needle for each patient and not a needle for two patients to prevent spread of HAIs				
12	I feel safe wearing hand gloves when treating patients with HAIs				
13	I feel secured when it comes to isolation of patients with HAIs towards preventing its spread				
14	I like being careful about final disposal of safety boxes into the incinerator so as to prevent HAIs				
15	I feel safe from HAIs with disinfectants to wash my hands after attending to a patient				
16	I like to disinfect non-				

	disposable equipment like aprons after use, to prevent the spread of HAIs				

Section D: Practice of Primary Healthcare Workers (PHCWs) on Safety Measures towards the prevention of Healthcare-Associated Infections (HAIs).
Please tick (√) the column that is most appropriate to you.

S/N	Statements	SA	A	D	SD
17	I do disinfect my aprons and other equipment in accordance with global best practices towards the prevention of HAIs				
18	I abide by infection control policy check list, to prevent HAIs by properly disposing human parts (amputations, placenta among others).				
19	I use new set of needle or scalped blade on each patient to prevent HAIs				
20	I dispose needles and sharps in puncture or leak-proof safety boxes to prevent HAIs				
21	I use gloves when in contact with body fluids, non-intact skin or mucous membranes to prevent HAIs				
22	I wash my hands before and after direct contact with patients to prevent HAIs				
23	I separate patients of chronic diseases from those with mild diseases to prevent HAIs				
24	I do report cases of HAIs immediately for necessary action to prevent further spread				

Section E: Availability of Safety Measures for Primary Healthcare Workers (PHCWs) towards the prevention of Healthcare-Associated Infections (HAIs).
Please tick (√) the column that is most appropriate to you.

S/N	Statements	SA	A	D	SD
25	Injection and sharps safety boxes are provided to prevent accidents of injuries and HAIs from sharps				
26	Separate safety disposal boxes are provided for proper disposal of medical organic wastes like placenta, amputated human parts, to prevent HAIs				
27	Aprons are adequately provided towards prevention of HAIs by direct contact with blood.				
28	Water is adequately provided for effective hand washing and cleaning of floors and equipment				
29	Disinfectants are provided for all PHCWs to carry out disinfections towards the prevention of HAIs				
30	Hand gloves are adequately provided to prevent HAIs				
31	Adequate needles are provided therefore, a needle is not used for two patients				
32	Nose masks are available so, I am protected when attending to Tuberculosis patients				