ASSESSMENT OF EXPOSURE TO BODY FLUIDS AMONG HEALTH CARE WORKERS IN KADUNA STATE HOSPITALS

BY

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A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADUBELLOUNIVERSITY, ZARIA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF EDUCATION IN HEALTH EDUCATION

DEPARTMENT OF PHYSICAL AND HEALTH EDUCATION
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JULY, 2015

DECLARATION

I declare that this thesis entitled **"Assessment of Exposure to Body Fluids among Health Care Workers in Kaduna State Hospitals"** has been carried out by me in the department of Physical 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 research work has been submitted for another degree or diploma at this or any other institution.

_____	_____	_____
Abdulfatah Hajara Aminu	Signature	Date

CERTIFICATION

This thesis entitled **"Assessment of Exposure to Body Fluids among Health Care Workers in Kaduna State Hospitals"** by Abdulfatah Hajara Aminu meets the regulations governing the award of the degree of Masters of Education in Health Education of Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

_____ _____

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DEDICATION

This thesis is dedicated to my parents, my dearest husband Maj M. Sani and my children Fatima, Zainab and Ibrahim who stood by me in their prayers toward the success of this research

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The researcher is most grateful to Almighty God for protecting her life and giving her good health, strength and vitality throughout the period of this programme. The researcher wishes to express her indebtedness to the assistance, patience, valuable constructive suggestions and deep sense of commitment shown by the supervisors, Prof. (Mrs) M.A. Suleiman and Prof. J.A. Gwani who took time to read through the work and made necessary corrections on the draft.

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ABSTRACT

The purpose of this study was to assess exposure to body fluids among health care workers in Kaduna State hospitals. The study population comprises of all doctors, nurses, lab scientists and attendants working in Kaduna State hospitals. The sample size used for the study was 346 using the Yamane sample size selection formula. Stratified sampling method was used, the three existing senatorial zones served as strata. Each of the stratum was clustered according to the existing local government areas. Simple random sampling of deep and pick was used in selecting nine state hospitals, three from each senatorial zone. Purposive sampling was further used to select nine local governments that have hospitals. Proportionate sampling was used at the various selected state hospitals to distribute questionnaires to the health workers. The 346 questionnaires were administered out of which 297 (85.8%) were retrieved. The data collected was analysed using one-way analysis of variance and t-test at 0.05 level of confidence. A constant mean of 2.5 was used to ascertain the agreement of the respondents on the questionnaire items. Findings from the study showed that there were a significant difference in gender and job category in predisposing the healthcare workers in Kaduna State hospitals to body fluid hazards. It was, therefore, recommended that the state government should provide protective devices against body fluid hazards for healthcare workers in Kaduna State hospitals, there is a need to overhaul the approaches to handling hazardous materials in-line with WHO standard, this will help to prevent exposure of healthcare workers in Kaduna State hospitals to body fluid hazards.

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ABBREVIATION

HIV	-	Human Immunodeficiency Virus
AIDS	-	Acquired Immunodeficiency Syndrome
HBV	-	Hepatitis B. Virus
HCV	-	Hepatitis C. Virus
WHO	-	World Health Organization
PPE	-	Personal Protective Equipment
ICOH	-	International Commission on Occupational Health
BOHS	-	Basic Occupational Health Service
BS	-	British Standard
OHSAS	-	Occupational Health and Safety Management System Requirement
FEPA	-	Federal Environmental Protection Agency
UAC	-	United African Company
ILO	-	International Labour Organization
PEP	-	Post Exposure Prophylaxis
NSI	-	Needle Stick Injury
HCW	-	Health Care Workers
UPs	-	Universal Precautions
BBF	-	Blood and Body Fluid
CDC	-	Centre for Disease Control

OPERATIONAL DEFINITION OF TERMS

Body fluids: Are those substances found in the body of the respondents such as blood, saliva, vomit, urine, semen, sweat and vaginal secretions.

Exposed: A respondent who comes in contact with the potentially infected body fluid.

Mucous membrane exposure: When body fluids come in contact with mucosal membranes (e.g., eyes, oral cavity) of the respondents.

Non-intact skin exposure: When body fluids come in contact with exposed skin of the respondent that is abraded or non-intact because of dermatitis or an open wound.

Percutaneous injury: Puncture or laceration of the respondent skin that penetrates into or below the dermis.

Post-exposure prophylaxis (PEP): Timely provision of medication/immunization following an exposure by the respondents to potentially infected body fluids in order to minimize the risk of acquiring infection.

Universal precaution: Guidelines for preventing the transmission of infection by respondent.

Source: Individual from whose body the potentially infected body fluid originated from.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Body fluids are liquids originating from inside the bodies of living humans. They include fluids that are excreted or secreted from the body. Human body fluids and other body tissues are widely recognized as vehicles for the transmission of human disease. Body fluid visibly contaminated with blood should be considered capable of transmitting hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV). Semen and vaginal secretions should also be considered potentially able to transmit these viruses. Similarly, cerebrospinal fluid, amniotic fluid, pleural fluid, synovial fluid, and peritoneal and pericardial fluids carry a significant risk of transmitting these viruses. In contrast, unless blood is visibly present, saliva, sputum, sweat, tears, feces, nasal secretions, urine, and vomitus carry a very low risk of transmission of HCV and HIV. It should be noted that saliva can also carry HBV. (Lohiya, Tan-Figueroa, Lohiya, Lohiya. 2013)

Exposure to body fluids among health care workers constitute a major occupational hazard globally, with an estimate of 2.6% of healthcare workers exposed to Hepatitis C virus (HCV), 59% to Hepatitis B virus (HBV) and 0.5% to Human Immunodeficiency virus (HIV), annually which equates to approximately 16,000 HCV infections, 66,000 HBV infections and 200-600 HIV infections, through occupational exposure, (Elliott, Ketton and Holt, 2005). The three body fluids pathogens that are the most commonly involved in occupational exposures in healthcare workers are hepatitis B, hepatitis C, and HIV (Weber, Rutala, Eron, 2012; Deuffic-Burbank, Delaroccque-Astagneau, Abitedoul, 2011).

Healthcare workers exposures to these pathogen are widespread. Some studies have estimated that there are more than 400,000 parental exposures suffered by healthcare workers in the United States every year and that every year, 1 out of 10 healthcare workers in the United States suffer a splash exposure or a needle stick injury (Karmon, Mehta, Brehm, 2013; Henderson, 2012). The exact number of exposures is not known and part of the problem is under reporting: it has been estimated that approximately 50-67% of all needlesticks and exposures to bloodborne pathogens are not reported (Bernard, Dattilo, Laporte, 2013; CDC, 2008).

Healthcare workers and patients in low income countries, Nigeria inclusive are placed at increased risk of infections because of comparatively common unsafe practices. The risk of occupational infections in such countries is worsened by a range of factors including but not limited to hospital overcrowding, lower healthcare workers' patient ratio, inadequate or unavailability of basic safety equipment, partial awareness of body fluid exposure risk, and the recycling or reuse of contaminated needles and sharp instruments, (Bartlett, Weber, 2013; Kuhar, Henderson, Struble, 2013; Cosens, 2012)

The use of personal protective equipment (PPE), adherence to universal precautions, effective post-exposure management, engineered safer devices, injury surveillance, and relevant legislations are amongst strategies which are designed to maximize the safety of care providers and patients in healthcare setting. In many low-income countries, especially sub-Saharan Africa where more than 70% of the global HIV-infected population live, (Sagoes-Moses, Pearson, Perry, Jagger. 2001) these interventions which have been employed in developed countries are rarely available, (Awusabo-Asare , Marfo, 1997).

Almost all healthcare workers are at risk for exposure to blood borne pathogens, but nurses are the group that is most affected (Camacho-Ortiz, Díaz-Rodríguez, Rodríguez-López, Martínez-Palomares, Palomares-De la Rosa, Garza-Gonzalez,2013; Yang, Wu, Wang. 2013). It has been estimated that more than 50% of nurses will experience at least one needlestick injury in their careers (Rhode, Dupler, Posta, 2013). Percutaneous exposures, (e.g. needle pricked injury and punctures or cuts with other sharps instrument) are most frequently sustained by those occupational groups that handle sharps instruments including surgeons but are also sustained by others including downstream workers such as those disposing waste (Attendants).

In this study, only exposure to body fluids that are capable of transmitting pathogens (HBV, HCV and HIV) to health care workers in Kaduna State hospitals are studied, because these three viruses are likely to be responsible for a much larger portion of the disease burden than other infections. This does not preclude the possibility that other infections may gain importance in the future.

1.2 Statement of the Problem

Globally, the cost of disease from occupationally acquired hepatitis B, hepatitis C, and HIV infection is high. Of 35 million Health Care Workers (WCHs) worldwide, the World Health Organization estimates that approximately 3 million experience percutaneous injuries each year. Of those injured HCWs, 70,000 are likely to be infected with hepatitis B virus as a result of exposure, 15,000 with HCV, and 1,000 with HIV, (WHO, 2007). Although, the majority of these occupational infections occur in developing countries, Nigeria inclusive, where the prevalence rates of bloodborne

pathogens are high, most documented infections are reported from industrialized countries, where surveillance is most commonly conducted (Sagoe-Moses, *et.al* 2001). Studies carried out in several countries have reported varying rates of needle-stick injuries or exposure to body fluids among different healthcare worker categories. The number of occupational exposures to HIV in Estonia, Lithuania and Hungary is reported to be less than 10 annually in each of these countries, (Pillay, Colvin, Williams, Coovadia, 2001). The incidence of needle-stick injury among healthcare workers in Turkey over a one-year period was found to be 68%, (Cutter, and Jordan, 2004), while in Egypt and Uganda in 2002 was 36% and 55% respectively, (Ilhan, Durukan, Aras, 2006). According to a study carried out in an emergency Department in USA 2003, 60% of healthcare workers were exposed to blood and body fluids, (Merchant, Becker, Mayer, 2003), it was also reported as the most common occupational health hazard in a Nigerian Teaching Hospitals, (Orji, Fasubaa, Onwudiegwu, 2002).

Body fluid infections such as HIV, hepatitis B virus (HBV), and hepatitis C virus (HCV), are highly endemic in Nigeria (WHO,2013), one of the most populated developing nations in the world. Although a few studies from Nigeria have reported high prevalence of various forms of occupational exposures to blood and body fluids among health workers (Ansa*et al.,* 2002; Erhabor*et al.,* 2007; Isara *et al.,* 2012; Medubietal 2006), there remains of dearth of studies from Nigeria describing the prevalence and determinants of these exposures in the different professional groups of health workers.

HIV is among the top 10 causes of death in developing countries Nigeria inclusive, and the leading cause of death in sub-Sahara Africa, (Sheriati, Shahidzadeh-mahani, Ovysi, Akhlaghi, 2007). It has been estimated that up to 60% of patients

admitted in public sector hospitals in South Africa are HIV infected, (Patton, Coffey, Sawyer, 2009). In this prevalence environment, healthcare workers investigating and managing these patients are at risk of contracting HIV during the course of their duties. Only HBV vaccination is available, leaving healthcare workers at significant risk of morbidity and mortality when exposed to HCV and HIV, (Landovitz, Currier 2009).

Few studies from northern Nigeria, where Kaduna State is located, have reported high prevalence of various forms of occupational exposures to body fluids among health workers. Dimie, Kemebradikumo, Babatunde, George, Christian, Sanusi, (2014), showed that the prevalence of occupational exposures to body fluids, in northern Nigeria is (84.4%) in one or more type of exposures. Another research from the same region reveals a high prevalence of (73.1%) at least one or more episodes of occupational exposures. No study has been found on this title in the case study area to the best knowledge of the researcher.

Nevertheless, some HCWs who are colloquies of the researcher have reported to be complaining of exposure as a result of unavailability of protective equipment in their place of work, when the issue was discussed, the researcher observed more exposed victims from within and outside the area. Some of the complainers were at advanced age with high level of working experience, others were fresher's. It is based on these facts that the researcher assessed the exposure of health workers in Kaduna State hospitals to body fluid hazards, and to ascertain the factors that predispose them to exposure.

1.3 Purpose of the Study

The main purpose of the study was to assess exposure to body fluids among healthcare workers in Kaduna state hospitals. The specific purposes of the study are to:

1. assess whether age is a factor that predispose health care workers to body fluids exposure in Kaduna State hospitals;
2. assess whether gender is a factor that predispose health care workers to body fluids exposure in Kaduna State hospitals;
3. assess whether years of working experience is a factor that predisposes health care workers exposure to body fluid in Kaduna State hospitals; and
4. assess whether job category is a factor that predispose healthcare workers to body fluids exposure in Kaduna State hospitals.

1.4 Research Questions

The study was conducted to answer the following specific questions:

1. Does age predispose health care workers to body fluids exposure in Kaduna State hospitals?
2. Does gender predispose health care workers to body fluids exposure in Kaduna State hospitals?
3. Do years of working experience predispose health care workers to body fluids exposure in Kaduna State hospitals?
4. Does job category predisposes health care workers to body fluids exposure in Kaduna State hospitals?

1.5 Significance of the study

The study which is to assess the exposure to blood and body fluid among healthcare workers in Kaduna State hospitals is significant for the following reasons:

1. The results of this study will play a vital role in creating awareness and encourage practices of universal precautions among healthcare workers in Kaduna State hospitals.
2. The results of this study will give healthcare workers in Kaduna State hospitals an insight of the magnitude to which their profession exposes them to body fluid hazards and risk that the diseases pose to their health and survival.
3. The findings of this study will also provide the much more needed evidence base for policy, planning and implementation for healthcare workers safety and environment programming in Kaduna state hospitals.
4. The result of this study will draw the attention of the government, the hospital management, health facility administrators, those responsible for infection control policy and practice, for procurement of safety equipment and other healthcare supplies.
5. The findings of this study will help healthcare workers in Kaduna State hospitals to identify the benefits of using strategies to prevent exposure, safe injection practices, and the actions to take immediately after exposure.
6. The findings of this study will give healthcare workers in Kaduna State hospitals an insight on the likely factors that predisposes them to body fluid exposure.

1.6 Basic Assumptions

On the basis of research evidence, the following assumptions are made for the purpose of this study:

i. that age can dispose health care workers to body fluids exposure in Kaduna State hospitals;

ii. that gender can dispose health care workers to body fluids exposure in Kaduna State hospitals;

iii. that years of working experience can dispose health care workers to body fluid exposure in Kaduna State hospitals; and

iv. that job category can dispose health care workers to body fluids exposure in Kaduna State hospitals.

1.7 Hypotheses

The following hypotheses were formulated for the purpose of this study:

Major Hypothesis

Health care workers are not significantly exposed to body fluid hazards in Kaduna State hospitals.

Sub-hypotheses

1. Age is not a significant predisposing factor of health care workers exposure to body fluid in Kaduna State hospitals.
2. Gender is not a significant predisposing factor of health care workers exposure to body fluid in Kaduna State hospitals.
3. Years of working experience is not a significant predisposing factor of health care workers exposure to body fluid in Kaduna State hospitals.

4. Job category is not a significant predisposing factor of health care workers exposure to body fluid in Kaduna State hospitals.

1.8 Delimitation of the Study

The study was delimited to assessment of exposure to body fluids among health workers (Nurses, Doctors, Attendants, Lab scientist), directly and indirectly in contact with patients' body fluid in Kaduna State hospitals. The study was delimited to determine whether healthcare workers are exposed to body fluids hazards in Kaduna State hospitals**.** The study is also delimited to examine the factors that expose health workers to body fluids exposure in Kaduna State hospitals, and is also delimited to identify the occupational safety measures available for health workers against exposure to body fluid in Kaduna State health facilities. The study was geared towards the collection of responses from healthcare workers in Kaduna state hospitals which are dimmed to be matured to provide information on the variables considered for this study.

1.9 Limitation of the Study

Despite the fact that all the respondents were assured of confidentiality of their responses by the researcher, some refused to return back their filled questionnaire leading to having only (85.8%) retrieved questionnaire. This was due to fear or other reasons best known to them. However, services of the research assistants were tremendous as they explained each of the variables under investigated to the healthcare workers before filling the questionnaire.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

Health care workers are at risk of exposure to a multitude of infectious diseases, including, but not limited to, tuberculosis (TB), influenza, human immunodeficiency virus (HIV), and hepatitis B virus. In some countries, hospital employees are three times more likely than the general population to contract TB (Menzies, Joshi, and Pai, 2007). Overall, airborne infections pose a significant hazard to health care workers (Menzies. *et al.,* 2007 and Aziz, 2008) especially in low- and middle-income countries (Fica, Cifuentes, Ajenjo, Jemenao, Zambrano, Febre, et al. 2008). A similar risk is present for occupational transmission of blood borne pathogens (Pruss-Ustun Rapiti, Hutin, 2003). The prevalence of hepatitis B among health care workers is estimated to be up to five folds higher than that in the general population in some areas (Ciorlia, and Zanetta, 2005). Most exposures among health care workers are caused by percutaneous injuries from sharp objects, such as needles, contaminated with blood or body fluids (Pruss-Ustun*et al.,* 2003) A staggering 90% of blood borne infections occur in low income countries, highlighting the vulnerability of front- line health care workers in these geographic areas (Menzies, *et al.,* 2007, and Pruss-Ustan et al. 2003).

This transmission occurs predominantly by percutaneous or mucosal exposure of workers to the blood or body fluids (BBF) of infected patients by splashes or needle sick injuries (NSI). Prospective studies of HCWs WHO, (2002), have estimated that the average risk for transmission after a percutaneous exposure is approximately 0.3%, 6 to 30% and 1.8% for HIV, hepatitis B, and hepatitis C, respectively. Over 90% of these

infections are occurring in low–income countries, and most are preventable (WHO, 2002). In high-income countries implementations of standard Universal precautions (UPs), injury surveillance programmes, provision of personal projective equipment (PPE), routine hepatitis B vaccination, post-exposure prophylaxis (PEP) and engineered safety devices have yielded positive results. In USA, the proportion of HCW's experiencing one or more needle stick injury (NSI) in one year preceding survey fell from 24 to 8.6% in a span of eight years (Clarke, Rockett, Sloane, and Aiken, 2002). In the developing countries, the HCWs are at greater risk due to sub-optimal infection control practices like lack of equipment, training, compliance with Ups (Sagoe-Moses, *et al*. 2001). A study among HCWs in rural health care facilities in India shows that proportion exposed to BBF and NSI during the year 2004 was 37.1% and 63.2% respectively (Kermode, Jolly, Langkham, Thomas, and Crofts, 2005).

The level of practice of universal precautions by health care workers may differ from one type of health care worker to another, various studies carried out among different categories of health care workers found that exposure to blood or other body fluid was high. A study conducted in Ibadan found a high exposure rate of 25.1% (Olowu, Oluag and Kehinde, 2001). Several factors ranging from personal to organizational causes were responsible for the non-adherence to the basic principles of universal precautions among health care providers, (Odujurin, Palenick, 2000).

Available relevant literatures are reviewed in the following order;

2.2 Theoretical framework

2.3 The concept of occupational health

2.4 Age as a predisposing factor of exposure

2.5 Gender as a predisposing factor of exposure

2.6 Years of working experience as a predisposing factor of exposure

2.7 Job category as a predisposing factor of exposure

2.8 Summary

2.2 Theoretical Framework: The Ottawa Model of Research Use

Aware of the lack of practical models to promote research use in a simple and useful framework leads to the formulation of the Ottawa model of research use (OMRU). The OMRU framework was created to be used by policy makers seeking to increase the use of health research by practitioners, as well as by researchers interested in studying the process by which research becomes integrated into practice. The Ottawa Health Decision Centre also part of the Ioeb Research Institute, is a leader in developing evidence-based decision aids for patients and is increasingly focusing on research transfer strategies. The elements are primarily drawn from the literature relating to research utilization, the diffusion of innovations, physician behavior change and the development and implementation of practice guidelines.

The Ottawa model of research use consists of six key elements that are connected to each other through the process of evaluation. These elements are believed to be the central components in the research use process;

- the practice environment
- potential adopters
- the evidence-based innovation
- strategies for transferring the evidence into practice
- the use of the evidence

- and health-related and other outcomes of the process (Logan and Graham, 1998).

The term innovation refers to research evidence that is new to the potential adoption, even though the evidence may have been available for some time. Evidence-based innovations may be evidence that some treatment or practice is beneficial and should be used, or evidence that some current treatment or practice is not beneficial and should be abandoned or used more selectively (Logan and Graham, 1998).

All of the OMRU elements influence and are influenced by each other. The dynamic interaction and interplay between the elements of the model distinguish this model from sequential stage models, which assume that the progression of research into practice occurs in an orderly, linear and rational way (Logan and Graham, 1998).

As patients and their health outcomes should be the primary focus of evidence-based practice, one assumption underlying the overall is that patients may play a key role in all aspects of the process and therefore must be considered within each model element. Another is that both the general and healthcare external environments will affect all aspects of the process (Logan and Graham, 1998).

2.2.1 Assessment, Monitor and Evaluate

Integral to the OMRU is the Systematic Assessment Monitoring and Evaluation (AME) of the State of each model element prior to, during, and following any research transfer efforts. The AME data serve four functions:

1. to identify potential barriers and supports to research use related to the practice environment potential adopters and the evidence-based innovation;
2. to provide direction for selecting and tailoring transfer strategies to overcome the identified barriers and enhance the supports;

3. to track the progress of the transfer effort; and
4. to evaluate the actual use of the evidence-based innovation and its impact on outcomes of interest (Logan and Graham, 1998).

2.2.2 Elements of the Ottawa Model of Research Use:

From the literature, barrier and supports to research use can arise from three distinct sources: the practice environment, potential adopters and the evidence-based innovation. The first step in using the model as a guide is to assess these elements for barriers and support (Logan and Graham, 1998).

1. Evidence-Based Innovation

The modal element focuses attention on potential adopters perceptions of the attributes or characteristics of both the process by which research evidence was translated into some evidence-based innovation (e.g., the process by which a practice guideline was developed) and the innovation itself (e.g. the actual guideline). The OMRU directs policymakers to consider how perceptions of the attributes of the innovation may affect potential adopters' decisions about adoption. This is to be done by identifying the attributes likely to be viewed positively or negatively and tailoring transfer strategies appropriately. Once policymakers have assessed the practice environment, potential adopters, and the evidence- based innovation and determined the potential barriers and supports related to each of these elements, the next step is to use all the information collected to efficiently select and tailor research transfer strategies to overcome identified barriers and enhance the existing supports.

2. Potential Adopters

Patients, clinicians, and other policymakers in the system are all potential adopters of research. The OMRU directs policymakers to identify all potential adopters or target audiences to whom they intend to direct the evidence and to define and describe them in terms of their attitudes, knowledge, and motivation, for adopting the evidence, skills, and current practices. Clinicians are similarly influenced by considerations other than research findings. For this reason, the OMRU emphasizes the need to view the proposed change from the potential adopter's perspective and to identify and understand all the scientific and the extra scientific considerations that may influence adoption of the evidence (Eveland 1986).

3. Practice Environment

The environment exerts a powerful set of influences on practitioners, researchers and policy-makers. These influences can encourage or discourage the process of research transfer and use. This element of the model directs attention to identifying, describing and assessing such influences within the practice environment. These factors may be broadly categorized as structural, social, patient and other situation - specific factors. Within the practice setting, structural factors such as the setting's decision-making structure, rules, regulations and official policies, physical structure, workload, available resources and supplies and the system of incentives are all factors that have been shown to influence research use. Special factors include such things as the politics and personalities involved and the culture and belief systems operating within the setting (Logan and Graham, 1998).

4. **Research Transfer Strategies (Implementation Intervention Strategies)**

This model element represents the strategies for getting evidence-based innovation to potential adopters and encouraging them to use these strategies. These strategies range from passive unplanned efforts (e.g. publication of research findings or practice guidelines in journal or putting them on the World Wide Web), to targeting and tailoring the evidence and the message for a particular audience, to systematic efforts to encourage adoption of the evidence (Lomas 1993).

5. Research Adoption and Use

Adoption is making full use of an innovation as the best course of action available (Rogers 1995) and represents behavioral change (using evidence-based innovation). Determining the extent to which the innovation is used is the only way policymakers can assess the success of the transfer strategies employed. By monitoring the adoption process, they can determine whether the innovation is being used as it was intended, whether it has been adapted to local conditions and may no longer be used as intended, or whether it has been adopted and later abandoned. Because the process of research use is evolutionary and interactive, it is essential for policymakers to understand how the innovation has been adopted (or rejected) and how this may have changed over time. In so doing, policymakers are in a better position to modify and existing transfer strategies or select new ones to maximize research transfer.

6. Outcomes

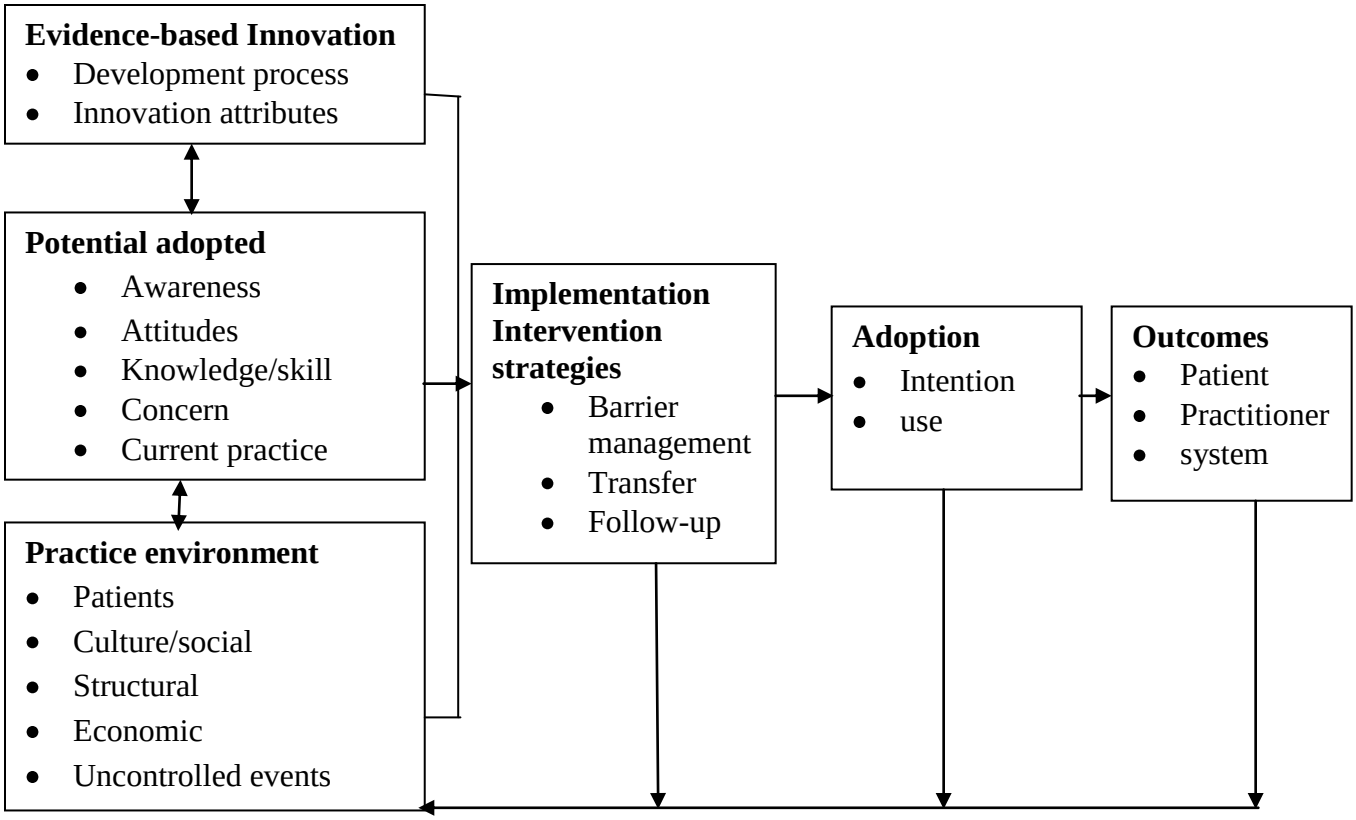
The final element of the model is outcomes, which represent the impact of using the evidence based innovation. The consequences of research use may be desirable, direct, anticipated, or undesirable, direct, and unanticipated (Greer 1988). Direct

outcomes can relate to patients and families, practitioners, and the system (economic outcomes) (Titler, Kleiber, Steelman, Goode, Rakel, Barry-Walker, Small, Buckwalter, 1994). An important assumption of the OMRU is that a primary objective of research use in health care improves patient health outcome (Basinki 1995; Davis and Vaisey I997).

THE OTTAWA MEDEL OF RESEARCH USE

Assess Monitor Evaluate outcome

Barriers and supports intervention and degree of use



2.2.3 Application of Ottawa Model of Research to the Study

The study, assessment of exposure to body fluids among health care workers in Kaduna State hospitals tries to identify the exposure, predisposing factors, availability of protective gears, and the outcome. According to the OMRU, there are three domains in the model:

a. **Assessment of Barriers and Supports**

1. Innovation "Universal Precautions" should be established in any care setting where exposure to blood and body fluid is possible. Their purpose is to eliminate or reduce the risk of transmission of blood- borne pathogens. Because patients infected with HBV or HIV cannot always be reliably identified, blood and fluid precautions should be used with all patients. This is a recent evidence- based innovation for the control of occupational exposure to blood and body fluid infections. Most institutions have infection control policies. Although usually developed to prevent the spread of infection to patients, these policies should also cover health care personnel; such policies could include directives for workers training, immunization, cleaning, disinfecting and sterilizing equipment, treatment of infective waste, and processing laundry. Hand washing remains the single most important procedures for preventing the spread of infectious disease in health care settings.

2. Adopters Health workers are the adopters of the innovation generated by using universal precaution. Barriers to the adopters is presence of predisposing factors, and inadequate safety gears, if they are adequate, it will promote adoption and utilization of the innovation as well as quality care and maximum protection from the side of the health workers .

3. Practice Environment Client/patient and physical structure constitutes the practice environment. The client to be considered here are all patients particularly those infected with body fluids while the physical structures are Kaduna State hospitals.

4. Monitor Intervention and Degree of Use The second domain of the OMRU: The exposure of health workers, predisposing factors and availability of safety gears for the

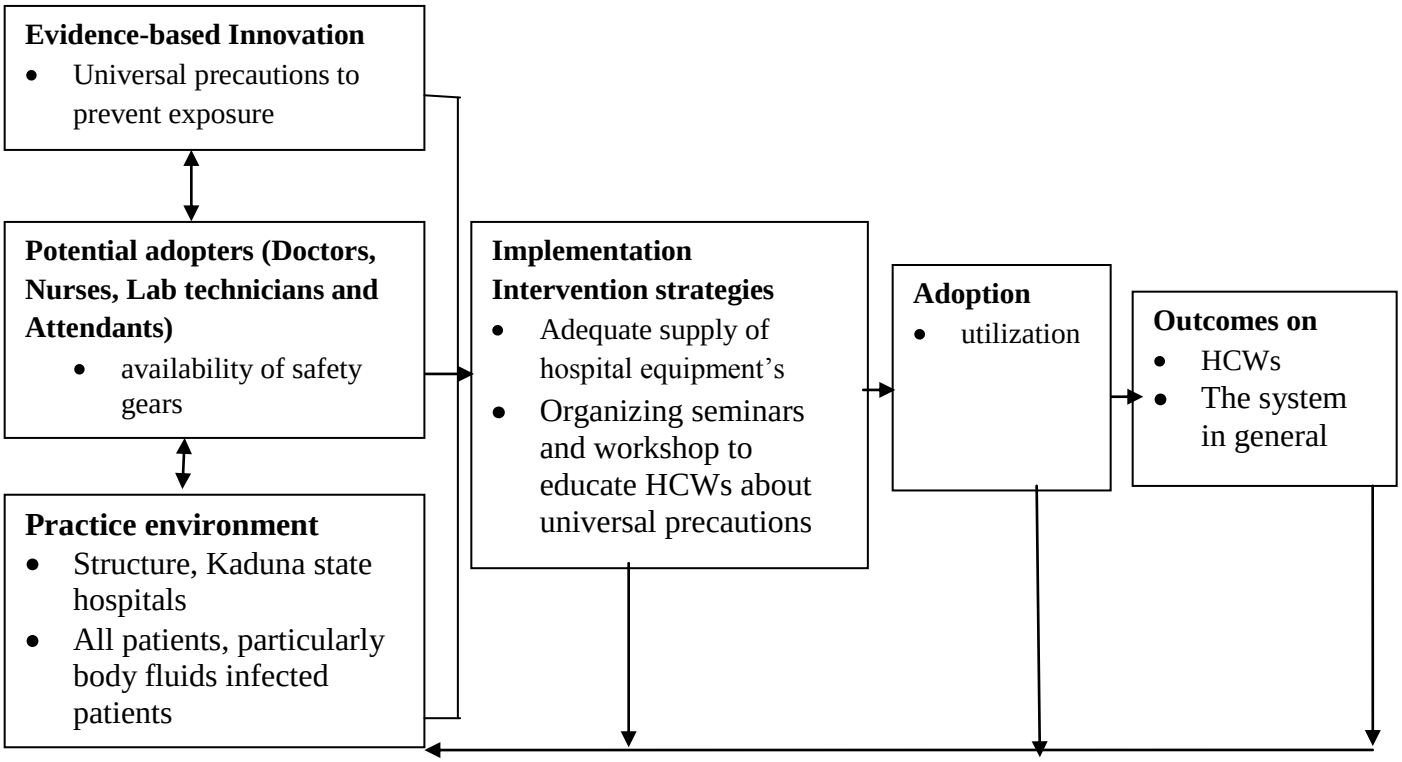
adopters will be assessed. Barriers/supporters that may arise is availability of the innovation in practice environment. The availability of safety gears may promote its utilization; therefore, the availability of safety gears in the practice environment will be assessed.

5. Evaluation of Outcomes this is the third domain of research use. Outcome of body fluid exposure will be assessed by the study

THE OTTAWA MODEL OF RESEARCH USE

Assess Monitor Evaluate outcome

Barriers and Supports Intervention and Degree of Use



2.3 The Concept of Occupational Health

Globalization of economies, fragmentation of enterprise structures, introduction of new technologies and new working methods and new types of work organizations, growing transfer of jobs between the countries, growing mobility of people, fragmentation of employment contracts, short-term employment, ageing of the workforce in many countries, constriction of public budgets and the declining role of Government governance set new challenges for the organization and provision of occupational health services (OHS).

The needs for OHS have increased rather than decreased during the times of globalization in both developing and industrialized countries. Both the elimination, prevention, diagnostics and treatment of traditional occupational health and safety problems, occupational diseases, injuries and unreasonable workloads call for wider coverage and higher efficiency of OHS.

Two key organizations concerned with the health of the workers are the World Health Organization (WHO) and the International Labour Organization (ILO). ILO has over 181 conventions and 191 recommendations, on various types of workers. Some of the conventions relevant to health workers include C 152 occupational safety and health (Dock work) convention, 1979 which stipulates among other things:

a. providing and maintaining work places, equipment and methods of work that are safe and without risk of injury to health;
b. providing and maintaining safe means of access to any work place;

c. providing the information, training and supervision necessary to ensure the protection of workers against risk of accident or injury to health arising out of or in the course of their employment;
d. providing workers with any personal protective equipment clothing and any life-saving appliances reasonably required where adequate protection against risk of accident or injury to health cannot be provided by other means;
e. providing and maintaining suitable and adequate first-aid and rescue facilities; and
f. developing and establishing proper procedures to deal with any emergency situations which may arise.

The constitution of the WHO, the Ata declaration on primary health care, the WHO Global Strategy on healthy for all, plus the ILO conventions on occupational safety and health and occupational health services stipulate among other issues, the fundamental right of each worker to the highest attainable standard of health. To achieve this objective, access to occupational health services should be ensured for all workers of the world irrespective of age, sex, nationality, occupation, type of employment, or size or location of workplace.

2.3.1 Occupational Health Services/Function

Occupational Health services are available to only 10-50% of workers worldwide. In industrialized countries, the coverage varies between services available, their quality and relevance may be low. To provide a response to such a global challenge, the WHO/ILO/ICOH (International Commission on Occupational Health) joint effort on development of basic occupational health services (BOHS) was launched. The ultimate

objective of the initiative is to provide occupational health services for all working people in the world regardless of economic sector, mode of employment, size or workplace or geographic location. The content of basis occupational health services includes as a minimum, the following activities:

1. surveillance of work environment and risk assessment;
2. health surveillance and health measures;
3. advice on preventive and control measures;
4. health education and health promotion of work ability;
5. first aid and treatment of acute illness; and
6. diagnosis of occupational disease.

Occupational health services is not only inadequate or of poor quality in developing countries but is even discriminatory. The British Standard, BS OHSAS 18001:2007 Occupational health and safety management system requirement, defines hazards identification as the process recognizing that a hazard exists and defining its characteristics. This includes identifying hazards and assessing risk, putting precautions in place and checking the arte use to protect people. Before an employee starts work, there is need for pre placement examination. This used to be known as pre- employment examination. Pre placement is a current terminology and test carried out depending on the nature of the job. While on the job, periodic medical examinations are carried out. The periodicity depends on the occupational hazards a worker is exposed to. Advice on preventive and protective measures should be given to workers. According to Legg's aphorism, a worker should not be left to find out the hazards he/she is exposed to at work; he/she should be told. Advice on protective measures should be accompanied by

provision or personal protective equipment (PPE). The definition of health promotion has been evolving in recent years to a concept that is broader than the prevention of specific diseases or their separate risk factors. As discussed by the world health organization, health promotion should encompass the ability of people to increase their control, health and to reduce health disparity within or across different societies, (WHO, 1986). Workplace health promotion programs are likely to be much effective if they empower employees to address hazards present in the work environment, as well as constraints on health behavior that result from the conditions of work, (Wenzel, 1994).

2.3.2 Hazards for Hospital Workers

Hospitals present numerous hazards in common with other complex employment setting sand industries as well as having some unique hazards. A great variety of jobs are performed in health care facilities including, direct patient care, laboratory and research work, laundry, food preparation, trades, security work, waste disposal, driving office and library work, housekeeping and maintenance, and pharmacy. According to Occupational Health Center (1995) the myriad or occupational hazard to which hospital workers may be exposed to, can be classified into five broad categories; Biological, chemical, physical, ergonomic/safety and psycho-social hazards.

2.3.2.1 Biological Hazard

Biological hazards are infectious agents such as bacteria, Viruses, fungi or parasites which may be transmitted via contact with infected patients or contaminated objects, body secretions, tissue, or fluid. Health care workers particularly those in hospital settings, are regularly exposed to biological or infectious agents. In the workplace both Hepatitis B (HBV) and human immunodeficiency Virus (HIV), can be

transmitted by infected blood and fluids when they are in direct contact with the inside of the mouth, the eye, or with broken, scraped, chapped or inflamed skin. The exposure of greatest concern, however, is when the skin is broken by a contaminated object such as needle or a scalpel. Neither HBV nor HIV can be transmitted by casual contact. The risk of HBV infection far exceeds the risk of HIV infection. Table 2.1 provides a list of some other infectious agents or disease to which health care workers may be exposed.

Table 2.1 Body Fluid Pathogens and other Infectious Agents and Diseases

Mode of Transmission	Infectious Agents/Disease
Body fluids	Hepatitis B, non-A, Non-B, hepatitis C, Acquired immunodeficiency syndrome (AIDS), cytomegalovirus (CMV).
Feces	Hepatitis (German measles)
Virus shedding in urine and stool	Rubella (German measles), Rubeola (Measles), Mumps, influenza, respiratory syncytial virus (RSV)
Contact with infected skin lesions	Scabies
Airborne droplet nuclei	Pulmonary tuberculosis, varicella zoster virus (VZV) (chicken pox only)
Secretion of lesions	Herpes simplex virus (HSV)-type I, type II, herpetic whitlow, varicella zoster virus (VZV) (chicken pox and shingles)

2.3.2.2 Chemical Hazards

Numerous chemicals found in hospitals may be toxic or irritating to body system. They may be present as dusts vapour or gases, liquid and they may be medications and other substances used for therapeutic purposes. Chemicals can enter the body through contaminated food or cigarette, absorption through the skin, inhalation or by accident needle stick. The major routes entries are by inhalation or skin absorption. Exposure does not always produce adverse health effects. Chemicals for which there is little or conflicting information about potentials toxic effects should be treated as toxic. Toxic

chemicals are best dealt with by preventing workers exposure. This can be done by identifying the chemicals, considering their toxic properties and potentials health effect and implementing control measures. Table 2.2 list a number of toxic chemicals commonly used in hospitals and the types of staff most likely to be exposed to them.

Table 2.2: Chemical Agents Commonly Found in the Hospital Environment

Employees potentially exposed	Selected chemical agents
Central Supply Workers	Clearing and sterilizing agents
Dietary and Housekeeping staff	Insecticides, detergents, disinfectant and solvents
Laboratory Technicians	Tissue fixative and reagents
Maintenance and facilities workers	Solvents, insecticides
Nurses	Medications, disinfectants, solvent, anti-cancer agents
Operation Room Staff	Anesthetic agents
Pharmacist	Medications and anti-cancer agents
Physicians	Anti-cancer agents, disinfectants
Workers in specialty procedure rooms	Disinfectants and sterilants

2.3.2.3 Ergonomic and Safety Hazards

Economic and safety hazards cause or worsen accidents, Injuries, strain or discomfort. Ergonomics is the application of scientific knowledge to the design of environments, tool, workstations and the content of work to suit the mental and physical limitations and capabilities. Work environments and procedures that ergonomic principles can anticipate accidents and avert injury and error. Health care safety hazards include slippery floors. Cluttered hallways or blocked exits, explosive gasses used in laboratories and operating rooms. Various, power tools and other maintenance equipment, sharp utensils and instrument, and malaria handling. One of the most common and most severe hospital injuries is musculoskeletal injuries, particular of the lower back. In 1990, Canadian hospitals reported 30,478 time-loss injuries. People

employed in nursing occupations sustained 53% of these injuries. The most frequent time lost injury was to the back resulting from over exertion while moving objects or handling patients. Approaches to reducing back injury disability must be comprehensive and involve ergonomic strategies, education, early and aggressive injury treatment and appropriate rehabilitation programs. Injuries also frequently experienced by health care workers include cuts, bruises and needle sticks.

Another problem is respective strain Injuries (RSls) of the upper limbs related improper workstation and task design. RSI risk factors include: high rates of manual repetition, use of excessive manual and awkward postures of the wrists and shoulder. Workers in dietary, laundry department and clerical positions such as data entry operators and medical transcriptionists, may be at increased risk. Violence against health care workers is an emerging occupational hazard, preventing injury from aggressive acts start when the employer acknowledges that the potential for violence exists. There must be strong management commitment to violence prevention programs. Strategies should encompass workplaces design, patient care approaches to reduce anger, frustration and agitation; staff training on recognition and interventions for potentially violent situations, and support system for workers who do experience a violence event.

2.3.2.4 Physical Hazards

Ionizing and non-ionizing radiation, electricity, noise and heat are examples of physical hazards found in hospitals. Ionizing radiation is used diagnostic procedures such as x-ray, fluoroscopy, angiography, and in treatments using radioactive implantations or injections. Cumulative and long-term health effects include genetic damage and adverse reproductive outcomes. The risk of long-term low-level exposure to ionizing radiation is

not fully known. Measures to minimize exposure include maximizing distance between the radiation source and the worker. Using appropriate shielding and minimizing exposure time, special attention should be given to the maintenance of portable fluoroscopy and x-ray equipment which may scatter radiation during procedures.

Non-ionizing radiation includes microwaves, magnetic fields, and lasers. The intensity of the light beam of lasers poses a risk especially to the eyes and skin, Procedures for the safe use laser should include training, posting warning signs, using appropriate safety eye wear, and using non-reflective tools. Excessive noise and heat are commonly found in kitchen, laundries and boiler rooms. Cold heat and sunlight are hazards for grounds and building maintenance personnel. Permanent hearing loss can result from long term exposure to noise in excess of 80 decibels (a measure of sound intensity). At lower levels, noise from equipment, alarms, conversation and other source can impede commutation and interfere with concentration. Comprehensive hearing conversation program should reduce noise through engineering controls, detect hearing loss early, provide worker education, and provide hearing protection devices.

Skin burns can result from exposure to hot surfaces or liquids or from exposure to excessive sunlight, cold temperatures can produce frostbite or a dangerous generalized cooling of the body (hypothermia). Engineering controls to prevent contact with hot surfaces or to reduce hot indoor temperature, protective clothing such as hates and long sleeves shirts to reduce sun exposure and administrative guidelines for working in hot and cold environments are important measures to reduce the risk of injury.

2.3.2.5 Psycho-Social Hazards

Many factors in the hospital environment can affect the psychological and social well-being of workers. Examples of work organization which can have an adverse impact on workers include: little decision-making latitude, excessive job demands, role ambiguity, poor management ability inadequate resources, and shift work. Rotating shifts and night work can have a negative impact on general well-being and performance because of the constant disruption of an individual's biological clock. Shift work can also negatively affect workers' social roles.

Combative patients, terminally-ill patients, and coworkers or managers are also stressor. The current economic climate in health care can create excessive workload demand and a sense of insecurity at work. Health care organizations should maximize worker participation in decisions, affecting their daily work and the organization as whole. Employers can also effectively conflict, help staff to respond positively to change and provide social support systems.

2.3.3 Pathogenicity and Transmission of Body Fluids

In the hospitals, Blood-borne pathogen transmission occurs predominantly by percutaneous or mucosal exposure of workers to the blood or body fluids of infected patients. Occupational exposures that may result in HIV, HBV, or HCV transmission include needle stick and other sharp injuries, direct inoculation of virus into cutaneous scratches, skin lesions, abrasions, or burns, and inoculation of virus onto mucosal surfaces of the eyes, nose, or mouth through accidental splashes. HIV, HBV and HCV do not spontaneously penetrate intact skin, and airborne transmission of these viruses does not occur.

2.3.3.1 Human Immunodeficiency Viruses (HIV-1 and HIV-2)

There are two types of human immunodeficiency virus, HIV-1 and HIV-2. HIV-1 is responsible for the large majority or global HIV infections and cases of AIDS, while the relatively less common HIV-2 is mainly restricted to West Africa. HIV-I and HIV-2 are very similar in almost every respect, although accumulating evidence indicates that progression of disease is slower in HIV-2 infection. Unless specifically highlighted, the properties of these viruses are presented under the generic health term 'HIV', (Health and Safe Executive 2008).

- **Pathogenesis of HIV Infections**

HIV infects certain types of white blood cell, specifically helper T-lymphocytes, monocytes and some other cells that are key elements of the human immune system, which usually results in the death of these cells. The hallmark of HIV infection is the gradual loss of helper T-lymphocytes from an infected person, ultimately leading to a State of generalized immunodeficiency and AIDS. In some cases, infection of the central nervous system occurs, often leading to progressive brain damage (encephalopathy). Several different conditions may occur as a result of HIV infections that precede the development of AIDS. Most infected individuals generate anti-bodies to HIV within 3 months and during this period, there may be a self-limiting illness resembling glandular fever (infectious mononucleosis). After a longer period, some develop a long lasting generalized enlargement of the lymph glands. Other non-specific symptoms (including fever, night sweats and swollen lymph glands) are associated with progressive immune dysfunction and when AIDS develops fully, which often takes several years, it is

characterized by the appearance of secondary opportunistic infections and tumours, (HSE, 2008).

- **Transmission of HIV**

Transmission occurs through sexual contact, vertical transmission or blood exposure caused by unsafe blood transfusions, unsafe medical injection practices and the sharing of needles and syringes by injecting drug user. HIV is less stable in the environment and less transmissible than either HBV or HCV. Potentially infectious materials include blood body fluid, semen and vaginal secretions that are visibly contaminated with blood, other body fluids are considered less infectious. HIV causes a brief primary infection several weeks after exposure, and quickly becomes detectable by antibody tests. There is no cure for HIV infection but antiretroviral treatment is increasingly available for acquired immunodeficiency syndrome (AIDS). Exposures that pose a risk of transmission in occupational settings include percutaneous injuries, contact of mucous membranes, or contact of non-intact skin with potentially infected fluids (Wilburn, and Eijkemans. 2004: Pruss-Ustun, Rapiti, and Hutin, 2005).

Infectious virus is present at all stages of the illness. However, the viral load (measured by viral RNA in blood plasma) is proportional to the chances of the infected person transmitting the virus, to a recipient. Viral loads are higher in the initial acute infection and towards the end of disease in an untreated person. It is usual for a person receiving anti HIV therapy to have low-or even undetectable- viral loads and be less likely to transmit virus, (HSE, 2008).

2.3.3.2 Hepatitis B Virus (HBV)

HBV infection is more common in developing countries where children often acquire infection from mothers during birth or through close contact ill early infancy. The United Kingdom is a low prevalence area, with a carriage rate of 0.1-0.5% although actual rates may vary between individual communities, (HSE, 2008)

- **Pathogenesis of HBV Infection**

Once inside the host, HBV is transported in the blood to the liver where it infects liver cells. The incubation period of acute HBV infection is about 75 days but it ranges from 45 to 200 days. The virus spreads efficiently in the liver and causes a spectrum of disease, ranging from acute hepatitis to more chronic liver disease and liver tumours. A small proportion of patients with acute infections suffer liver failure, although most recover from the infection. Newly acquired HBV infection is often asymptomatic only 30-50% of children over 5 years of age and adults have initial clinical signs or symptoms (CDC, 2006: WHO, 2009). The fatality rate among people with reported cases of acute symptomatic hepatitis B is 0.5-1.0 (WHO, 2009). Chronic HBV infection develops in about 90% of those infected as infants, 30% of infected children under 5 years of age, and less than 5% of infected individuals over *5* years of age (CDC, 2006;WHO 2009). Overall, about 25% of those who become chronically infected during childhood, and 15% of all those who become chronically infected after childhood, die prematurely from cirrhosis or liver cancer (CDC, 2006; WHO, 2009).

HBV is an unusual virus as large quantities of viral proteins are produced, resulting in the production of a range of different particles, some of which are infectious and some of which are not. Viral protein is secreted into the blood and its presence can be

a useful marker of infection. In individuals chronically infected with HBV, the persistence in the circulation of viral proteins indicates continuing high potential infectivity for sexual partners and for babies born to carrier mothers. These chronically infected individuals, who may be totally without symptoms also present a major risk to non-immune health care workers and others accidentally exposed by for instance, a needle-stick injury. In addition, the continued presence of viral proteins is associated with progressive liver damage (chronic active hepatitis and cirrhosis) and increased risk of primary liver cancer, much of the damage to the liver in chronic cases is believed to be as a result of immune responses to the infection (HSE, 2008).

- **Transmission of HBV**

HBV is transmitted by percutaneous or mucosal exposure to infectious blood body or fluid. Infections can also result from unnoticed exposures, such as inoculation into cutaneous scratches lesions or mucosal surfaces (CDC, 2001). Hepatitis B surface antigen (which indicates chronic infection) has been detected in multiple body fluids; however, only serum, semen and saliva have been shown to be infectious (CDC, 2006). HBV is most highly concentrated in serum with lower concentration in semen and saliva. The virus is comparatively stable in the environment and remains viable for 7 days or longer on environmental surfaces at room temperature (CDC, 2006). Among susceptible health workers, the risk or HBV infection after a needle stick injury involving an HBV-positive source is 23 -62%, (Pruss-Ustun*et al.,* 2003; Pruss-ustun *et al.,* 2005, CDC 2001). Prompt and appropriate interventions with PEP measures can lessen the risk. However, the recommendation is to vaccinate health workers, including waste handlers

with hepatitis B vaccine. The vaccination should be given during pre-service training for those that did not receive it in childhood (WHO, 2009).

In Western Europe, North America and other developed countries, infection occurs sporadically by sexual contact and blood transfer, particularly by the sharing of needles and syringes in drug misuse. In England and Wales, injecting drug use was the most frequently reported route or infection. Transmission to babies from infected mothers has been largely attributed to exposure during or after delivery, with transplacental infection being apparently rare. Vertical transmission from mother to baby can be prevented by the administration of HBV immunoglobulin and vaccinating the newborn in cases where the mother is infected with the virus, (HSE, 2008).

2.3.3.3 Hepatitis C Virus

Post-transfusion infectious hepatitis caused by agents other than HBV has long been recognized. These cases at one time were collectively termed 'non-A non-B hepatitis' and the main cause is now known to be the hepatitis C virus (HCV). HCV has a worldwide prevalence, although actual rates of infection vary depending on socio-economic factors, such as intravenous drug use and medical practices, as the virus is primarily transmitted via direct introduction of the virus into the blood. It is estimated that 0.5-1 % of the UK population has a chronic HCV infection, (HSE, 2008).

- **Pathogenesis of HCV Infection**

Once inside the host, HCV is transported in the blood to the liver where it infects liver cells although other types of cell, including blood cells, may also be infected. The incubation period for HCV ranges from 2 to 26 weeks. Individuals with acute HCV infection are typically either asymptomatic or have a mild clinical illness. Antibody to

HCV (anti-HCV) can be detected in 80% of patients within 15 weeks after exposure, and in 97% by 6 months after exposure (CDC, 1998). If the infection proceeds to a chronic phase, progression of liver damage is usually slow and the most common complaint is fatigue. Liver enzyme abnormalities may fluctuate or persist and the degree of liver damage is variable. Chronic HCV infection develops in 75- 85% of infected individuals (CDC. 1998). Most people remain asymptomatic until onset of cirrhosis or end-stage liver disease, primary liver cancer several decades later. This develops in approximately 10- 20% of infected individuals within 20- 30 years (CDC, 1998). There is no specific treatment for acute hepatitis C, treatment for chronic hepatitis C infection is costly and is often not available,(Beltrami, Williams, Shapiro, Chamberland. 2000).

- **Transmission of HCV**

HCV is transmitted primarily through percutaneous exposures to blood, but transmission is less efficient than for HBV. HCV is viable in the environment for at least 16-23 hours (Kamili, Krawczynski, McCaustland, Li, Alter 2007). The risk for transmission from exposure to fluids or tissues other than HCV-infected blood has not been quantified, but is expected to be low. Transmission rarely occurs from exposure to blood through mucous membranes or non-intact skin, (CDC, 1998; Beltrami et al. 2000; WHO, 2002). The average incidence of anti-HCV seroconversion after accidental percutaneous exposure from an HCV-positive source is 1.8% (range: 0-7%), (CDC, 1998). Currently, there is no vaccine or effective PEP for HCV.

2.3.4 Risk of Transmission of Body Fluid Pathogens From Patient to Worker Post Exposure

The risk of viral transmission after a percutaneous injury is highest for HBV, followed by HCV and HIV. Comprehensive exposure prevention strategies have played a

significant role in decreasing the probable risk of infection from blood borne pathogens. The risks of exposure with appropriate precautions are low, but they are real. Understanding how an exposure occurs and the risks of exposure is imperative for both the occupational health clinician and the healthcare professional. After an occupational exposure to a blood borne pathogen, the risk of infection depends on a number of factors including:

- type of body substance involved;
- route of exposure;
- volume of blood or body fluid involved;
- severity of exposure;
- pathogen involved;
- degree of viremia;
- the immune status of the healthcare professional at the time of the injury; and
- whether appropriate post exposure prophylaxis (PEP) was used

2.3.4.1 Risk of HIV Infection Post Exposure

The average risk of HIV transmission after a percutaneous exposure to HIV-infected blood has been estimated to be approximately 0.3%. (Hoffman, Bucholz, Schnitzler, 2013). The risk after a mucous membrane exposure is approximately 0.09% (PEPline). Although episodes of HIV transmission after non-intact skin exposure have been documented, the average risk for transmission by this route has not been precisely quantified but is estimated to be less than the risk for mucous membrane exposures. (Kuhar, Henderson, Struble, 2013). The risk for transmission after exposure to fluids or tissues other than HIV-infected blood also has not been quantified but is probably

considerably lower than for blood exposures (Kuhar, *et al.,* 2013). The risk may be greater in countries with higher prevalence or in settings that have limited resources, where the reuse of medical supplies and equipment is higher and overall safety standards are lower, (WHO, 2010).

2.3.4.2 Risk of HBV Infection Post Exposure

The use of hepatitis B vaccine is considered to be the 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, Ghany, Rehermann, 2013), and the absence/presence of a hepatitis B infection in healthcare workers has been strongly associated with vaccination status (Thomas, Factor, Kellen, *et al.,* 1993). The risk of hepatitis B infection is primarily related to the degree of contact with blood in the workplace and also to the hepatitis B e antigen (HBeAg) status of the source person. Individuals who are both hepatitis B surface antigen (HBsAg) positive and HBeAg positive have more virus in their blood and are more likely to transmit hepatitis B (MacCannell, Laramie, Gomaa, Perz, 2010: Michelin, Henderson, 2010). Amongst healthcare professionals who are susceptible, the risk of infection after one percutaneous exposure is 6-31% (Bader, McKinsey, 2103; Cosen 2012). Although obvious percutaneous injuries are among the most efficient modes of hepatitis B transmission, these exposures probably account for only a minority of hepatitis B infections among healthcare professionals. In several investigations of nosocomial hepatitis B outbreaks, most infected healthcare professionals could not recall an overt percutaneous injury, although in some studies, up to one third of the infected

recalled caring for a patient who was HBsAg-positive. Additionally, HBV has been demonstrated to survive in dried blood at room temperature on environmental surfaces for at least 1 week (Bond, Favero, Petersen, 1981).

Hepatitis B infections that occur in healthcare professionals with no history of non-occupational exposure or occupational percutaneous injury might have resulted from direct or indirect blood or body fluid exposures that inoculated hepatitis B into cutaneous scratches, abrasions, burns, other lesions, or on mucosal surfaces (CDC, 2001). In approximately two-thirds of all people infected with hepatitis B, no obvious injury, e.g., needle stick could be identified (Dienstag, 2012). HBsAg is also found in several other body fluids, including breast milk, bile, cerebrospinal fluid, feces, nasopharyngeal washings, saliva, semen, sweat, and synovial fluid. However, aside from blood most body fluids are not efficient vehicles of transmission because they contain low quantities of infectious hepatitis B virus, despite the presence of HBsAg, (CDC, 2001).

2.3.4.3 Risk of HCV Infection Post Exposure

Most hepatitis C infections are caused by injection drug use or another obvious cause, but in approximately 10-20% of all cases the cause of the infection cannot be identified (Dhawan, 2013; Pondé, 2011). Hepatitis C virus is not transmitted very often or (seemingly) very efficiently through occupational exposures to blood. Transmission from patients to healthcare workers has been reported rarely, but more than half the reported cases had other risk factors (Pearlman, 2004), approximately 39% of all hepatitis C infections in healthcare workers are considered to be occupational (Strasser, Aigner, Shmidt, 2013). The risk for hepatitis C infection after a needlestick or sharps exposure to HCV-positive blood is approximately 1.8% (range: 0–10%) (Strasser, *et al.*, 2013).

Transmission rarely occurs from mucous membrane exposures to blood (Hosoglu, Celen, Akalin, 2003), and no transmission to healthcare professionals has been documented from intact or non-intact skin exposures to blood. Hepatitis C virus has been found in ascites, menstrual fluid, saliva, semen, spinal fluid, and urine. Transmission of the hepatitis C virus from these fluids has not been reported, but if there was a parenteral exposure to ascites, spinal fluid, etc, or someone if was exposed to a large amount of one of these fluids, transmission could possibly occur (Henderson, 2003). Hepatitis C virus has been reported to survive on environmental surfaces for up to 16 hours, (Kamali, *et al.*, 2007).

2.3.5 Management of Exposure to Blood or Body Fluid Infections

Although exposure prevention remains the best strategy for protecting HCWs from occupationally acquired infection, exposures are nevertheless likely to occur. Employers should have in place a system that includes written protocols for prompt reporting, evaluation, counseling, treatment, and follow-up of occupational exposures that may place a worker at risk of blood-borne pathogen infection. Employers also must establish exposure control plans and comply with incident reporting requirements mandated by OSHA.

2.3.5.1 Management of HBV Exposure

PEP for HBV can be highly effective in preventing transmission of the virus after exposure. PEP for HBV is based on the hepatitis B vaccine, either alone or combined with hepatitis B immune globulin (HBIG). For PEP to be effective, the initial dose of vaccine must be administered soon after exposure, the longer the gap between exposure and administration of the vaccine, the less effective the PEP. Few studies have researched

the maximum time after exposure during which PEP is effective, but it is likely to be less than seven days for needle-stick exposures (CDC, 2001). The steps to take after HBV exposure are to:

- Evaluate the exposed person for HBV - assess the person's immunization status for hepatitis B (i.e. by taking their history of hepatitis B vaccination);
- Administer HBV PEP for exposures that pose a risk of infection transmission.

WHO has no specific guidelines for HBV PEP; however, it does recommend HBV PEP (WHO, 2004). This document refers to the CDC guidelines (CDC, 2001). As shown in Table 2.1 the regimen recommended for HBV PEP depends on the vaccination status of the exposed person. HBV PEP is safe for pregnant and lactating women.

Table 2.3 Hepatitis B post-exposure prophylaxis and immunization follow-up in occupational settings

Source of exposure	Action according to Vaccination status
Unvaccinated or incompletely Vaccinated (<3 doses)	**Vaccinated (3 or more doses)**
Unknown hepatitis B positive Initiate and complete Vaccination, Give hepatitis B Immune globulin (where available)	No PEP
Negative Initiate and complete Vaccination	No PEP

PEP, post-exposure prophylaxis
Source: Centers for Disease Control and Prevention, 2001.

• Follow-up of HBV Exposure

Perform follow-up testing for antibodies to hepatitis B in individuals who receive hepatitis B vaccine in response to an exposure. The recommendation is to test for antibodies 1 to 2 months after the last dose of vaccine. However, if the person received

hepatitis B immune globulin in the previous 3 to 4 months, it is not possible to use the test for antibodies to hepatitis B to determine the response to the vaccine, (WHO, 2010).

2.3.5.2 Management of Exposure to HCV

There is no recommended PEP for exposure to HCV-positive blood. Immunoglobulin and antiviral agents are not recommended as PEP, and there is no vaccine against HCV. Instead, the procedure is to identify infection as soon as possible and refer the person for evaluation of treatment options. There are no guidelines for administration of therapy during the acute phase of hepatitis C. However, a few studies suggest that antiviral therapy might be beneficial when started early in the course of the infection. The steps to take after HCV exposure are simply to perform baseline testing for antibodies to HCV and for alanine aminotransferase (ALT). (WHO, 2010).

- **Follow-up of HCV Exposure**

Perform follow-up testing for individuals potentially exposed to HCV. Test for anti-HCV and ALT 4 to 6 months after exposure. Test for HCV ribonucleic acid (RNA) at 4 to 6 weeks if early diagnosis of HCV infection is desired. Confirm repeatedly positive results in anti-HCV enzyme immunoassays (ElAs) with supplemental tests. If an individual has seroconverted, refer the person to a specialist, (WHO, 2010; Bader, McKinsey, 2013).

2.3.5.3 Management of Exposure to HIV

Refer the person exposed to the risk of transmission to a trained person for medical evaluation, risk assessment and prescription of PEP. Appropriate information and counseling on adherence and on the possible adverse reactions to the antiretroviral drugs (WHO, 2010).

- **Testing and Counseling**

For people potentially exposed to HIV, testing is highly recommended but should never be mandatory) (WHO, 2006). If testing is available, offer a test, but ensure that the person receives appropriate counseling, with the option to option out of testing. Where possible, also test the source patient, with that person's informed consent. DO NOT delay the administration of antiretroviral drugs for PEP while waiting for test results. If the test results of the source person are negative, consider stopping PEP. Issues to raise in PEP counseling include: the importance of treatment adherence: the importance of HIV prevention in general and at the workplace; recommendations on the use of condoms and the avoidance of donating blood, sperm or organs until a test at 6 months after exposure is negative; information on contraception for women of childbearing age; information on alternatives to breastfeeding for lactating mothers.

- **Administration of PEP**

Do not administer PEP to a person who is HIV positive, because PEP generally includes only two drugs to be taken for only 28 days, and is thus not a treatment for HIV infection. HIV treatment is based on a combination of three antiretroviral drugs taken continuously. If desired, it is acceptable to administer antiretroviral drugs for PEP, and to stop the treatment if the exposed person is found to be HIV positive. In situations where PEP is required: administer the antiretroviral drugs for PEP as soon as possible after the exposure (ideally within 4 hours): continue the PEP regimen continuously for 28 days; use the two-drug regimen (recommended by WHO) unless there is suspicion or evidence of drug resistance, or unless there are national guidelines on choice of PEP regimen (in which case, follow these in preference): evaluate the person taking PEP within 72 hours,

to monitor for possible adverse drug reactions and adherence, and follow-up (as described below) for at least two weeks (WHO, 2010).

- **HIV PEP Standard Drug Regimen**

WHO recommended two-drug combination therapies for PEP for HIV exposure, which are: zidovudine and lamivudine (ZDV + 3TC), or stavudine and lamivudine (d4T + 3TC). As explained above, in cases where the source person is known to be HIV positive with drug resistance or in settings where the drug resistant HIV prevalence is above 15%, a three-drug regimen with the addition of a protease inhibitor is recommended. Possible regimens are: zidovudine, lamivudine and lopinavir (ZDV + 3TC plus LPV/r), or tenofovir, lamivudine and saquinavir/ritonavir, (TDF + 3TC plus SQV/r), or tenofovir, emtricitabine and atazanavir/ritonavir (I'DF + FTC' plus ATV/r) (WHO, 2010).

- **Follow-up of HIV Exposure**

An exposed health worker should seek or be referred for medical follow-up (ILO WHO. 2005). The aim of follow-up visits is to: support adherence to PEP; prevent or treat side effects of PEP; Perform HIV-antibody testing at baseline, six weeks, 3 months and six months post-exposure; a complete blood count should be done at baseline, two weeks, and four weeks post-exposure; renal and hepatic function tests at baseline and at two weeks post-exposure; HIV RNA polymerase chain reaction should be perfumed if the exposed person develops an illness suggestive of an HIV infection, and; a urine test for pregnancy in all women of reproductive age (Bader, McKinsey, 2013; Kuhar, *et al.*, 2013). Repeat the test for HIV antibodies at 6 weeks and 6 months after exposure: if seroconversion occurs, refer the exposed person for treatment, care and support. Advise

anyone who has been exposed to use precautions to prevent secondary transmission during the follow-up period: such precautions include: avoiding pregnancy; seeking safe alternatives to breastfeeding avoiding blood, tissue or sperm donation, and using condoms for sexual intercourse until a test at 6 months shows that the exposed person remains seronegative. Evaluate individuals taking PEP within 72 hours, to monitor for possible adverse drug reactions and treatment adherence. Follow up for at least two weeks, (WHO, 2010).

2.3.6 Prevention of Exposure

Avoiding occupational blood exposures is the primary way to prevent transmission of hepatitis B virus, hepatitis C virus, and HIV in health-care settings. However, hepatitis B immunization and postexposure management are integral components of a complete program to prevent infection following bloodborne pathogen exposure and are important elements of workplace safety (Heininger, Gambon, Gruber, 2010; MacCannell, Laramie, Gomaa, 2010). Healthcare workers should treat all blood and body fluids as if they were infectious. This approach called universal Basic Principles to prevent infection in Health care setting precautions should be used in the care of all patients. This is one of the basic principles to follow to prevent transmission of blood borne infection in a health care setting. Prevention is an essential component for the overall control and management of exposure to blood borne pathogens in the health care setting. Prevention is largely achieved through the establishment of administrative controls, the training and insistence on safer workplace practices, the use of personal protective equipment, utilization of the best instrument design available, use of

alternatives to parenteral diagnostic or therapeutic procedures and proper use of sterilization and disinfection.

• Standard Precautions

Standard precautions are strategies for protecting healthcare professionals from occupational transmission of organisms. The premise is that all pre-existing patient infections cannot be identified. Given that, all body fluids and secretions with the exception of sweat should be considered potentially infectious and, barrier precautions should be used routinely to protect the healthcare worker from exposure, Standard precautions apply to nonintact skin and mucous membranes, blood, and all body fluids, secretions, and excretions, except sweat, regardless of whether or not they contain visible blood. Additional precautions are based on highly transmissible or epidemiologically important pathogens. Transmission Based Precautions (isolation) are airborne, droplet, and contact precautions. New elements of standard precautions have been added. These elements include safe injection practices, and the use of masks and possibly head coverings and gowns for insertion of catheters of injections into spinal or epidural spaces via lumbar puncture (Radcliffe, Meites, Briscoe, 2012; Horlocker, Birnbach, Connis, 2010).

• Safe Injection Practice

Percutaneous injuries can be avoided by eliminating the unnecessary use of needles, using devices with safety features, and promoting education and safe work practices for handling needles and related systems. Since 1993, the use of safety-engineered sharps devices has increased while the use of conventional sharps devices has decreased. Percutaneous injury rates have decreased dramatically, and many studies have

proven that the use of safety-engineered devices has significantly decreased the number of needlestick injuries (Black, 2013). A number of sources have identified the desirable characteristics of safety devices. These characteristics include the following (CDC, 2008); Needles should NEVER be recapped, bent, broken, or removed from contaminated syringes. Recapping by hand is prohibited under the OSHA bloodborne pathogens standard [29 CFR 1910.1030] unless no alternative exists. Sharps should be disposed into a puncture-proof container. There is exposure to percutaneous injuries during procedures where there is opportunity for percutaneous exposure, especially where there is poor visualization, blind suturing, non-dominant hand opposing or next to a sharp, and exposure to bone spicules and metal fragments. Sharp equipment should be disassembled using forceps or other devices. Suturing should always be done with a needle holder, forceps, or other tool. Do not use fingers to hold tissue when suturing or cutting. Never leave sharps on a work field. If used needles or other sharps are left in the work area or are discarded in a sharp container that is not puncture resistant, a needlestick injury may result. Injury may occur when a healthcare professional attempts to transfer blood or other body fluids from a syringe to a specimen container (such as a vacuum tube) and misses the target.

Safe injection practice in some hospitals is well established. However, outbreaks of infections with hepatitis B and hepatitis C amongst patients have been traced back to ambulatory care facilities and associated with non-compliance with safe injection practices, identifying the need to define and reinforce safe injection practices in outpatient care settings (Branch-Elliman, Weiss, Balter, 2013). The reuse of needles, multidose vials, and work areas containing both sterile and contaminated injection

supplies contributed to the problem. There was a lack of understanding of aseptic technique, a lack of oversight, and failure to follow up on infection control breeches (CDC, 2013; CDC, 2007). The following are safe injection practices recommended by the CDC (CDC, 2011,) that apply to the use of needles, cannulas that replace needles, and, where applicable intravenous delivery systems. Examples of these safe injection practices include:

- use aseptic technique to avoid contamination of sterile injection equipment;
- use fluid infusion and administration sets (i.e., intravenous bags, tubing and connectors) for one patient only and dispose appropriately after use;
- se single-dose vials for parenteral medications whenever possible;
- if multidose vials must be used, both the needle or cannula and syringe used to access the multidose vial must be sterile;
- do not use bags or bottles of intravenous solution as a common source of supply for multiple patients;
- infection control practices for special lumbar puncture procedures; and
- employee safety

• Hand Washing

It has been estimated that between 20-40% of all hospital acquired infections are caused by cross-infection from the hands of healthcare workers (Chow, Arah, Chan, 2012). Studies have clearly shown that the hands of healthcare workers are often contaminated with microbial flora and that the amount of time spent performing patient care increases the amount of contamination. Hand washing is the most important measure to reduce the transmission of microorganisms (Crews, Whaley, Syblik, *et al.,* 2013), and

hand washing reduces infection rates, even in high-risk patient populations (Edmonds, Macinga, Mays-Suko, 2012). Hands should be washed or alcohol-based rubs should be used between patient contacts and after gloves are removed. Hands should be washed after contact with blood, body fluids, secretions, excretions, and contaminated equipment. It may be necessary to wash hands between tasks on the same patient to prevent cross-contamination of different body sites, (Rock, Harris, Reich, *et al,* 2013; CDC, 2011; WHO, 2009). Improved adherence to hand hygiene (i.e. hand washing or use of alcohol-based hand rubs) has been shown to terminate outbreaks in healthcare facilities, to reduce transmission of antimicrobial resistant organisms (e.g. methicillin resistant staphylococcus aureus) and reduce overall infection rates (Chow, *et al.* 2012). CDC recommends the use of alcohol-based hand cleansers by healthcare personnel for patient care because they address some of the obstacles that healthcare professionals face when taking care of patients.

- Hand washing with soap and water remains a sensible strategy for hand hygiene in non -healthcare settings.
- When healthcare personnel's hands are visibly soiled, they should wash with soap and water instead of an alcohol-based rub.
- The use of gloves does not eliminate the need for hand hygiene. Likewise, the use of hand hygiene does not eliminate the need for gloves. Gloves reduce hand contamination by 70% to 80 % (Garus-Pakowska, *et al.,* 2013), prevent cross contamination and protect patients and healthcare personnel from infection.
- Alcohol-based hand rubs have been proven to be an effective method for hand hygiene (Shen, Pan, Sheng, 2013). Alcohol-based hand rubs are preferred for

hand hygiene in most situations. They require less time to use than soap and water, they remove more bacteria then soap and water, they are easy to use, and they rapidly reduce bacterial contamination on the hands (Marra, Edmond, 2012). These products have also been shown to be associated with increased compliance by healthcare workers with hand hygiene requirements (Ahmed-Lechebed, Cunat, Hartemann, 2012). When using an alcohol-based hand rub, apply the product to the palm of one hand and rub hands together, covering all surfaces of hands and fingers, until hands are dry.

- Note that the volume needed to reduce the number of bacteria on hands varies by product. Alcohol-based hand rubs are available as foams, gels, and rinses and with alcohol concentrations ranging from 60-95%. It does not appear that the formulation influences the effectiveness of these products and a higher alcohol concentration is not necessarily better (Edmonds, et al. 2012). It is important to follow the manufacturer's instructions for any particular product.
- Alcohol-based hand rubs significantly reduce the number of microorganisms on skin, are fast acting and cause less skin irritation than repeated washing with soap and water. Decreasing skin irritation is important and not only to help increase hand hygiene compliance by healthcare workers. An intact skin prevents the entry of microorganisms. Frequent hand washing with soap and water can be very irritating and also rapidly breaks down the stratum corneum, creating a potential entry point for microorganisms. Alcohol-based hand rubs cause this breakdown as well, but there is evidence that this breakdown happens to a lesser degree when using alcohol-based hand rubs (Ahmed-Lechebed, *et al.,* 2012).

- Healthcare personnel should avoid wearing artificial nails and keep natural nails less than one quarter of an inch long if they care for patients at high risk of acquiring infections (e.g. patients in intensive care units or in transplant units).
- When evaluating hand hygiene products for potential use in healthcare facilities, administrators or product selection committees should consider the relative efficacy of antiseptic agents against various pathogens and the acceptability of hand hygiene products by personnel. Characteristics of a product that can affect acceptance and therefore usage include its smell, consistency, color and the effect of dryness on hands.
- As part of these recommendations, CDC is asking healthcare facilities to develop and implement a system for measuring improvements in adherence to these hand hygiene recommendations. Some of the suggested performance indicators include periodic monitoring of hand hygiene adherence and providing feedback to personnel regarding their performance, monitoring the volume of alcohol-based hand rub used/1000 patient days, monitoring adherence to policies dealing with wearing artificial nails, and focused assessment of the adequacy of healthcare personnel hand hygiene when outbreaks of infection occur.

- **Personal Protective Equipment**

The appropriate use of personal protective equipment (PPE) is an important element of standard precautions. Gloves provide a protective barrier between the patient and the healthcare professional and prevent gross contamination of the hands. Gloves may also reduce the transfers of blood from a needlestick (Mast, Woolwine, Gerberding, 1993). Gloves do not replace the need for hand washing because the gloves may have

small defects, may be torn during use, and hands may become contaminated during glove removal. In addition, microorganisms such as hepatitis B can pass through the pores of gloves, significant surface contamination of hands is possible, even when healthcare workers wear gloves (Garus-Pakowska, *et al.*, 2013), and glove use has been associated with lower rates of hand hygiene compliance (Fuller, Savage, Besser, 2011; Flores, Pevalin, 2006).

Masks, goggles, or face shields should be used to protect the mucous membranes of the eyes, nose, and mouth during situations where there is a likelihood of splashes or sprays. Gowns are worn to prevent contamination of clothing and protect the healthcare professional's skin from blood and body fluid exposure. Impermeable gowns, leg coverings, boots, or shoe covers provide more protection when large quantities of blood or body fluids may be splashed. However, as with any PPE, gowns must be used properly and incorrect use of gowns (and other PPE) has been shown to cause contamination of the gowns, contamination of the hands and/or the environment and potential harm to healthcare workers (Mitchell, Gravel, Roth, 2013: Beam, Gibbs, Boulter, Beckerdite, Smith,2011; Weiner-Well, Galuty, Rudensky, Schlesinger, Attias, Yinnon,2011).

• Immunization against Hepatitis B

Immunization is one method to reduce the transmission of communicable diseases. WHO considers universal immunization to be the most effective preventive measure against diseases induced by infection with hepatitis B. All health workers including waste disposal workers, emergency and safety workers exposed to the risk of bloodborne pathogens are at risk of exposure. They should be immunized either before training or as soon as possible when at work, unless they are already immunized (WHO,

2008). The following are recommendations for immunization for healthcare personnel (MMWR, 2011).

Table 2.4:Healthcare Personnel Vaccination Recommendations

Vaccine	
Hepatitis B	Hep B (3 doses)
Influenza	TIV or LA IV annually
MMR	MMR if born 1957 or later if no serologic evidence of immunity or prior vaccination
Varicella	Varicella vaccine (2 doses) if no serologic evidence of immunity
Tetanus, Diptheria, Pertussis	Tdap one time if younger than 65, TD every 10 years
Meningococcal	1 dose to microbiologist who routinely exposed to N. meningitis

Recommendations for immunization for healthcare personnel (MMWR, 2011).

- **Decontamination of Reusable Instruments:**

All reusable instruments should be decontaminated immediately after use. Decontamination is a procedure that makes objects safe to touch with intact (unbroken) skin. Immediate decontamination will protect the person who will then clean or sterilize the instruments. All reusable instruments should be cleaned and after be decontaminated. Cleaning is the removal of foreign matter from objects by scrubbing with water and soap. Proper cleaning of objects before sterilization and disinfections is very important. This is because if foreign matter is not adequately removed before soaking in a disinfectant, the instrument underneath the foreign matter, thus allowing some microorganisms to remain.

- **Disinfections or Sterilization of Reusable Instrument after Decontaminating and Cleaning**

All reusable instruments should be disinfected or sterilized correctly after decontamination and cleaning. All instruments for invasive procedures should be sterilized if at all possible or at least given high-level disinfection. Since skin on the hands can be easily pierced by sharp instruments, strong rubber gloves should be worn.

Sterilization: Method of sterilization will include:

1. Dry heat: Here closed oven at 170°c for at least two hours is used for sterilization.

2. Steam: Here closed pressured vessel a 121°c for 20 minutes is used for sterilization.

High-Level Disinfection: Clean, dry-instruments may be disinfected as below:

• Boiling: Immersion of used instrument in boiling water for 20 minutes will inactivate or destroy Human Immunodeficiency Virus, Hepatitis B and bacteria, but not spores present in large numbers.

• Chemical: Chemical disinfection should only be used as a last resort, if either sterilization or disinfection by boiling is not possible. Chemical sterilization will include the use of 2% gluteral (gluteraldelyde). Aqueous immersion time will be 30 minutes at room temperature for high-level disinfection and 10 hours at room temperature for sterilization. Six percent (6%) hydrogen peroxide could also be used 30 minutes at room temperature for high disinfection. After immersion in chemical, all equipment should be thoroughly rinsed with sterile water and then handled with sterile gloves and forceps and dried with sterile towels to prevent recontamination. Iodine can also be used as disinfectant.

- **Decontamination of Surface Areas**

Any spills of body fluids or blood should be immediately cleaned up using 0.5% chlorine bleach solution. To make a 0.5% chlorine solution 1 part of JIK is mixed with 7 parts of water. This is the formula for JIK, or any bleach that is 3.5% chlorine. Other solutions that can be used for decontamination of surface include 50% solution of lysol, savlon, Zephiran and alcohol. If alcohol is used, the surface must be wiped several times because alcohol evaporates quickly. Gloves should be worn when cleaning the contaminated surface. First the spill is covered with 0.5% chlorine bleach solution or any other solution such as savlon that can be used for decontamination then this is mopped up. The solution is then used again to wipe the surface. Examination tables ideally should be wiped after every patient. There should be daily cleaning of laboratory tables, equipment, and trolleys.

- **Waste Management**

Use of sealed, puncture and leak-proof sharps containers helps to prevent access to used devices (WHO, 2000). Practical guidance on waste management to ensure that waste is dealt with safely: transport and store sharp containers in a secure area before final disposal; close, seal and dispose of sharps containers when the containers are three quarters full; assign responsibility in written policy for monitoring the fill level of sharps containers and replacing them when three quarters full; discard waste that is not categorised as sharp or infectious in appropriate colour- coded bags; ensure that infectious waste bags and sharps containers are closed before they are transported for treatment or disposal. Used syringes and blades should be collected in an old glass metal or heavy plastic jar with tight lid and buried or thrown in a pit latrine.

- **Disposal of Non-Reusable Materials/Instruments**

Contaminated rubbish such as papers, dressing swabs and other disposals which are soiled by blood or body fluids such as vaginal secretions, urethral discharge and pus, soiled needles, syringes and blades should be disposed off in a container with a tight cover and burned or buried. The burning should be at least 10 metres from clinic or houses.

- **Handling of Dirty Linen**

Dirty linen should be handled as little as possible as they can be contaminated with blood. Vaginal secretions and body fluids containing blood or pus which can infect the health care worker or patient any linen with large amount of blood should be first soaked in a (1.5% chlorine bleach solution. They should be washed with soap and water and hung in the sun to dry when possible.

2.4 Age as Predisposing Factor of Exposure

A study conducted in (3) hospitals in Ecuador showed that the demographic profile of the participant group was generally reflective of the workforce as a whole: Workers 40 to 49 years old (39.0%) were the largest age cohort, followed by the 30 to 39 year old group (27.0%) and workers 50 years or older (23.9%). (Lavoie, *et al.*, 2010).

(Sreedharan, Muttappallymyalil, and Venkatramana, 2010; Fabin, and Fu-Prudhomot, 2008), found that among injured persons, more than 50% were young staff, with a mean age of the respondents as 32.14 years. This is in line with the findings of Mbaisi, Ng´ang´a, Wanzala, Omolo (2010), who stated that the prevalence of percutaneous injuries was high among female HCWs (21%), HCWs of age-group 31-40 (26.4%) and also in line with the findings of Gourni, *et.al* (2012). In their study

Occupational Exposure to blood and body fluids of nurses at Emergency department who found that the "profile" of nurses as it is reflected by the study is mainly consisted of age 25 to 45 years old. Clement, Comfort, Olajide and Ukeme (2014); Amoran, (2013). Jaber, Nazanin, and Farideh, also, found the mean age of exposed health workers to be 34.09 SD=8.1yrs, 37.6 years, and 30.49±7.04 years respectively.

Zeleke, Tadese, Gebeyaw, (2013), in their study managements of exposure to blood and body fluids among healthcare workers and medical students found that in their study among respondents age range from 19 to 54 years with a mean age of 29years are more exposed to body fluids which is in line with the findings of Dement *et al.,* (2004) who showed that persons less than 45 years of age were more exposed. Also, with that of Getahun and Teresa, (2014) who found that respondents' age range from 20–60 years with a mean (standard deviation) age of 29.5 (6.75) years. Majority, 249 (62.1%) of the study participants were found in the age group of 20–29 years

A study conducted in Northern Nigeria has shown that, Majority (77.2%) of the participants were aged 20-39yrs and only (0.25%) and (0.5%) were less than 20years and greater than 60 years respectively. (Amoran, 2013).This findings is similar to the findings of Ibtissam, Hala, Sanaa, Hussein, Nabil, (2013) who found out that all participants in their study were between 16 and 64-year-old (mean age = 32.14; SD = 10.33; median = 29 years

Another study done by Muluken and Gedefaw (2014), had found the mean age of the respondents in their study to be 29 ± 6.7 years. This is similar to the findings of Omar, Abdo, Salama, Al-Mousa (2015) who found that the mean age of their respondents was 32.31 ± 6.98 years. Similar to the findings of Azar, Mojgan, Mehrnaz, Mahboobeh,

Nahid, Shirin, Negin, (2013), who found that the mean age of the exposed healthcare workers in their study was 30.46 ± 7.1 (SD) years (range 20 - 56).

2.5 Gender as Predisposing Factor of Exposure

A study conducted in (3) hospitals in Ecuador showed that the demographic profile of the participant group was generally reflective of the workforce as a whole: three-quarters (72.8%) of the survey group were female. (Lavoie, *et al.*, 2010). (Anagaw, Shiferaw, Anagaw, Belyhun, Erku, Biadgelegn, Moges, Alemu, Moges, Mulu, (2012), also found significant higher proportion of body fluid exposure were detected in female (RR = 4.0; 95%CI = 0.62-25; P = 0.25). This is in line with the findings of Gourni, *et..al* (2012). In their study Occupational Exposure to blood and body fluids of nurses at Emergency department found that the "profile" of nurses as it is reflected by the study mainly consisted of women. Also, in the study of (Sreedharan, *et.al* 2010; Fabin, and Fu-Prudhomot, 2008) who found 57.4% to be female, the rate was slightly higher in males than females (8.5% versus 7.6%) in the study of Clement, *et al* (2014). This is in line with the findings of Amoron (2013), who also found that (67.5%) of the respondents were males and (32.5%) were females. but Mehrdad, Atkins, Sharifian, Pouryaghoub (2014) in their study found no association between gender of the respondents and exposure to body fluid pathogens.

Dement *et al.*, (2004), show that more often males were exposed. This in line with the findings of Zeleke, *et al*, (2013), who shown that among the respondents, 127 (50.4%) were males. The findings of Getahun and Teresa, (2014) who found that of the total study participants, in their study 224 (55.9%) were males. But in contrast with the findings of Muluken and Gedefaw (2014), who found a total of 121 of the healthcare

personnels (38.2%) were men. Similarly with the findings of Ibtissam, *et al*(2013) who found that 57.4% were females. Azar et al (2013), also found that 54% of their respondents were female.

2.6 Years of Working Experience as Predisposing Factor

(Musharrafieh, Bizri, Nassar, Rahi, Shoukair, Doudakian, and Hamadeh, 2008; Wicker, Jung, Allwinn, Gottschalk, and Rabenau, 2007) In the same study, the most exposed to BBF were the older and more experienced HCWs. This is in contrast with data reported by others (Sreedharan, Muttappallymyalil, and Venkatramana, 2010; Fabin, and Fu-Prudhomot, 2008; Muluken and Gedefaw, 2014), where among injured persons, more than 50% were young staff, and in the group with experience of less than 5 years.

Gourni, Polikandrioti, Vasilopoulos, Mpaltzi, and Gourni, (2012). In their study Occupational Exposure to blood and body fluids of nurses at Emergency department identify that the "profile" of nurses as it is reflected by the study mainly consisted of working for over 5 years. Dement *et al.,* (2004) show that more often were exposed males; persons employed less than 4 years, Hispanic employees, and persons less than 45 years of age.

A study conducted in Northern Nigeria has shown that, Among the health workers, 47.0% have been working for 5yrs or less, 26.4% for 6-10yrs, 11.4% for 11-15yrs and 15.2% for more than 15yrs and above, (Amoran, 2013). In another study done by Zeleke, *et al*, (2013) shown that Among participants in their study 113(44.5%) had less than two years of work experiences. HCWs who hand experiences two to four years were 62(24.6%) and only 45(17.7%) were five years and more experienced in their current position.

A study done by Getahun and Teresa, (2014), show that HCWs within 5–10 years' work experience were more likely to experience exposure to HIV/AIDS risky conditions compared to those who had less than 5 years' work experience. This is similar to the findings of Ibtissam, *et al* (2013), who found that 41.2% had been professionally active for less than 5 years. But, in another study, the prevalence of occupational exposure was high among those with experience less than 10 years (Mbaisi, Ng'ang'a, Wanzala, Omolo, 2013). Azar et al (2013), also found that the mean of the employment period was 6.5 ± 6 years; 75% had less than 5 years, 9% between 5 and 10 years and 16% had over 10 years of experience.

2.7 Job Category as Predisposing Factor

Almost all healthcare workers are at risk for exposure to bloodborne pathogens, but nurses are the group that is most affected (Camacho-Ortiz, Diaz-Rodriguez, Rodriguez-Lopez, *et al.,* 2013; Yang, Wu, Wang, *et al.*, 2013). It has been estimated that > 50% of nurses will experience at least one needlestick injury in their careers (Rhode, Dupler, Posta, 2013). Singru and Banerjee, (2008), in their study also found the incidence of accidental exposure to potential infectious material to be highest among the staff nurses at 39.63%, followed by interns at 37.34%, technicians at 26.92% and least among the resident doctors at 21.01%. This is in line with study conducted by Sabbah, Sabbah, Sabbah, Akoum, Droubi (2013), who found that nursing personnel are the most commonly affected group. It is also in agreement with other studies (Monge, Mato, Mariano, Fernández, and Fereres, 2001; Ndiaye, Cissokho, and Sow, 2011), but it differs from that reported by other authors who found the highest frequency of injury among physicians (55.1%), compared to nurses (22.0%), (Musharrafieh, Bizri, Nassar, Rahi,

Shoukair, Doudakian, and Hamadeh, 2008; Wicker, Jung, Allwinn, Gottschalk, and Rabenau, 2007).

In United States, nurses ranked first (49.7%), and then the group of medical doctors (12.6%). Nurses were also recognized as the most vulnerable group in Canada (70%), (Canadian Center for Occupational Health and Safety, 2000).Hsieh, *et al.,* (2006), who explored blood and infectious body fluid exposures for health care workers, show that nurses had the highest percentage (60.6%) of exposure and other job categories including physicians, technicians, cleaning staff, and interns accounted for around 10% each. This is also in line with the findings of Ibtissam, *et al* (2013) who found that physicians (15.5%), RN (62.8%), nurses (13.4%), and students specializing in nursing (8.3%). And of that of Amoran, (2013) who found that (12.4%) medical doctors, (18.5%) were nurse, (12.8%) were laboratory scientists, (17.6%) were hospital orderlies.

Another study done by Muluken and Gedefaw (2014), show that 62% of exposed healthcare workers were nurses, 24% were working in outpatient departments which is similar to a study from Taiwan (Hsieh*et al*2006) Occupational exposure to BBFs in this study did not show a statistically significant difference across the HCPs, except for midwives. This finding is comparable with the Dire Dawa study (Reda, Fisseha, Mengistie, Vandeweerd 2010)However, in their study midwives were 12.09 times more likely to have occupational exposure to BBFs than nurses.

A study conducted by Omar *et al*(2015) show that the majority of predisposed healthcare workers to exposure were nurses: 166 (66.7%), followed by doctors: 35 (14.1%), technicians: 26 (10.4%) and housekeeping personnel: 22 (8.8%). This is similar to the findings of Azar *et al* (2013), who found that most exposures had occurred among

nurses (35%), followed by residents (29%), interns (18%), housekeepers (7%), the lab staff (6%), and specialists (5%).

2.8 Summary

This chapter focused on the assessment of the occupational exposure of health care workers in the hospital to blood and body fluid infectious diseases in Kaduna State. In doing so, historical overview/evolution of occupational health, occupational health regulations, occupational health in Nigeria, occupational health services/function and occupational hazards for hospital workers were discussed, blood borne pathogens, transmission of blood-borne pathogens in the hospital, body fluids presenting risk for blood borne disease transmission, epidemiology of blood contact and risk of occupational transmission of blood borne pathogens from patient to worker post exposure were highlighted. Exposure of the health care workers to body fluid hazards, factors that predispose health care workers to exposure and occupational health safety measures were reviewed. Also, management of exposure to blood or body fluid infections and Prevention of exposure were discussed.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The study assesses the exposure to body fluid among health care workers in Kaduna State hospitals. This chapter deals with the methods used by the researcher in gathering information for the study. In conducting this research, the methods adopted are described under the following sub headings:

- Research Design
- Population
- Sample and Sampling Technique
- Instrument for Data Collection
- Validation of Instrument
- Administration of the Instrument
- Statistical Techniques

3.2 Research Design

The research design employed for this study was ex-post facto design. This design is very appropriate because it is undertaken after the events have taken place and the data are already in existence. In this design, it is difficult for the researcher to manipulate variables because data are already in existence. It is associated with certain occurrence, condition or type of behavior, by analyzing past events or already existing conditions (Bello and Ajayi, 2000).

3.3 Population of the Study

The population for this study comprised of 2548 healthcare workers (Doctors, Nurses, Laboratory scientist and Attendants) working in Kaduna State hospitals as shown by the State Ministry of Health (2013/2014), distribution table as follows:

Table 3.1: Distribution of Kaduna State Hospitals and Numbers of Healthcare Workers (Doctors, Nurses, Laboratory scientist and Attendants) working in the Facilities

S/No	Name of faculties	L.G.A	Senatorial Zone	Population Of Health Care Workers					No. Selected
				Doctors	Nurses	Lab scientists	Attendants	Total	
1.	BarauDikkoSpecialistHospital	Kaduna North	Kaduna Central	52	219	45	86	402	402
2.	YusufDantsohoMemorialHospital T/Wada	Kaduna South		20	179	30	80	309	
3.	Dr. AwanKakurekaduna	Kaduna South		16	150	35	114	315	
4.	General Hospital Kawo	Kaduna North		3	40	11	22	76	
5.	General Hospital Sabon Tasha	Kaduna South		5	50	19	55	129	129
6.	General Hospital Rigasa	Igabi		3	13	13	17	46	
7.	R.H Kujama	Kaduna South		1	26	5	16	48	
8.	R. H Doka	Kaduna North		3	23	6	11	43	
9.	HajiyaGamboSawaba Zaria	Zaria	Kaduna North	7	56	17	69	149	149
10.	R. H Maigana	Soba	Kaduna North	2	11	6	13	32	
11.	R. H Turunku	Igabi	Kaduna Central	4	13	1	12	30	
12.	Major Ibrahim Hosp.	SabonGari	Kaduna North	1	25	6	20	52	52
13.	General Hospital Giwa	Giwa	Kaduna central	3	26	9	11	49	49
14.	General Hospital Hunkuyi	Kudan	Kaduna North	3	20	3	8	34	
15.	General Hospital Makarfi	Makarfi	Kaduna North	4	23	4	8	39	39
16.	General Hospital Ikara	Ikara	Kaduna North	1	19	4	20	44	
17.	General Hospital Kauru	Kauru	Kaduna South	3	17	4	9	33	
18.	Gen. Hosp. Pambegua	Kubau	Kaduna North	2	14	4	12	32	
19.	Gen. Hosp. S/Naka	Lere	Kaduna North	5	49	8	30	92	
20.	General Hospital Kafanchan	Jama'a	Kaduna South	7	73	13	58	151	151
21.	Gen. Hosp. Z/Kataf	Zangonkataf	Kaduna South	3	17	6	13	39	39
22.	General Hospital Gwantu	Sanga	Kaduna South	2	24	6	11	43	
23.	General Hospital Kachia	Kachia	Kaduna South	3	32	12	35	82	82
24.	R. Hospital Idon	Kachia	Kaduna South	2	12	5	13	32	
25.	R. Hospital Kaura	Kaura	Kaduna South	3	22	5	18	48	
26.	R. Hospital Kwoi	Jaba	Kaduna South	1	20	7	12	40	
27.	R. Hospital Zonkwa	Jaba	Kaduna South	3	21	3	12	39	
28.	General Hospital Kagarko	Kagarko	Kaduna South	_	_	_	_	_	
29.	General Hospital B/Gwari	Birningwari	Kaduna North	9	35	8	35	87	
30.	Dental/Center Kadi			5	-	-	15	20	
31.	Dental/Center Zaria	Zaria	Kaduna North	3	-	-	10	13	
32.	TOTAL			179	1229	295	845	2548	1092

Source: Kaduna State hospitals as shown by the State Ministry of Health (2013/2014),

Therefore healthcare worker's Population of the study was (2548) and the population of the healthcare workers in the selected hospitals was (1092).

3.4 Sample and Sampling Technique

The sample size for this study was 346.

- For the purpose of this study, stratified random sampling technique was used. Castillo, (2009) opined that, stratified sample is a probability sampling technique in which the researcher divides the entire target population into different sub-groups or, strata, and then randomly selects the final subjects proportionately from the different strata. Thus, the State hospitals were stratified using the existing three senatorial zones in Kaduna State which are: Kaduna South, Kaduna central, and Kaduna North Senatorial Zone.
- Each stratum of the senatorial zone was clustered according to the present existing local government areas. Asika, (2001), observes that a cluster sampling is a method of composing a sample by randomly sampling from each of the identified existing geographical areas, naturally occurring events, or phenomena. It permits the study of subjects in their naturally occurring groups. Therefore, southern senatorial zone has the following local government areas as clusters (Zangon Kataf, Jama'a, Kachia, Sanga, Jaba, Kagarko, Kaura, and Kauru). Central senatorial zone has the following local government areas as clusters (Kaduna-North, Kaduna-South, Giwa, Igabi, Birningwari, Chikun, and Kajuru) while northern senatorial zone has the following local government areas as clusters (Makarfi, Ikara, Zaria, Lere, Kubau, Soba, Sabon-Gari and Kudan). The method was employed to represent the three zones of the State.

- A simple random sampling technique using dip and pick method was used to select nine (9) hospitals that were mixed in each of the zone. Purposive sampling technique was used to select the specified number of Local governments that were in line with the hospitals selected in each zone. Nworgu (1991) opines that, in purposive sampling, specific elements which satisfy some pre- determined criteria are selected. The selection of the local governments was in-line with the number of hospitals selected from the population in each of the zone. As such, the randomly selected State hospitals were (Barau Dikko Specialist Hospital, General Hospital Sabon Tasha, General Hospital Giwa, General Hospital Makarfi, Gambo-Sawaba Memorial Hospital Zaria, Major Ibrahim Memorial Hospital Sabon-Gari, Gen. Hospital Zangon Kataf, General Hospital Kafanchan and General Hospital Kachia) served as the sampling frame from which the sample of 346 respondents were drawn.
- Proportionate sampling was used at the secondary healthcare institutions to distribute questionnaires to the health workers that were available. This was employed because the researcher can easily reach out to the respondents at their various work locations.
- In other to arrive at the proportion of health workers in each State hospital, the following steps were used :

STEP1=Proportionate sampling = $\frac{\text{Total number of health workers in a hospital}}{\text{Total number of health workers in all the hospitals selected}}$ *Sample size

STEP 2= BarauDikko =127

STEP 3= Sabon Tasha = 41

STEP 4= Zaria = 47

STEP 5 = SabonGari = 17

STEP 6 = Giwa = 16

STEP 7 = Makarfi = 12

STEP 8 = Kafanchan = 48

STEP 9 = Kachia = 26

STEP 10 = Zangonkataf= 12

Total = 346

3.5 Instrumentation

Instrument for data collection in this study, was eighteen (18) self-structured questionnaire items (see appendix). The questionnaire was worded carefully in order to elicit the correct responses. It is ideally suited for the collection of factual information because it is relatively quick and a cheaper method of gathering data from the respondent. The questionnaire was grouped into sections:

- Section A consisted of 4 items on; demographic information of the respondents.
- Section B contained 4 items on; Age as a predisposing factor of body fluid exposure.
- Section C consisted 4 items on; job category as a predisposing factor of body fluid exposure
- Section D contained 3 items on; years of experience as a predisposing factor of body fluid exposure
- Section E contained 2 items on; Gender as a predisposing factor of body fluid exposure.

Likert scale format of Strongly Agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2, and Strongly Disagree (SD) = 1. The likert scale was chosen because when all the responses are added up, it is easy to draw a conclusion based on the total value.

3.6 Validation of the Instrument

Self-structured questionnaire was developed by the researcher. A copy of the draft questionnaire was corrected and validated by the researcher's supervisors. The structured questionnaire was distributed to five (5) professional experts to further ascertain its face and content validity. These experts were drawn from the Department of Physical and Health Education, Institute of Education, and Nursing Sciences, A.B.U Zaria. After all the suggestions and observations made by these experts were incorporated, the final questionnaire was prepared.

3.7 Administration of the Instrument

Copies of the questionnaire were administered to the respondents via face to face with the help of three (3) research assistants. The research assistants were trained on the modalities and objectives of the study. The researcher went through every item in the questionnaire with them to ensure proper understanding with which they could guide the respondents in case of any misunderstanding.

The respondents were presents at the selected State hospitals because it serves as their place of work which makes it easier for the researcher to locate them. The researcher introduced self as well as the objectives of study, and informed the health workers that participation is voluntary and confidentiality will be maintain. The consented health workers were given the prepared questionnaire to fill. Some of the respondents filled it at the spot and were collected back by the researcher/ assistant, while those that were busy were allowed to fill the questionnaire at their convenient time so that it will not interfere with their routine duty schedule.

The filled questionnaires copies were retrieved from the health workers at the various selected State hospitals by the researcher/assistant after one week of administration. The health workers that were off duty gave their filled questionnaire to the Charge -Matron to deliver it to the researcher/assistant.

3.8 Statistical Techniques

Responses from the questionnaire formed the basis for coding. The data collected were analyzed using descriptive statistics of frequencies and percentage for the demographic variable, while mean and standard deviation was used to analyze variables related to body fluid exposure. T-test and analysis of variance were used for the test of hypotheses. Ifah (1996) States that t-test is a statistical method for comparing the means of two variables. A significant level of (alpha) 0.05 was used in the tests.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

The statistical analyses, and interpretations of the results of the responses on the items used in the assessment of exposure to body fluids among health care workers in Kaduna State hospitals was presented in this chapter. Three hundred and forty six (346) questionnaires were administered out of which two hundred and ninety seven (297) were successfully retrieved, which is (85.8%) of the total sample size. The demographic variables are presented in a single table. Variables relating to age, job category, years of experience, and gender as predisposing factors of body fluid exposure of health workers were each presented on a single table.

The research hypotheses involved in the study were determined and analyzed using one sample t-test, analysis of variance and two sample t-test at 0.05 level of significance. The t-test and analysis of variance values belonging to the level of significance and the number of degrees of freedom are located in a table, in order to determine whether the t-test and analysis of variance values are statistically significant or not. In order to interpret the result, the null hypothesis is rejected if the calculated t-test and analysis of variance values are greater than the critical value. In that case, the null hypothesis stating that there is no difference is rejected, and it is concluded that the difference is statistically significant. The reverse is also the case, if the calculated t-test and analysis of variance value are less than the critical value, the null hypothesis, stating that there is no difference, is upheld and cannot be rejected. It is then concluded that the difference is not statistically significance.

4.2 Results of Demographic Characteristics of the Respondents

A total of 297 health care workers selected from the three senatorial zones of Kaduna State were involved in this study. Their personal data selected along their respond on the subject of investigation were gender, age, Years of working experience and Job category. These variable were considered to be directly associated with the dispositions of care giving by the subjects in the selected health facilities in the State. Each of the variables was classified in frequencies and percentages in Table 4.2.1.

Table 4.1: Classifications of the Respondents' Demographic Characteristics

Variables	Variable options	Frequency	Percent
Sex	Male	135	45.5
	Female	162	54.5
	Total	297	100.0
Age	18-25 years	70	23.6
	26-33 years	93	31.3
	34-41 years	79	26.6
	Above 41years	55	18.5
	Total	297	100.0
Year of experience	<5 years	112	37.4
	5-10 years	173	58.2
	>10 years	12	3.7
	Total	297	100.0
Job category	Doctors	36	12.1
	Nurses	153	51.1
	Lab scientist	50	16.8
	Attendance	48	16.1
	Total	297	100.0

From the classification of the respondents in the table, 135 (45.5%) were male while 162 (54.5%) were female. The gender representation helps to take off the gender bias aspect of the study and is more so since all decisions would be based on weighted mean scores which will be devoid of numbers.

The table reveals that 70 (23.6%) of the respondents were between 18 and 25years. Respondents who were between 26 and 33years were 93 (31.3%) while 79 (26.6%) of the staff were between 34 and 41years. Only 55 (18.5%) of the total respondents were above 41yars.

The years of working experience of the staff as classified in the table shows that 112 (37.8%) have worked for less than 5 years while 173 (58.2%) have worked for 5-10 years. Staff of Kaduna state hospital that worked for more than 10 years were relatively few with 12 (4.0%).

By job category, 36 (12.1%) of the health care workers were Doctors while 153 (51.5%) were Nurses. Laboratory scientist were 50 (16.8%) and Attendants were 48 (16.1%) of the total number of staff involved in the study.

4.3 Assessment of Age on Health Workers Disposition to Body Fluid Exposure in Kaduna State Hospitals

The aim here is to assess the age of healthcare workers as a factor of their exposure to body fluid in the process of their duties in the State hospitals. The research question is: Does age group predispose health care workers to body fluids exposure in Kaduna State hospitals? To determine the impact of the workers' age on their predisposition to body fluid exposure, the means scores of the different age groups on the extent of possible exposure to body fluid examined in Table 4.1. The mean score along with the standard deviations and standard errors for the respective age groups are presented in Table 4.2.

Table 4.2: Mean Scores of the Health Workers on Age Disposition to Body Fluid Exposure in Kaduna State Hospitals

Age	N	Mean	Std. Deviation	Std. Error
18-25 years	70	2.69	0.512	0.061
26-33 years	93	2.63	0.532	0.055
34-41 years	79	2.68	0.477	0.054
Above 41years	55	2.77	0.487	0.066
Total	297	2.68	0.504	0.029

The table shows that health care workers who were above 41 years were more likely to be exposed to body fluid than those in the age bracket of 26 and 33years. Those between the age of 18 and 25years tended to have the probable prospect of such exposure as well with little variability between those who were between 34 and 41years. The overall observation is that age could be a factor, going by the mean scores which are all above the midpoint of 2.5. But the significance of the variability between the different age groups is tested in the related hypothesis.

4.4 Assessment of Gender on Health Workers Disposition to Body Fluid Exposure in Kaduna State Hospitals

The objective here is to assess the gender of healthcare workers to determine the rate of their exposure to body fluid in the State's health facilities. The research question used for the investigation is: Does gender predispose health care workers to body fluids exposure in Kaduna State hospitals? To determine the extent the gender of the workers predispose them to body fluid exposure in the hospitals, the mean scores of the male and female staff on the items in Table 4.1 was computed along with their standard deviations and standard errors. Table 4.3 shows the mean scores.

Table 4.3: Mean Scores of the Health Workers on Gender Role on Factors Predisposing the Health Care Workers to Body Fluid Exposure in Kaduna State Hospitals

Sex	N	Mean	Std. Deviation	Std. Error
Male	135	2.8027	.36044	.03102
Female	162	2.6714	.56483	.04438

From the mean scores in the table, the male workers tended to be more inclined to indulge in the factors of exposure to body fluid in the health facilities than their female counterparts in the State. In the table, the mean score of the male staff is 2.8027 compared to the score of the female staff which was 2.6714. Both mean scores however clearly indicate that the groups were equally dispose to body fluid exposure in the health facilities. The observed variability therefore is the magnitude to which a particular group is more open to such exposure. The difference is subjected to statistical test for significance in the related hypothesis of the study.

4.5 Assessment of Years of Experience as a Factor that Predisposes Health Care Workers' Exposure to Body Fluidin Kaduna State Hospitals

The assessment here is aimed at identifying the years of experience as a risk factor to body fluid exposure by health workers in the State hospitals. For the identifying the effect of the role played by years of working experience of the staff in the predisposing factors, the scores of the years of experience on the items in Table 4.1 were computed and compared as presented in Table 4.4.

Table 4.4: Mean Scores of the Health Workers' Years of Experience Predisposition to Body Fluid Exposure in Kaduna State Hospitals

Years of experience	N	Mean	Std. Deviation	Std. Error
< 5 years	112	2.66	0.834	0.231
5-10 years	173	2.70	0.461	0.029
>10 years	12	2.61	0.597	0.141
Total	297	2.68	0.504	0.029

From the mean scores in the table, workers with <5 years of working experience and workers with 5-10 years of working experience tended to be more inclined to indulge in the factors of exposure to body fluid in state hospitals than workers with >10 years of working experience that were relatively few in the State. For example, though workers with 5-10years of experience have the highest score of 2.70 but workers that are <5 years of experience were next to them in their score with 2.66 while workers with >10 had scores of 2.61. One thing of note here is that all the workers were highly dispose to body fluid exposure as indicated by their respective mean scores. The observed differences in the mean scores are tested in the related hypothesis.

4.6 Assessment of Job Category on Health Workers Disposition to Body Fluid Exposure in Kaduna State Hospitals

The level to which job categoryof the staff determines the level of their exposure to body fluid in the State hospitals is the subject of this assessment here. The related research question was aimed at identifying whether the job categoryof health care workers play a role in their predisposition to body fluids exposure in the State hospitals? To provide the solution to this question the mean scores of the different job categoriesof the staff on the items in Table 4.1 was computed and compared in as presented in Table 4.5.

Table 4.5: Mean Scores of the Health Workers' Job Category Predisposition to Body Fluid Exposure in Kaduna State Hospitals

job category	N	Mean	Std. Deviation	Std. Error
Doctors	36	2.41	0.834	0.231
Nurses	153	3.10	0.686	0.162
Laboratory scientist	50	2.16	0.597	0.141
Attendance	48	2.30	0.461	0.029
Total	297	2.68	0.504	0.029

The mean scores in the Table show that job categorymay be a major factor in the workers exposure to body fluid. For example, though Nurses have the highest score of 3.10 but Laboratory scientist were next to them in their score with 2.76 while Attendance and Doctors had scores of 2.30 and 2.41 respectively. One thing of note here is that all the workers were highly disposed to body fluid exposure as indicated by their respective mean scores. The observed differences in the mean scores are tested in the related hypothesis.

4.7 Test of Hypotheses

Major Hypothesis (null hypothesis) was formulated stating Health care workers are not significantly exposed to body fluid hazards in Kaduna state hospitals.

Four (4) sub-hypothesis were drawn in other to answer the major hypothesis stated.

Hypotheses I: Age is not significant predispose factor of healthcare workers to body fluid exposure in Kaduna State hospitals

The age groupings of the staff was used here as the independent variable. In the test of the hypothesis, the analysis of variance was used to determine significant difference in the level of exposure by the staff to the body fluid with respect to the different age groups. The use of the one way analysis of variance was informed by the

more than two groups of the independent variable (age grouping of the staff) involved in the test. The test result is summarized in Table 4.12.

Table 4.6: One-way Analysis of Variance on Predispose Health Care Workers to Body Fluid Exposure by Ages of the Health Care Workers in Kaduna State Hospitals

Source of variations	Sum of Squares	DF	Mean Square	F	Sig.
Between Groups	0.26782	3	0.089272	0.349	0.790
Within Groups	74.9975	293	0.255964		
Total	75.2653	296			

(F-critical at DF (3, 293) = 2.60, P > 0.05)

The observed F-values 0.349 obtained in the test is lower than the critical value of 2.60 at the same degree of freedom of 3,293. The observed levels of significance 0.790 is higher than the fixed value of 0.05 (P > 0.05). This means that the staff did not differ significantly by their age groupings in their predisposition to body fluid hazards in the State hospitals. Therefore, the null hypothesis that Age group will not significantly predispose health care workers to body fluid exposure in Kaduna State hospitals is thus retained. The mean scores for the different groups on the variable are presented in Table 4.7.

Table 4.7: Mean Scores of the Staff on their Disposition to Body Fluid Exposure by Age Grouping

Age	N	Mean	Std. Deviation	Std. Error
18-25 years	70	2.69	0.512	0.061
26-33 years	93	2.63	0.532	0.055
34-41 years	79	2.68	0.477	0.054
Above 41years	55	2.77	0.487	0.066
Total	297	2.68	0.504	0.029

The table shows that the means were approximately within the same range by the different age groups of the health workers. This would imply that age could not be seen as a significant factor of their exposure to body fluid hazards in the State hospitals.

Hypotheses II: Gender is not a significant predispose factor of health care workers to body fluid exposure in Kaduna State hospitals

The influence of gender on the disposition of the workers to body fluid hazards in the hospitals was conducted here by comparing the mean scores of the male and female staff on the rated disposition to body fluid hazards, as the assessment of gender effect in the third objective of the study. The test was carried with the two sample t-test and the result is summarized in Table 4.8.

Table 4.8: Two Sample t-test on Factors that Predispose Health Care Workers to Body Fluid Exposure in Kaduna State Hospitals by Gender

Sex	N	Mean	Std. Deviation	Std. Error	t-value	DF	P
Male	135	2.8027	.36044	.03102	2.335	295	.020
Female	162	2.6714	.56483	.04438			

(t-critical = 1.96, $P < 0.05$)

The result in the table revealed that the male differed significantly from the female on the factors that predispose health care workers to body fluid exposure in the State hospitals. The observed t-value (2.335) for the test is higher than the critical value of 1.96. The observed level of significance is 0.020 ($P < 0.05$). With these observations, the null hypothesis that gender will not significantly affect the factors that predispose health care workers to body fluid exposure in Kaduna State is therefore be rejected.

Hypotheses III: Years of working experience is not significant predispose factor of health care workers to body fluid exposure in Kaduna State hospitals

This hypothesis was tested with the one way analysis of variance because of the multiple levels of the independent variable (years of experience) involved. The scores of the staff on the rated disposition to body fluid hazards in the hospital assessed in Table 4.1 were used as the dependent variables. A summary of the analysis of variance model on the variable is presented in Table 4.9.

Table 4.9: One-way Analysis of Variance on Health Care Workers' rated Exposure to Body Fluid Hazards in Kaduna State Hospitals by Years of Working Experience of the Staff

Source of variations	Sum of Squares	DF	Mean Square	F	Sig.
Between Groups	1.36069	3	0.89271	0.348	0.791
Within Groups	74.9046	293	0.25233		
Total	75.2653	296			

(F-critical at DF (3, 293) = 2.60, P > 0.05)

The observed F-values 0.348 obtained in the test is lower than the critical value of 2.60 at the same degree of freedom of 3,293. The observed level of significance 0.791 is higher than the fixed value of 0.05 (P > 0.05). This means that the staff did not differ significantly by their years of experience in their predisposition to body fluid hazards in the State hospitals. Therefore the null hypothesis that years of working experience will not significantly predispose health care workers to body fluid exposure in Kaduna State hospitals is thus retained. The mean scores for the different groups on the variable are presented in Table 4.10.

Table 4.10: Mean Scores of the Health Workers Years of Experience Predisposition to Body Fluid Exposure in Kaduna State Hospitals

Years of experience	N	Mean	Std. Deviation	Std. Error
<5 years	112	2.66	0.834	0.231
5-10 years	173	2.70	0.461	0.029
>10 years	12	2.61	0.597	0.141
Total	297	2.68	0.504	0.029

The table shows that the means were approximately within the same range by the different Years of experience of the health workers. This would imply that Years of experience could not be seen as a significant factor of their exposure to body fluid hazards in the State hospitals.

Hypotheses IV: Job category is not significant predispose factor of health care workers to body fluid exposure in Kaduna State hospitals

This hypothesis was tested with the one way analysis of variance because of the multiple levels of the independent variable (job category) involved. The scores of the staff on the rated disposition to body fluid hazards in the hospital assessed in Table 4.1 was used as the dependent variables. A summary of the analysis of variance model on the variable is presented in Table 4.11.

Table 4.11: One-way Analysis of Variance on Health Care Workers' rated Exposure to Body Fluid Hazards in Kaduna State Hospitals by Job Category of the Staff

Source of Variations	Sum of Squares	DF	Mean Square	F	Sig.
Between Groups	1.36069	3	0.45356	2.948	.048
Within Groups	73.9046	293	0.25223		
Total	75.2653	296			

(F-critical at DF (3,293) = 2.60, P > 0.05)

The test reveals that the staff did differ significantly in their rated exposure to body fluid hazards by the staff category of job. The observed F-value for the test in the table is 2.948. These value is higher than 2.60 for the critical value at the 3, 293 degree of freedom. The observed level of significance (P) for the tests (0.048) for the test is lower than 0.05 ($P < 0.05$). With these observations, there is sufficient evidence to reject the null hypothesis. The null hypothesis that job category will not significantly predispose health care workers to body fluid exposure in Kaduna State hospitals is therefore rejected. The mean scores for the different educational attainment are resented in Table 4.12.

Table 4.12: Mean Scores of the Staff on their Disposition to Body Fluid Exposure by Job Category

Job category	N	Mean	Std. Deviation	Std. Error
Doctors	36	2.41	0.834	0.231
Nurses	153	3.10	0.686	0.162
Laboratory scientist	50	2.16	0.597	0.141
Attendance	48	2.30	0.461	0.029
Total	297	2.68	0.504	0.029

The table shows that the rating of the staff on exposure to body fluid hazards in the hospitals were basically at different levels. The observed variability in the rating was found to be much. This accounted for the significant difference. In other word, job category of health care workers in the state health hospitals is a factor to their exposure to body fluid hazards in their assigned routine duties.

4.8 Discussion of Findings

The researcher assesses the exposure to body fluid among health care workers in Kaduna State hospitals. Table 4.1 revealed the demographic variables of the respondents. The table shows the ages of the subjects that cut across various ages groups with more

concentration in the 26-33 years age range. The percentage score for the range (26-33 years) is 31.3% of the total number of subjects involved in the study. The remaining subjects could be said to be fairly distributed as indicated in the table. The fairly distribution of subjects that cut across the various age group imply that the respondents were at the active stage of care delivering in the respective health facilities. The classification of gender though not equitably distributed, reveals that the opinions of male and female staff of the facilities could be said to be fairly represented in the study. The males account for (45.5%) while the females accounts for (54.5%). On years of working experience of the respondents, the table shows staff of the facilities that were >10 years as hospital workers were relatively few with (4.0%) as workers with <5years (37.7%) and workers with 5-10 years working experience (58.2%). The study could therefore be said to have covered across years of experience of the health workers in the State. On job category of the respondents, the table shows that Nurses equivalent to (51.5%) has the highest percentage score among the respondents. Followed by Lab scientist and Attendance with (16.8%) and (16.1%) respectively. Doctors are the least with (12.1%).

Table 4.2 reveals that age could be a factor, going by the mean scores which are all above the midpoint of 2.5. The table shows the ages of the subjects that cut across various age groups with more concentration in the 26-33 years age range with the mean score of (2.68).This finding supported the work of Sreedharan, *et al.* (2010), Fabin, and Fu-Prudhomot, (2008),Amoran, (2013), Mbaisi et al (2010), Zeleke et al (2013) Azar *et al* (2014), Muluku and Gedefaw (2014) and Omar (2015), which stated that more than 50% of the respondents were young staff with mean age of 32.14 years. In contrary Lavoie *et al.* (2010) which stated that workers 40 to 49 years old were the largest age

cohort. And also with Getahun and Teresa (2014), and Ibtissam *et al* (2013) which stated that it affects virtually across all ages (20 -60) years and (16 – 64) years respectively

In table 4.3 the mean score of the male staff is (2.8027) compared to the score of the female staff which was (2.6714).This finding supported the work of Amoran, (2013),Getahun and Teresa (2014),Muluku and Gedefaw (2014), and Zeleke *et al* (2013) who found that the male respondents were more exposed than the females. But in contrast to the finding of Gourni, *et al.* (2012), Ibtissam *et al* (2013), and Lavoie, *et al.* (2010), which stated that three-quarters of the survey group in their study were female.

From the mean scores in table 4.4, workers with <5 years of working experience and workers with 5-10 years of working experience tended to be more inclined to indulge in exposure to body fluid in the health facilities than workers with>10 years of working experience that were relatively few in the State. Workers with 5-10 years of working experience have the highest score of 2.70. This might be attributed to the fact that most of the HCWs who had less than 5 years' work experience took training on infection prevention, which enhances their skills and knowledge pertaining to health and safety precautions. This finding is supported by Lavoie, *et al.* (2010), and Getahun and Teresa (2014), who stated that health workers who had worked in the hospital for more than 6 years are more predispose to body fluid exposure. But differs from the findings of Amoran, (2013), Sreedharan, *et al.* (2010), Fabin, and Fu-Prudhomot, (2008), Getahun and Teresa (2014), Muluku and Gedefaw (2014), and Zeleke *et al* (2013) who found more predisposing factor to be among the younger staff, in the group with experience of 5years or less.

On job category of the respondents, table 4.5 shows that Nurses equivalent to (3.10) have the highest mean score among the respondents. This finding is supported by Singru and Banerjee, (2008), Hsieh, et al (2006), Azar et al (2014), Muluku and Gedefaw (2014) Omar (2015), and Sabbah, *et al.* (2013), who found that nursing personnel are the most commonly affected group. It is also in agreement with other studies, Monge, *et al.* (2001), Ndiaye, *et al.* (2011), and (Amoran, 2013). But it differs from that reported by other authors Musharrafieh, *et al.* (2008), Ibtissam et al (2013) and Wicker *et al.* (2007), who found the highest frequency of injury among physicians, compared to nurses. This distribution could be associated with the health personnel requirement in the facilities which tended to be more associated with professionalism and thus have more to do with job category.

In the test of the first hypothesis of the study, the staff were found to have rated their exposure to body fluid hazards to be significant. The null hypothesis was therefore rejected. From the related data it was found that the nature of the routine duties of the staff like the use of needles and other such instruments, attendance to were child delivery and test of blood samples in the laboratories among others. The finding here agrees with the reports of Henderson, (2012), and Karmon, Mehta and Brehm, (2013); who respectively pointed out that there are more than 400,000 parental exposures suffered by healthcare workers in the US every year and that every year, 1 out of 10 healthcare workers in the US suffers a splash exposure or a needle stick injury.

Hypothesis one tested for differences in the age grouping of the staff in their disposition to body fluid hazards in the health facilities. One way analysis of variance used for the test did not reveal significant differences associated with the different age

groups of the staff. The null hypothesis was therefore retained. The mean scores revealed that the staff rated their exposure to body fluid hazards in the dispensation of their duties to almost equal levels.

Hypothesis two tested possible difference between male and female staff in their rated exposure to body fluid hazards in the State. The result of the two sample t-test used for the test reveal significant difference between the male and female staff in the rated exposure to body fluid hazards in the hospitals. The null hypothesis was therefore rejected. From the analysis of the related items, it was observed that both groups were disposed to the exposure to body fluid hazards but the male were more disposed to the hazards than the female. This was the basis of the observed difference between the groups.

Hypothesis three tested for differences in the years of working experience of the staff in their disposition to body fluid hazards in the health facilities. One way analysis of variance used for the test did not reveal significant differences associated with the different years of working experience of the staff. The null hypothesis was therefore retained.

The effect of job category on the staff exposure to body fluid hazards in the discharge of their routine duties was tested in hypothesis four. The hypothesis was tested with the one ways analysis of variance and the result revealed significant difference in the rated exposure levels of the staff with different job category to the body fluid hazards in the hospitals. The null hypothesis was therefore rejected.

CHPATER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the assessment of exposure to body fluids hazards among health care workers in Kaduna State hospitals. The chapter includes among others the conclusion, recommendations and suggestions for further study on the subject.

5.2 Summary

Occupational exposure to body fluids among health care workers consists a major occupational hazard. Such hazards include HIV, hepatitis among others. Healthcare workers exposures and potential exposures to these pathogens are considered to be widespread in health facilities across the world, including Nigeria and Kaduna State. Few studies from Northern Nigeria, where Kaduna State is located, have reported high prevalence of various forms of occupational exposures to body fluids among health workers. Dimie, *et al.* (2014). However, no study has been conducted in Kaduna State on the hazards of body fluid exposure among health care workers. This study therefore assess exposure of health workers in Kaduna State hospitals to body fluid hazards, and whether there are certain factors that predispose them to such exposure.

To accomplish the objectives of the study, a structured questionnaire was designed and administered to health care workers across the health facilities in the three senatorial zones of Kaduna State through a stratified sampling procedure. In all 297 health care workers of different cadres successfully filled and returned the questionnaires that were administered to them for the study. The data collected were subjected to a

descriptive analysis using frequency and percentages tables for the demographic characteristics and the research questions of the study. The hypotheses were tested using the inferential statistics using the t-test and analysis of variance procedures. A total of four null hypotheses were tested. A summary of the major findings from the analysis of the data and test of the hypotheses are presented below.

5.2.1 Summary of Major Findings

The major findings of the study are:

1. the age of health workers is not a significant factor in their exposure to body fluid hazards in Kaduna State hospitals;
2. gender is a significant factor of healthcare workers exposure to body fluid hazards in Kaduna State hospitals;
3. years of working experience is not a significant factor of healthcare workers exposure to body fluid hazards in Kaduna State hospitals; and
4. job category of health care workers is a significant factor of their exposure to body fluid hazards in Kaduna State hospitals.

5.3 Conclusion

From the analysis of the data and test of the hypotheses of this study, the researcher would want to conclude as follows:

1. Age is not a predisposing factor of exposure to health workers' exposure to body fluid hazards in the State hospitals.
2. Gender is a significant factor of exposure to body fluid hazards among health workers in the State hospital.

3. Years of working experience of health care workers is not a predisposing factor to health workers' exposure to body fluid hazards in the State hospitals.
4. Job category of health care workers is a predisposing factor of exposure to health workers' exposure to body fluid hazards in the State hospitals.

5.4 Recommendations

Based on the findings from the study, the researcher recommends as follows:

1. The State government should provide protective devices against body fluid hazards by health care workers in the State hospitals.
2. There is need for overhauling the approaches to handling hazardous materials in line with WHO standard to avoid possible contamination among health workers.
3. All health care organizations should train health care workers from all categories on infection control procedures and the importance of reporting occupational exposures.
4. Gender of the healthcare workers should be put into consideration during job allocation
5. Proper and consistent use of devices engineered to prevent sharp injuries should be continuously evaluated among different categories of jobs.

5.5 Suggestions for Further Studies

The study could be replicated in other States of the federation towards better management of hazardous routines among health workers in States hospitals.

REFERENCES

Abiola O. O., Olorunfemi A. O., Babatunde I. A., Oladele S. O., Omolara A. O., Titilope A., Akinlolu G. O. (2013).Occupational exposure to HIV and use of post-exposure prophylaxis in a general hospital in North Central, Nigeria. *International Journal of Occupational Safety and Health*, Vol. 3 No 1: 11 – 17.

Adesunkanmi A.K., Badmus T.A., Ogunlusi J.O. (2003). Accidental injuries and cutaneous contaminations during general surgical operations in a Nigerian teaching hospital, *East African Journal of Medicine*. 80(5):227-34.

Ahmed-Lechebed D., Cunat L., Hartemann P., Hautemaniére A., (2012). Prospective observational study to asses hand skin condition after application of alcohol-based hand rub solutions. *American Journal of Infection Control*. 40 (2), 160-164.

AmoranO. E. (2013). Occupational Exposure, Risk Perception and Access to Prophylaxis for HIV/AIDS Infection among Health Care Workers in Northern Nigeria. *British Journal of Medicine & Medical Research* 3(2): 275-287.

Asika, N. (2001).*Research Methods in Behavioural Sciences.* Lagos. Longman Nigeria Plc.

Araoye, M.O.(2005). *Research Methodology with Statistics for Health and Social Sciences*. Ilorin. Nathadex Publishers.

Awusabo-Asare K, Marfo C. (1997) Attitude to management of HIV/AIDS among health workers in Ghana: the case of Cape Coast Municipality. *Health Transition Review Supplement*. 7:271–280.

Azap A., Ergonul O., Menikoglu K.O, (2005). Occupational exposure to blood and body fluids among health care workers in Ankara, Turkey. *American Journal of Infection Control*. 33(1): 48-52.

Aziz A.M. (2008). Tuberculosis and the implications for healthcare workers in hospitals. *British Journal of Nursing*. 17(7):442-447.

Azar H., Mojgan K., Mehrnaz R., Mahboobeh H. A., Nahid H., Shirin A., Negin E.,(2013) Post-Exposure Prophylaxis against HBV and HIV Infection in Health Care Workers Vol. 3(3):7 ,

B. Anagaw, Y. Shiferaw, B. Anagaw, Y. Belyhun, W. Erku, F. Biadgelegn, B. Moges, A. Alemu, F. Moges A. Mulu, (2012) Seroprevalence of hepatitis B and C viruses among medical waste handlers at Gondar town Health institutions, Northwest Ethiopia. *Biomedcentre of Research* Notes 5:55

Bader, M.S., McKinsey, D.S. (2013).Post-exposure prophylaxis for common infectious diseases. *American Family Physician*. 88 (1), 25-33.

Bartlett, J.G, Weber, D.J. (2013). Management of healthcare personnel exposed to HIV. UpToDate, September, 2013. Retrieved 10/18/13.

Beam, E.L., Gibbs, S.G., Boulter, K.C., Beckerdite, M.E., and Smith, P.W. (2011).A method for evaluating healthcare workers' personal protective equipment technique. American Journal of Infection Control. 39 (5), 415-420**.**

Bello, Alkyd resin and Ajayi O.O.S (2000). Research Methods and Statistical analysis. Haytee press and publishing company limited. Ilorin.

Beltrami EM, Williams IT, Shapiro CN, Chamberland ME. (2000). Risk and management of blood-borne infections in health care workers. Clin. Microbiol Rev. 13(3):385-407.

Bernard, J.A., Datillo, J.R., LaPorte, D.M. (2013). The incidence and reporting of sharps exposure among medical students, orthopedic residents, and faculty at one institution. *Journal of Surgical Education*. 70 (5), 660-668.

Basinski, A. (1995). Evaluation of clinical practice guidelines. *Canadian Medical Association Journal* 153: 1575-81.

Black, L. (2013), Chinks in the armor: Percutaneous injuries from hollow bore safety engineered sharps devices. *American Journal of Infection Control*. 41(5), 427-432.

Blenkharn J.I. (2009). Sharps management and the disposal of clinical waste. *British Journal of Nursing.* 18(14):860,862-4.

Bond, W.W., Favero, M.S., Petersen, N.J., et al. (1981).Survival of hepatitis B virus after drying and storage for one week. Lancet 1 (8219), 550-551.

B.R. Sangroam, Kotwal A., A.K. Verma, (2011).Occupational exposure to blood and body fluids amongst health care workers in a teaching hospital of the armed forces, Department of Community Medicine, Afmc, Pure-40 Mjafi. 67:21-24.

Branch-Elliman, W., Weiss, D., Balter, S., Bornschlegel, K., Phillips. M. (2013). Hepatitis C transmission due to contamination of multi-dose medication vials: Summary of an outbreak and a call to action. *American Journal of Infection Control.* 41(1), 92-94.

Brooks A.J., Phipson M., Potgieter A., et al. (1999). Education of the trauma team: video evaluation of the compliance with universal barrier precautions in resuscitation. *Europian Journal of Surgery*. 165(12):1125-8

British Standard. BS OHSAS 1801 (2007). Occupational health and safety management systems – Requirements. London: BS; 2-9.

Camacho-Ortiz, A., Díaz-Rodríguez, X., Rodríguez-López, J.M., Martínez-Palomares, M., Palomares-De la Rosa, A., Garza-Gonzalez E. (2013). A 5-year surveillance of occupational exposure to bloodborne pathogens in a university teaching hospital in Monterrey, Mexico. *American Journal of Infection Control*, 41 (9), e85-e88.

Castillo, J. J, (2009). Stratified Sampling Method. Retrieved March 2012 from Experimental Resources: http//www.experiment-resources.com/stratified-sampling.htlm

Centers for Disease control and prevention (2006). Sexually transmitted diseases treatment guidelines http://www.cdc.gov/std/treatment/2006/hepatitis-b.htm**.**

Centers for Disease control and prevention. (2007). Guidelines for isolation Precautions: Preventing Transmission of Infectious Agents In Healthcare Settings. Retrieved 10/18/13.

Centers for Disease control and prevention. (May 19, 2011). Hand Hygiene in Healthcare Settings. Retrieved 10/17/13.

Centers for Disease control and prevention. (May 21, 2013). Healthcare-associated hepatitis B and C outbreaks reported to the Centers for Disease Control and Prevention (CDC) in 2008-2012. Retrieved 10/22/13.

Centers for Disease control and prevention. (1998).Surveillance of healthcare workers with HIV/Aids. Centers for Disease Control Atlanta, (Accessed November 2002 at http://www.aegis.com/files/cdc/FactSheets/1998/HCW.pdf).

Centers for Disease control and prevention.(2001). Recommendations for prevention of transmission of human immunodeficiency virus and hepatitis B virus to patients during exposure-prone procedures. Retrieved 10/24/13.

Centers for Disease control and prevention.(2008). Workbook for Designing, Implementing, and Evaluating a Sharps Injury Prevention Program. Retrieved 10/23/13.

Centers for Disease Control and Prevention. Updated US Public Health Service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for post exposure prophylaxis. Morbidity and Mortality Weekly Report. 2001. pp. 21–23. http://www.cdc.gov/MMWR /preview/MMWRhtml/rr5011a1.htm. [PubMed].

Centers for Disease Control and Prevention. Workbook for designing, implementing and evaluating a sharps injury prevention program. 2004. Available from: http://www.cdc.gov/sharpssafety/pdf/WorkbookComplete.pdf.

Chow, A., Arah, O.A., and Chan, S.P. (2012). Alcohol hand rubbing and chlorhexidine hand washing protocols for routine hospital practice: A randomized clinical trial of protocol efficacy and time effectiveness. *American Journal of Infection Control.* 40 (9), 800-805.

CiorliaL.A., Zanetta D.M., (2009). Hepatitis B in healthcare workers: prevalence, vaccination and relation to occupational factors. *Brazil Journal of Infection and Disease.* (5):384-9.

Clarke S.P., Rockett J.L., Sloane D.M., Aiken L.H. (2002). Organizational climate, staffing and safety equipment as predictors of needlestick injuries and near-misses in hospital nurses. *American Journal of Infection Control*. 30: 207-16.

Clement I. M., Comfort A. E., Olajide J. A and Ukeme U. I. (2014). Behavioural and occupational risk factors associated with hepatitis B surface antigen (HBsAg) among healthcare workers in a tertiary teaching hospital, in South Nigeria. *Journal of Microbiology and Biotechnology Research.,* 4 (5):1-8

Cosens B. (2012). Needle-stick guideline. eMedicine, November 30, 2012. Retrieved 10/20/13.

Crews, J.D., Whaley, E., Syblik, D., Starke, J. (2013).Sustained improvement in hand hygiene at a children's hospital. *Infection Control and Hospital Epidemiology*, 34(7).751-753.

Cutter J, Jordan S. (2004) Uptake of guidelines to avoid and report export to blood and body fluids.JAdvNurs. 46(4):441-452.

Davis, D. A., and A. Taylor-Vaisey. (1997). Translating guidelines into practice: Summarizing theoretical concepts, practical experience and research evidence in the adoption of clinical practice guidelines. Unpublished manuscript.

De Schryver, A., Claesen, B., Meheus, A., Van Sprundel, M., Francois, G. (2011).European survey of hepatitis B vaccination policies for healthcare workers. *European Journal of Public Health*. 21(3), 338-343.

Dement JM. Epling C, Ostbye T. Pompeii LA, Hunt DL. Blood and body fluid exposure risks among health care workers: results from the Duke Health and Safety surveillance system. *Am J Ind Med* 2004; 46(6): 637-48.

Deuffic-Burban, S., Delarocque-Astagneau, C., Abiteboul, D., Bouvet, E., Yazdanpanah, Y. (2011).Bloodborne viruses in healthcare workers: Prevention and management. *Journal of Clinical Virology*. 52 (1), 4-10.

Dhawan, V. K. (2013). Hepatitis C. eMedicine, September 18, 2013. Retrieved 10/25/13.

Dienstag, J.L. (2012). Acute viral hepatitis. In: Long, D. l., Fauci, A.S., Kasper, D.L., Hauser, S.L., Jameson, J.L., Loscalzo, J., eds. Harrison's Principles of Internal, on-line ed. 18th ed. New York, NY: McGraw-Hill. Retrieved 10/24/13 from UConn Health Center.

Dimie O., Kemebradikumo P., Babatunde A., George C., Christian I., Sanusi G.,.(2014). Prevalence and determinants of occupational exposures to blood and body fluids among health workers in two tertiary hospitals in Nigeria, Ogoina*et al.,African Journal of Infection and Disease*. 8(2): 50 – 54.

Edmonds, S.L., Macinga, D.R., Mays-Suko, P., et al. (2012). Comparative efficacy of commercially available alcohol-based hand rubs and World Health Organization-recommended hands rubs: formulation matters. *American Journal of Infection Control*. 40 (6), 521-525.

Elliott SKF, Ketton A, Holt A. Medical students' knowledge of sharps injuries. *J Hospl Infect.* 2005, 60:374-377.

Eveland, J.D. 1986.Diffusion, technology transfer and implementation. Thinking and talking about change. Knowledge: Creation, Diffusion Utilization 8:303-22.

Everline M. M., Zipporah N., Peter W., Jared O. (2010) Prevalence and factors associated with percutaneous injuries and splash exposures among health-care workers in a provincial hospital, Kenya. *The Pan African Medical Journal.* 2013;14:10

Fabin, C. and Fu-Prudhomot, P. (2008) Observatoire ACMS des accidents avec exposition au sang (AES) bilan de 5 ans de fonctionnement. Cahier de Medecine Inter Professionnelle, 2, 117 124.http://www.camip.info/IMG/pdf/ObservatoireAESACMS5ans2008-2-2.pdf.

Fica CA, Cifuentes DM, Ajenjo HM., Jemenao PM, Zambrano OA, Febre VN, Tuberculosis en el personal de salud. *Rev ChilenaInfectol*. 2008:25(4):243-55.

Flores A., Pevalin, D. (2006).Healthcare workers compliance with glove use and the effect of glove use on compliance with hand hygiene. Journal of Infection Prevention. 7(6), 15-18.

Fuller, C., Savage, J., Besser, S. (2011)."The dirty hand in the latex glove."A study of hand hygiene compliance when gloves are worn. *Infection Control and Hospital Epidemiology*. 32 (12), 1194-1199.

Garus-Pakowska, A., Sobala, W., Szatko, F. (2013).The use of protective gloves by medical personnel. International Journal of Occupational Medicine and Environmental Health. 26 (3), 423-429.

Getahun K. B., and Teresa K. B., (2014) Epidemiology of exposure to HIV/AIDS risky conditions in healthcare settings: the case of health facilities in Gondar City, North West Ethiopia *BMC* Public Health 14:1283 Accessed http://www.biomedcentral.com/1471-2458/14/1283

Gerberding JL, Littell C, Tarkington A, Brown A, Scheter WP. Risk of exposure to surgical personnel to patients' blood at San Francisco General Hospital: *N Eng. J. Med* 1990:322:1788-1793.

Gourni P, Polikandrioti M, Vasilo Poulos G, Mpalthzi E, Gourni M, Occupational exposure to blood and body fluids of Nurses at Emergency Department. *Health Science Journal* © All Rights Reserved E-ISSN. 2012: 11(6); 791-809.

Greer, A. L., 1988. The State of the art versus the State of the science, the diffusion of new medical technologies into practice. *International Journal of Technology Assessment in Health Care* 4:5-28.

Gurubacharya Dl, Mathura KC, Karki DB. Knowledge attitude and practices among healthcare workers on needle- stick injuries. *Kathmandu Univ Med J* (KUMJ). 2003; 1(2):91-4.

Health and Safety Executive with the Advisory committee on Dangerous pathogens (2008) protection against blood – borne infections in the workplace: HIV and hepatitis. http://www.hse.gov.uk/biosafety/diseases/bbv.pdf.

Heininger, U., Gambon, M., Gruber, Margelli, D. (2010).Successful hepatitis B immunization in non- and low-responding healthcare workers. Human Vaccines. 6 (9), 725-728.

Henderson, D. K. (2003).Managing occupational risks for hepatitis C transmission in the healthcare setting.Clinical Microbiology Reviews. 16 (3), 546-568.

Henderson, D.K. (2012). Management of needlestick injuries. A house officer who has a needlestick. *Journal of the American Medical Association*. 37 (1), 75-84.

Hepatitis B position paper. Geneva: World Health Organization; 2004. http://www .who.int/immunization /wer7928HepB_July04_position_paper.pdf.

Hersey JC. Martin LJ. Use of infection control guidelines by workers in health care facilities to prevent occupational transmission of HBV and HIV: results from a national survey. *Infect Control Hosp. Epidemiol* 1994: 15: 243-52.

Hoffman C, Buchholz L., Schnitzler P. (2013). Reduction of needlestick injuries in healthcare personnel at a university hospital using safety devices. *Journal of Occupational Medicine and Toxicology.* 8 (1), 8-20.

Horlocker T.T., Birnbach, D.J., Connis, R.T. (2012). Practice Advisory for the Prevention, Management, and Diagnosis of Infectious Complications Associated with Neuroaxial Techniques. A Report by the American Society of Anesthesiologists Task Force on Infectious Complications Associated with Neuroaxial Techniques. Anesthesiology. 112 (3), 530-545.

Hosoglu, S., Celen, M.C., Akalin, S., Geyik, M.F., Soyoral, Y., Kara, I.H. (2003). Transmission of hepatitis C by blood splash into conjunctiva in a nurse. *American Journal of Infection Control.* 31(8), 502-504.

Hsieh WB, Chiu NC, Lee CM, Huang FY. Occupational blood and infectious body fluid exposures in a teaching hospital: a three-year review. *Journal of Microbial Immunol Infection* 2006; 39(4):321-7.

Ibtissam S., Hala S., Sanaa S., Hussein A., Nabil D.,(2013) Occupational exposures to blood and body fluids (BBF): Assessment of knowledge, attitude and practice among health care workers in general hospitals in LebanonVol.5 No.1(2013), Article ID:26524,9 .

Ifah, S. (1996).Introduction to Social Statistics. Department of Sociology and Anthropology University of Maiduguri, University of Maiduguri Printing Press.

Ilhan M.N. Durukan E, Aras E, (2006). Long working hours increased risk of sharp and needle-stick injury in nurses: the need for new policy implication. *Journal of Advance Nursing* ;56(5):563-568.

ILO Code of practice. Safety and Health in Ports Geneva: 2005.

Jaber P., Nazanin I., and Farideh G., (2013) Factors Associated with Needle Stick and Sharp Injuries among Health Care Workers *international journal of occupational hygiene* (IJOH) 5: 191-197.

Joint ILO/WHO guidelines on health services and HIV/AIDS: Fact sheet No. 4. Geneva: International Labour Organization; 2005.

K Vaz, D Mcgrowder, R Alexander-Lindo, L Gordon; P Brown, R Irving, Knowledge, Awareness and Compliance with Universal Precautions among Health care workers at the university hospital of west Indies, Jamaica Faculty of Medical Sciences Of West Indies; Mona, Kingston 7, 2010; 4(1): 171-181.

Kaduna State Ministry of Health, Comprehensive List State Hospitals, year 2013/2014, State Ministry of Health, Kaduna State, Nigeria.

Kamali, S., Krawczynski, K., McCaustland, K. Li, X., Alter, M. (2007).Infectivity of hepatitis C virus in plasma after drying and storing at room temperature. *Infection Control and Hospital Epidemiology*. 28 (9), 519-524.

Karani H, Rangiah S, Ross AJ, Occupational exposure to blood-borne or body fluid pathogens among Medical Inters at Adington Hospital, Durban. (P) Peer Reviewed. © Saafp S AfrFamPract 2011; 53(5):462-466.

Karmon, S.L., Mehta, S.A., Brehm, A., Dzurenko, J., Phillips, M. (2013). Evaluation of bloodborne pathogen exposures at an urban hospital. *American Journal of Infection Control*. 41(2), 185-186.

Kermode M, Jolley D, Langkham M, Thomas MS, Crofts N, Occupational exposure to blood and risk of bloodborne virus infection among health care workers in rural north Indian health care settings. *American Journal of Infection Control*.2005:33:34-41.

Kermode M, Jolly D, Langkham B, Thomas MS, Holmes W, Gifford SM. Compliance with Universal/Standard Precautions among health care works in rural north India. *Indian Journal of Infect Control* 2005; 33: 27-33.

Kesieme EB, Uwakwe K, Irekpita E, Dongo A, Bwala KJ, Alebeleye BJ. Knowledge of Hepatitis B Vaccine among Operating Room Personnel in Nigeria And Their Vaccination Status. Hepat Res Treat, 2011; 2011: 157089.

Kuhar, D.T., Henderson, D.K., Struble, K.A. (2013). Updated US Public Health Service Guidelines for the management of occupational exposure to human immunodeficiency virus and recommendations for post-exposure prophylaxis. *Infection Control and Hospital Epidemiology*. 34(9), 875-892.

Landovitz RJ, Currier JS, Post-exposure prophylaxis for HIV infection. NEJM, 2009. 361:168-175.

Lavoie MC, Yassi A, Bryce E, Fujii R, Logronio M, Tennassee M, et al. International collaboration to protect Health Workers from infectious diseases in Ecuador, Rev PanamSaludPublica. 2010:27(5):396-402.

Legge A. Sharps Disposal Systems. Prof Nurse. 1996;12(1):57-62.

Leiss JK, Ratcliffe JM, Lyden JT, Sousa S, Orelien JG, Boal WL, Jagger J (2006): Blood exposure among paramedics: Incidence rates from the national study to prevent blood exposure in paramedics Ann. Epidemiol 16(9): 720 – 725.

Logez S. Soyolgerel G, Fields R, Luby S, Hutin Y. Rapid assessment of injection practices in Mongolia (2001) In: WHO. Pilot-testing the WHO tools to assess and evaluate injection practices: A summary of 10 assessments coordinated by WHO in seven countries (2000-2001). Geneva: WHO/BCT/03. 10; 2003.

Lohiya GS, Tan-Figueroa L, Lohiya S, Lohiya S. (2013) Human bites: bloodborne pathogen risk and postexposure follow-up algorithm. *J Natl Med Assoc*. Spring 2013;105(1):92-5.

Lomas .J. 1993. Diffusion, dissemination and implementation: who should do what? Annals of the New YorkAcademy of Sciences 703:226-35.

MacCannel, T., Laramie, A.K., Gomaa, A., Perz, J.F. (2010). Occupational exposure of healthcare personnel to hepatitis B and hepatitis C: prevention and surveillance strategies. Clinics in Liver Disease. 14 (1), 23-36.

Marra, A.R., Edmond, M.B. (2012). Hand hygiene: State-of-the art review with emphasis on new technologies and mechanisms of surveillance. Current Infectious Disease Reports. 14 (6), 585-591.

Mast, S.T., Woolwine, J.D., Gerberding, J.L. (1993). Efficacy of gloves in reducing blood volumes transferred during simulated needlestick injury. *Journal of Infectious Diseases*. 168(6), 1589-1592.

Mbaisi EM, Ng'ang'a Z, Wanzala P, Omolo J: (2013) Prevalence and factors associated with percutaneous injuries and splash exposures among health-care workers in a provincial hospital, Kenya, 2010. *Pan African Medical Journal* 2013., 14(10) doi:10.11604/pamj.2013.14.10.1373

Mehrdad A, Malekmakan L. The prevalence of needlestick injuries in Medical, Dental, Nursing and Midwifery students at the University Teaching Hospitals of Shiraz, Iran. *Indian journal of Medical Sciences* 2006; 60:227-32.

Mehrdad R, Atkins EH, Sharifian SA, Pouryaghoub G. (2014) Psychosocial factors at work and blood-borne exposure among nurses. *International Journal of Occupational and Environmental Medicine*, 4:32-39

Menzies D. Joshi R. Pai M. Risk of tuberculosis infection and disease associated with work in health care settings. Int J Tuberc Lung Dis. 2007:11(6):593-605.

Merchant RC, Becker BM, Mayer KH, (2003). Emergency department blood or body fluid exposure evaluations and HIV post exposure prophylaxis usage. AcadEmerg Med. 10(12):1345-1353.

Michelin, A., Henderson, D.K. (2010).Infection control guidelines for prevention of healthcare-associated transmission of hepatitis B and C viruses. Clinics in Liver Diseases. 14(1), 119-136.

Mitchell R., Roth, R., Gravel, D. (2013). Are healthcare workers protected? An observational study of selection and removal of personal protective equipment in Canadian acute care hospitals. *American Journal of Infection Control*. 41(3), 240-244.

Monge, V., Mato, G., Mariano, A., Fernández, C. and Fereres, J. (2001) Epidemiology of biological-exposure incidents among Spanish healthcare workers. Infection Control and Hospital Epidemiology, 22, 776-780. doi:10.1086/501862.

Morbidity and Mortality Weekly Report. (November 25, 2011). Immunization of healthcare personnel. Recommendations of Bader, M.S., McKinsey, D.S. (2013).Post-exposure prophylaxis for common infectious diseases. American Family Physician. 88 (1), 25-33. the Advisory Committee on Immunization Practices (ACIP). Retrieved 10/19/13 from the CDC.

Muluken A. Y. and Gedefaw A. F.,(2014) Occupational Exposure to Blood and Body Fluids Among Health Care Professionals in Bahir Dar Town, Northwest Ethiopia. Saf Health Work. 2014 Mar; 5(1): 17–22.

Musharrafieh, U.M., Bizri, A.R.N., Nassar, N.T., Rahi, A.C., Shoukair, A.M., Doudakian, R.M., and Hamadeh, G.N. (2008) Health care workers' exposure to bloodborne pathogens in Lebanon. Occupational Medicine, 58, 94-98. doi:10.1093/occmed/kqm139.

Ndiaye, M., Cissokho, B.D. and Sow, M.L.L. (2011) Les accidents avec exposition au sang (AES) au CHNU de Fan de Dakar (Senegal). CAMIP—L'Actualite de la Sante au Travail, 1, 10 p.http://www.camip.info/IMG/pdf/AES_Senegal.pdf.

Nworgu, B.G. (1991). Educational Research. Basic Issues and Methodology. Wisdom publ. Ltd Ibadan. Nigeria.

Occupational Health Center.(1995). Occupational hazards for hospital workers, Manitoba. Revised August 2006 Retrieved from http://www. Mflohc.mb.ca/fact_sheets_folder/hospital_hazards_revised.pdf.

Occupational Safety and Health Administration Occupational exposure to blood borne pathogens; final rule. Federal Register 1991; 56: 64003 – 62182.

Odujurin O.M, Adegoke O.A. Aids: Awareness and blood handling practices of healthcare workers in Lagos. Nig. J Epidl 1995; 11(4)425-30.

Omar A.A., Abdo N.M., Salama M.F., Al-Mousa H.H.(2015) Occupational Injuries Prone to Infectious Risks amongst Healthcare Personnel in Kuwait: A Retrospective StudyMed Princ Pract 2015;24:123-128.

Olowu O., Oluaje E.Y., Kehinde O.I., Knowledge and practice of universal precautions among final year medical and dental students in university college in Ibadan. Dokita 2001; 28 (1) 6-9.

Orji E.O., Fasubaa O.B., Onwudiegwu U. (2002) Occupational health hazards among health care workers in an obstetrics and gynaecology unit of a Nigerian teaching hospital. *Journal of Obstetrics and Gynaecology* ; 22(2):75-8.

Patton G.C., Coffey C., Sawyer S.M. (2009). Global patterns of mortality in young people: a systematic analysis of population health data. Lancet, 2009; 374 (9693):853-854.

Pearlman, B. (2004). Hepatitis C infection: A clinical review. *Southern Medical Journal*. 97 (4) 365-376.

Phipps W., Honghong W., Min Y., Brugess J., Pellico L., Watkins C.W., (2002) Risk of medical sharps injuries among Chinese Nurses. *American Journal of Infection Control*.2002; 30: 277-82.

Pillay K., Colvin M., Williams R., Coovadia H.M., Impact of HIV-1 infection South Africa.Arch Dis Child. 2001:85:50-51.

Pondé, R.A., (2011). Hidden hazards of HCV transmission. Medical Microbiology and Immunity. 200 (1), 7-11.

Prüss-Üstün A., Rapiti E., Hutin Y. Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. American Journal of Industrial Medicine. 2005; 48(6):482–490. http://www .who.int/quantifying_ehimpacts/global/7sharps.pdf. [PubMed].

Pruss-Ustus A., Rapiti E., Hutin Y., 2003.Sharps injuries: global burden of disease from sharps injuries to healthcare workers. World Health Organization, Geneva (WHO Environmental Burden of Disease Series No. 3).

Puro V., De Carli G., Cicalini S., Soldani F., Balslev U., Begovac J. (2005). European Occupational Post-Exposure Prophylaxis Study Group. European recommendations for the management of healthcare workers occupationally exposed to hepatitis B virus and hepatitis C virus. Euro Surveill. 2005; 10(10):260-4.

Radcliffe, R., Meites E., Briscoe, R. (2012). Severe methicillin-susceptible Staphylococcus aureus infections associated with epidural injections at an outpatient clinic. American Journal of infection Control, 40 (2), 144-149.

Reda A.A., Fisseha S., Mengistie B., Vandeweerd J.M. Standard precautions: occupational exposure and behavior of health care workers in Ethiopia. PLoS ONE. 2010;5:1–6.

Rhode, K.A., Dupler, A.E., Postma, J., Sanders A. (2013).Minimizing nurses' risks for needlestick injuries in the hospital setting. Workplace Health & Safety. 61 (5), 197-202.

Richman G., Dorsey A., Stayer S., Schwartz R. (2000) Compliance with Standard Precautions among Pediatric Anesthesia Providers. *The Internet Journal of Anesthesiology* 2000 4(4):1-8.

Rock, C.R., Harris, A.D., Reich, N.G., Johnson, J.K., Thom, K.A., (2013). Is hand hygiene before putting on non-sterile gloves in the intensive care unit a waste of healthcare worker time? – A randomized, controlled study. American Journal of Infection Control, Jul 24. pii: S0196-6553(13)00848-1. doi: 10.1016/j.ajic.2013.04.007. [Epub ahead of print].

Rogers, E.M. 1995. Diffusion of innovations. 4thed. New York: Free Press.

Sabbah, I., Sabbah, H., Sabbah, S., Akoum, H. and Droubi, N. (2013) Occupational exposures to blood and body fluids (BBF): Assessment of knowledge, attitude and practice among health care workers in general hospitals in Lebanon.*Health*, 5, 70-78. doi: 10.4236/health.2013.51010.

Sagoe-Moses C, Pearson RD, Perry J, Jagger J. (2001) Risks to health-care workers in developing countries.*NEngl J Med* 2001; 345:538-541.

Sangwan, M.C.B.R., Kotwal, C.A. and Verma, B.A.K. (2011) Occupational exposure to blood and body fluids amongst health care workers in a teaching hospital of the armed forces. *Medical Journal Armed Forces India,* 67, 21-24.

Shariati B., Shahidzadeh-Mahani A., Oveysi T., Akhaghi H. Accidental exposure to blood in medical interns of Tehran University Of Medical Science. J Occup Health, 2007; 49:317-321.

Shen N. J., Pan S. C., Sheng, W. H., et al. (2013) Comparative antimicrobial efficacy of alcohol-base hand rub and conventional surgical scrub in a medical centre. Journal of microbiology, immunology, and infection, sep 21. Pii: S 1684 – 1182(13)00 150-3 doi: 10. 1016/j.jmii.2013.08.005.

Simith D.R., Smyth W., Leggat P.A., Wang R.S., (2006) Needlestick and sharps injuries among nurses in a tropical Australian hospitals.*Int J NursPract* 12, 71-7.

Sreedharan, J., Muttappallymyalil, J. and Venkatramana, M. (2010) Knowledge and practice of standard measures in occupational exposure to blood and body fluids among nurses in a UniversityHospital in the United Arab Emirates. *Italian Journal of Public Health*, 7, 90-94.

Strasser, M., Aigner, E., Schmid, I. (2013). Risk of hepatitis C virus transmission from patient to healthcare worker: A prospective, observational study. Infection Control and Hospital Epidemiology. 34 (7), 759-761.

Sukriti Pati N.T., Sethi A., Agrawal K., Agrawal K., Kumar G.T. (2008). Low levels of awareness, vaccine coverage, and the need for boosters among health care workers in tertiary care hospitals in India. *J Gastroenterol Hepatol*. 2008; 23(11):1710-5.

Talas M.S., Occupational exposure to blood body fluids among Turkish Nursing Students during clinical practice training; frequency of needle stick/sharp injuries and hepatitis B immunization*. J. ClinNurs*. 2009; 18(10) 1394 – 403.

Thomas, D.L., Factor, S.H., Kellen, G.D. (1993). Viral hepatitis in healthcare personnel at Johns Hopkins Hospital: The seroprevalence of and risk factors for hepatitis B virus and hepatitis C virus infection. *Annals of Internal Medicine*. 153 (14), 1705-1712.

Titler, M.G., C. Kleiber, V. Steelman, C. Goode, B. Rakel, J. Barry-Walker, S. Small and K. Buckwalter.Infusing research into practice to promote quality care.Nursing Research.1994; 43:307-13.

Tokars J. I., Chamberland M. E., Schable C. A., Culver D. H., Jones M., McKibben P. S., Bell D. M., the American Academy of Orthopaedic Surgeons Serosurvey Study Committee *(1992) A survey of occupational blood contact and HIV infection among orthopedic surgeons. JAMA 268:489–494.*CrossRefMedline.

Weber D.J., Rutala, W.A., Eron J. (2012). Management of healthcare workers exposed to hepatitis B virus or hepatitis C virus. Up To Date, October 3. 2012. Retrieved 10/18/13.

Weiner-Well, Y., Galuty, M., Rudenksy, B., Schlesinger, Y., Attias, D., Yinnon, A.M. (2011).Nursing and physician attire as possible source of nosocomial infection.*American Journal of Infection Control*. 39 (7), 555-559.

Weiss S.H., Saxiinger W.C., Rechtman D., Grieco M.H., et al. HTLV III infection among health care workers. Association with needle – stick injuries. JAMA 1985; 254: 2080 – 2093.

Wenzel E. Conceptual issues in worksite health promotion. In: Chu C, Simpson R. (eds) The ecological public health: From vision to practice. [Online] Centre for Health Promotion, University Toronto/ Institute of Applied Environmental Reearch, GriffithUniversity 1994; 172. [Accessed Dec 14 2008]; Available from: URL: http://www.1db.org/whpr.htm .

Werner, J.M., Abdalla, A., Gara, N., Ghany, M.G., Rehermann, B. (2013). The hepatitis B vaccine protects re-exposed healthcare workers, but does not provide sterilizing immunity. Gastroenterology. 45(5), 1026-1034.

Wicker, S., Jung, J., Allwinn, R., Gottschalk, R. and Rabenau, H.F. (2007) Prevalence and prevention of needlestick injuries among health care workers in a German university hospital. International Archives of Occupational and Environmental Health, 81, 347-354. Doi: 10.1007/s00420-007-0219-7.

Wilburn S.Q., Eijkemans G. (2004) Preventing needlestick injuries among healthcare workers: a WHO-ICN collaboration. Int, Occup Environ Health. 2004; 10: 451 – 456.

Willy M.E., Dhillon GL, Loewen NL, Wesley RA, Henderson DK, (1990) Adverse exposures and universal precautions practices among a group of highly exposed health professionals. *Infect Control Hosp. Epidemiol* 1990; 11: 351 – 356.

World Health Organization, (2010).Best Practices for Injections and Related Procedures ToolkitGeneva: World Health Organization; March 2010.WHO Press, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland ISBN-13: 978-92-4-159925-2.bookorders@who.int.

World Health Organization, (2008).Training for mid-level managers, module 3 Immunization safety.Department of Immunization, Vaccines and Biologicals.Family and Community health, 20, Avenue Appia, CH-1211, Geneva 27 Switzerland [MLM]-WHO/VB/08.03.Retrieved from http://www.who.int/immunization/en/.

World Health Organization, Aide-Memoire for a strategy to protect health workers from infection with bloodborne viruses. Geneva: Department of Blood Safety and Clinical Technology, WHO; 2003. Available at: http://www.who.int/injection_safety/toolbox/en/AM_HCW_Safety_EN.pdf. Accessed July 11, 2007.First citation in article).

World Health Organization, (2009).World Health Organisation Guidelines On Hand Hygiene In Healthcare. Retrieved 10/17/13.

World Health Organization, (2006).Universal Precautions including injection Safety.www.whoint/hir/tropics/precautions/unhiversal/an, 22.4.

World Health Report 2002: Reducing risks, promoting healthy life. Available from: http//www.who.int/whr/en.accessed Jan 2009.

World Health Organization. Ottawa Charter for Health Promotion. Geneva 1986;WHO/HPR/HEP/ 95.1.

World Health Organization, Regional Office for South – East Asia and Regional Office for Western Pacific, SEARO regional publication no. 41 WHO practical guidelines for infection control in health care. 2004.

Yamane, T.(1967). *''Statistics; an introductory analysis''*. New York; Harper and Row.

Yang, Y.H., Wu, S.J., Wang, C, L. (2013). Incidence of needlestick and other sharp object injuries in newly graduated nurses. *American Journal of Infection Control*. 41 (10), 944-945.

Zeleke Y. N., Tadese E. T., Gebeyaw T. K., (2013),Managements of Exposure to Blood and Body Fluids Among Healthcare Workers and Medical Students in University of Gondar Hospital, Northwest of Ethiopia. Global Journal of Medical Research Volume 13 Issue 5 Version 1.0.

APPENDIX I

DEPARTMENT OF PHYSICAL AND HEALTH EDUCATION
FACULTY OF EDUCATION
AHMADUBELLOUNIVERSITY, ZARIA

QUESTIONNAIRE

INTRODUCTION

This research intends to **"Assessment of Exposure to Body Fluids among Health Care Workers in Kaduna State Hospitals."** The information obtained from the questionnaire will be kept strictly confidential and be used only for research purposes. Your participation in the study is completely voluntary.

Thank you.

DEPARTMENT OF PHYSICAL AND HEALTH EDUCATION, AHMADUBELLOUNIVERSITY, ZARIA

DATA SHEET FOR RESEARCH ON ASSESSMENTOF EXPOSURE TO BODY FLUIDS AMONG HEALTHCARE WORKERS IN KADUNA STATE HOSPITALS

Respondents should please tick the most appropriate answer, choosing from the key words below:

SA = Strongly Agreed

A = Agreed

D = Disagreed

SD = Strongly Disagreed

SECTION A: DEMOGRAPHIC DATA

1. Sex: Male [ ] Female [ ]

2. Age group

a. 18—25 [ ]

b. 26—33 [ ]

c. 34—41 [ ]

d. 41 and above

3. Years of working experience:

a. <5 years [ ]

b. 5-10 years [ ]

c.>10 years [ ]

4. Job category

a. Doctors [ ]

b. Nurses [ ]

c. Lab technicians [ ]

d. Attendance [ ]

SECTION B: AGE AS A PREDISPOSING FACTOR

S/N	VARIABLES	SA	A	D	SD
5	Healthcare workers that are 18 to 25 years of age are more predispose to body fluid exposure				
6	Healthcare workers that are 26 to 33 years of age are more predispose to body fluid exposure				
7	Healthcare workers that are 34 to 41 years of age are more predispose to body fluid exposure				
8	Healthcare workers that are 41 and above years of age are more predispose to body fluid exposure				

SECTION C: JOB CATEGORY AS A PREDISPOSING FACTOR

S/N	VARIABLES	SA	A	D	SD
9	Majority of cadre that experience exposure to body fluids are Attendants				
10	Majority of cadre that experience exposure to body fluids are Nurses				
11	Majority of cadre that experience exposure to body fluids are Laboratory Staff				
12	Majority of cadre that experience exposure to body fluids are Doctor				

SECTION D: YEARS OF EXPERIENCE AS A PREDISPOSING FACTOR

S/N	VARIABLES	SA	A	D	SD
13	Health care workers with less than 5 years working experience are more predispose to body fluid exposure				
14	Health care workers with 5 – 10 years working experience are more predispose to body fluid exposure				
15	Health care workers with more than 10 years working experience are more predispose to body fluid exposure				

SECTION E:GENDER AS A PREDISPOSING FACTOR

S/N	VARIABLE	SA	A	D	SD
17	Female gender are more predispose to body fluid exposure in the hospital				
18	Male gender are more predispose to body fluid exposure in the hospital				

APPENDIX II

SAMPLE AND SAMPLING TECHNIQUE

According to Yamane, (1967) the formula for calculating sample size is as follows:

$$n = \frac{N}{1 + N(e)^2}$$

Where;

n = sample size

N = population size

e = level of precision which is constant with a value of 0.05 or 5%

Therefore; $n = \frac{2548}{1 + 2548(0.05)^2}$

$$n = \frac{2548}{1 + 2548 * 0.0025}$$

$$n = \frac{2548}{1 + 6.37}$$

$$n = \frac{2548}{7.37}$$

=345.7 approximately = 346, Therefore the sample size was 346.

APPENDIX III

SAMPLE SIZE

STEP 2= Barau Dikko = 402/ 1092 *346=127

STEP 3= Sabon Tasha = 129/ 1092 * 346= 41

STEP 4= Zaria = 149/ 1092 *346= 47

STEP 5 = Sabon Gari = 52/ 1092 * 346= 17

STEP 6 = Giwa = 49/ 1092 * 346 = 16

STEP 7 = Makarfi = 39/ 1092 * 346= 12

STEP 8 = Kafanchan = 159/ 1092 * 346=48

STEP 9 = Kachia = 82 / 1092 * 346 = 26

STEP 10 = Zangon Kataf= 39/ 1092 * 346 = 12

Total = 346