### NURSING INTERVENTION FOR THE PROMOTION OF INFECTION CONTROL IN TWO TEACHING HOSPITALS

**ABSTRACT**

This study examined the effects of a training program on knowledge, perception, and risk reduction regarding infection control among nurses. This study adopted a pretest–posttest quasi‑experimental design. The samples consisted of 87 participants comprising 42 nurses in the experimental group and 45 nurses in the control group. The instruments used for data collection were a questionnaire on knowledge about infection control and a questionnaire on perception about infection control. Findings showed that the mean (SD) age in the experimental group was 34.92 (8.99) whereas that of the control group was 47.43 (6.60). The mean (SD) years of experience in the experimental group was 10.42 (9.95) years whereas in the control group it was 21.89 (8.72) years. Findings further revealed that 26 participants (62.90%) in the postintervention group had high knowledge level compared to the preintervention where none had high knowledge. A significant difference was observed between the mean perception score on infection control in the experimental and control groups (*t* = 17.12; *p* = 0.001). This study has shown that a training program is very effective and that all nurses should be exposed to infection control training to equip them with the necessary knowledge and skills with which to fight against the spread of infection in the healthcare setting. Based on these findings, it is recommended that there should be adequate provision of facilities for infection control. Training and retraining should be organized for all nurses and other categories of healthcare workers to promote adherence to infection control.

**CHAPTER ONE**

**INTRODUCTION**

**1.1 Background to the Study**

Infection control is an aspect of healthcare delivery that deals with the curtailment of the spread of infection within the healthcare set-up, be it from patient-to-patient, patient-to-staff, staff-to-patients or staff to staff. According to World Health Organisation (WHO, 2011) the components of infection prevention and control are as follows: organisation, technical guidelines, human resources, surveillance, microbiology laboratory support, environment, evaluation and links with public health and other services. Organisation involves setting up a programme, formation of the infection control committee and inter-professional team, which should include physicians, nurses, microbiologists, epidemiologists, infection control specialists, information specialists and others. The committee must have a good working relationship with one another, because their work entails collaboration with other departments, staff and programmes. Technical guidelines involve developing, disseminating and implementing technical evidence-based information in preventing the risks of infection. Human resources involve training and re-training of health care personnel in preventing infections and the training of infection control professionals. It guarantees a pool of adequate staff responsible for infection prevention and control activities.

Surveillance is the tracking of demonstrated or suspected spread of infection. It involves the collection of data on epidemic and detection of outbreaks as well as the assessment of level of compliance with infection control practices, response to outbreaks and documentation of the situation of healthcare associated infection. Surveillance is important in that it causes early detection, identification, isolation and intervention, and results in effective infection prevention. Microbiology laboratory supports generate data, standardised laboratory techniques and promotes interaction between infection control activities. The environment refers to the minimum requirements for infection control. It includes water, ventilation, hand-hygiene equipment, placement of patient as well as isolation facilities, sterile supply storage, building conditions and renovation activities. Evaluation has to do with monitoring, assessment and report of infection prevention and control outcomes, processing and strategizing at national level and in healthcare facilities. It mirrors the impact of the infection control programmes. Links with public health and other services ensures proper coordination and collaboration between staff and departments in the events of mandatory reporting and activities such as waste management and sanitation, bio-safety, occupational health, patients and consumer’s care and the quality of health care (Hebden, 2015; Stempliuk & Eremin, 2015; WHO, 2011).

There are various sources of infections. Healthcare associated infections (HAI) are infections that develop in the course of healthcare and results in aggravating illnesses and may lead to deaths, extends the duration of hospital stay, and calls for more interventions at an added cost to the one already expended by the patient’s initial disease. Its occurrence is an indicator of the quality of patient care, adverse event and an issue of patient safety. The sources includes adverse drug events, surgical complications, microorganism isolates, antimicrobial resistance, decreasing trends in intensive care units, exogenous microorganisms such as bacteria, fungi, viruses, protozoan from other patients, endogenous flora of the patients- residual bacteria residing on the patient’s skin, mucous membrane, gastro intestinal tract, respiratory tract, inanimate environmental surfaces, contaminated objects, patient room touch, surfaces, equipment, medication, individual patient, medical equipment, devices, hospital environment, contaminated drugs and foods and hospital flora in the healthcare environment. Other sources include doctors’ white coats, nurses’ uniform, hospital garments, privacy drapes, stethoscopes, bed rails, common hospital surfaces, contaminated water, compromised immune system, negligence or poor attitude of hospital staff, hands of health care workers. It could be from patient to patient, patient to environment, staff to patient, renovation works in the hospital (Hans, 2012; Stubblefield, 2014; WHO, 2011).

Healthcare workers generally are at risk of infection, because they constantly come into contact with infected materials such as tissues, fluid, blood and blood products. There are several infection control measures aimed at controlling the spread of infectious diseases, such as hepatitis B and C, Human immunodeficiency virus (HIV) and other life threatening infections. Moreover, the hospital waste itself is a potential source of infection hence the need for proper infection control measures. It has been found that healthcare workers do not adhere strictly to the various infection control measures, probably because they do not recognise such, or they lack adequate knowledge, or could be due to poor attitude towards infection control measures, including non-availability of materials and equipment (Amoran & Onwube, 2013).In a study conducted at the Federal Medical Center (FMC), Gombe, in North Eastern Nigeria among nurses, it was found that some respondents were not aware that standard precautions is applied to all patients, and majority of the respondents have poor knowledge of the components of standard precautions (Saidu, Habu, Kever, Dathini, Inuwa, Maigari et al, 2015).

Standard precautions are infection control measures that are put forward by the United States Centre for Disease Prevention & Control (CDC), in 1996. By complying with standard precautions, a lot of infections can be avoided, such as occupational exposure to pathogens. While some health workers are familiar with the infection control measures, some are not. This may be due to lack of awareness or knowledge and moreover, the attitude that some who are familiar with the infection control measures, show towards practice is not encouraging. When one considers the importance of adequate knowledge and practice of infection control measures, by the healthcare workers, one cannot but think of what to do to improve on that knowledge and practice. Jain, Dogra, Mishra, Thakur and Loomba (2012), in their study among doctors and nurses in a tertiary care hospital, found that there is lack of knowledge and practice regarding basic infection control measures. This deficit in knowledge can be improved through educational intervention. Wasswa, Nalwadda, Buregyoya, Gitta, Anguzu and Nuwama (2015), in their study on implementation of infection control in health facilities in Uganda, found that with prior training on infection control, the respondents were more likely to wash their hands. Level of education and a prior nosocomial infection experience will have a role in the practice of infection control measures. In-service training on infection control measures will boost the practice of infection control measures.

Amoran and Onwube (2013) found that inadequate workers’ knowledge on infection control and environment related problems are crucial issues that need urgent attention. According to Gebresilassie, Kumei, and Yemane (2014) in their study, “there is suboptimal and inconsistent practice of standard precautions in the healthcare setting that put patients and healthcare workers at significant risk of acquiring infections”. They also emphasized the need for in-service training for the healthcare workers on infection control. Adly, Amin and Abd El-aziz, (2014) found that intervention influenced the compliance of nurses with infection control measures, because of the knowledge gained during the intervention or training programme. There is a standard of infection control measures that can guarantee infection safety among health workers and patients.

**1.2 Statement of the Problem**

Healthcare workers generally are at risk of infection. WHO (2006), reported that among the 35million health workers worldwide, about 3 million sustain percutaneous exposures to the blood borne pathogens each year, including 2 million to Hepatitis B virus (HBV), 0.9 million to Hepatitis C virus (HCV) and 170,000 to Human Immunodeficiency virus (HIV). These injuries may result in 70,000 HBV; 15,000 HCV and 5,000 HIV infections. Nurses are at higher risk of being infected with blood-borne pathogens from clinical blood exposure through injuries with sharp instruments and needle-stick injuries if infection control measures are not strictly followed. This is because they are usually the first contact with a patient on arrival in the hospital and provide 24 hour patient care. Studies have also shown evidence of clinical nurses becoming infected due to occupational exposure (Centers for Disease Control & Prevention, 2012).  Abdulraheem, Amodu, Saka, Bolarinwa & Uthman (2012), in their study, among health workers in North Eastern Nigerian found that the level of knowledge and implementation of standard precautions is below standard to guarantee infection safety. They concluded that there is still much to learn and implement when it comes to infection control measures.

Furthermore, in some health institutions, the researcher observed that some nurses do not adhere to the components of standard precautions while providing nursing care. For example, few nurses were observed not to wash their hand after removing gloves and before commencing another procedure. In some of the wash hand basins in the outpatient department, liquid soap is not available for health workers and patients to wash their hands. When blood or body fluids are spilled on the floor, the house keepers do not decontaminate with hypochlorite solution before mopping with soap and water. The health institutions infection control units are not well equipped to function effectively to ensure compliance to standard precautions. It is in the light of the gaps that the researcher became interested in planning a training programme on knowledge, perception, attitude and practice of infection control for nurses at Babcock University Teaching Hospital (BUTH), Ilisan-Remo, Ogun state.

**1.3 Objective of the Study**

The main objective of this study is to determine the effects of a training programme on infection control among nurses. The specific objectives are to:

1.     assess the effectiveness of the training programme on knowledge of participants about infection control;

2.determine the effectiveness of the training programme on perceptions of participants  about infection control;

3. document the effectiveness of the training programme on attitudes of participants  towards infection control;

4.   implement a training programme on infection control;

5.   determine the level of skills possessed and practice of participants on infection control;

6.  assess the effectiveness of a training programme on infection risk reduction and

7.   ascertain if there is any difference between the self-reported practices and the actual   observed practices of infection control in the experimental group.

**1.4 Research Questions**

This study attempted to answer the following research questions:

1.      What are the effects of training programme on attitudes of participants?

2.      What are the effects of training programme on the perceptions of participants?

3.   What are the effects of training programme on the knowledge of participants?

4.   What is the effect of the training programme on infection risk reduction?

**1.5   Hypotheses**

These three hypotheses were tested at 0.05 level of significance:

Ho 1. There is no significant difference in the mean knowledge score of infectio control between the experimental group and the control group.

Ho 2.     There is no significant difference in the mean practice score of infectio control between the experimental group and the control group.

Ho 3.  There is no significant difference between the self reported practice and observed practice of infection control in the experimental group.

**1.6 Scope of the Study**

This study focused on the knowledge, attitude, perception and practice of infection control among nurses. Specific areas are; hand hygiene, use of personal protective equipment (PPE), handling sharps/injection safety, cleaning and disinfection as well as waste management. The independent variable is the training package, and the dependent variables are the participants’ knowledge, attitude, perception and practice.

**1.7 Significance of the Study**

The importance of the training programme to nurses, patients, hospital and society cannot be over emphasized. The training programme may improve infection control practices among nurses. The practices include: hand washing, donning and removing PPE for example, gloves, gown, mask, eyewear, and injection safety. The study may also improve the knowledge of nurses on the components of standard precautions. Training and practicing standard precautions may lead to a situation where nurses actually feel more protected from the risk of exposures to HIV and Hepatitis, and are more likely to provide improved “physical care”. Nurses also experience less fear and are less judgmental towards patients, thus less likely to stigmatise or discriminate patients, leading to improved “psychosocial or emotional care” when rendering care to patients with highly infectious diseases.

In the practice of standard precautions, all patients are assumed to be possible sources of infection and must be handled professionally in that regard. The importance of this programme to the hospital is that the patients that receive care are not likely to have nosocomial infection. This may in turn allow the hospital to have recognition which may attract more patronage by Ogun state indigenes and beyond.

Adequate infection control measures may have economic as well as political effect on the society. However, the nurses will be conversant with what to do and how to do it, in terms of preventing infection. For instance, Hepatitis kills more quickly than HIV, if one is infected with either of the two, it will result in severe economic loss for the individual and the family, and when this is translated on to the national stage, it will be a great loss due to the multiplier effect.

**1.8 Justification for the Study**

Knowledge and practice of standard precautions has been shown to reduce the risk of exposure to blood and body fluids (Chan, Molassiootis, Chan, Chan, Ho, Lai, et al, 2002). Standard precautions are the basic level of infection control precautions which are to be used, as a minimum in the care of all patients. It is therefore necessary for nurses to have training and re-training programme on standard precautions to improve their compliance.

**1.9 Operational Definition of Terms**

**Infection control:**This refers to an aspect of healthcare delivery that deals with the curtailment of the spread of infection within the healthcare set-up, be it from patient-to-patient, patient-to-staff, staff-to-patients or staff to staff.

**Nursing intervention**: This refers to a training package that focuses on improving knowledge, attitude, perception and practices of infection control. The areas of focus include hand washing, PPE such as gowns, mask, goggles, and gloves. The training also includes injection safety/handling sharps, cleaning decontamination and sterilization, waste management as well as post exposure prophylaxis (PEP).

**Knowledge**: This means facts, information and skills acquired through experience or education on infection control.

**Attitude**: Internal mental disposition expressed towards infection control or feelings expressed towards infection control.

**Perception**: This means conscious understanding of what infection control is all about or meaning ascribed to infection control.

**Practice**: This refers to a regular repeated exercise in order to gain proficiency in skills on the components of infection control. This includes hand hygiene, use of personal protective equipment, injection safety/handling sharps, cleaning decontamination and sterilization, waste management as well as PEP.

**Effectiveness**: This refers to the positive impact of a training programme on infection control which may include increased level of participant’s knowledge and practice.

**Nurses**: These are registered nurses working at BUTH, Ilisan-Remo and Olabisi Onabanjo University Teaching Hospital (OOUTH), Ogun state.

**Promotion of Infection Control:**This means disseminating information about infection control.

**CHAPTER TWO**

**REVIEW OF LITERATURE**

**INTRODUCTION**

Our focus in this chapter is to critically examine relevant literature that would assist in explaining the research problem and furthermore recognize the efforts of scholars who had previously contributed immensely to similar research. The chapter intends to deepen the understanding of the study and close the perceived gaps.

Precisely, the chapter will be considered in three sub-headings:

* Conceptual Framework
* Theoretical Framework
* Empirical framework

**2.1 CONCEPTUAL FRAMEWORK**

**2.1.1 Concept of Nursing**

According to the American Nurses Association (ANA), nursing is a caring profession that has its significance and direct influence on the life, health, and well-being of people, families, and communities. Furthermore, nursing is a career that has been around for a long time. The nursing profession is guided by both ethical and legal principles because they are tools for professional discipline. These principles provide the nurse with a comprehensive understanding of what is expected of her as she transitions from the safe environment of school into the environment of society. Both ethics and the law are important tools of regulation and provide prescriptions for how individuals ought to behave in relation to one another. They are also closely connected in terms of notions, such as rights and justice, which have implications in both ethical and legal contexts.

Care of people of all ages, families, groups, and communities, whether they are ill or well and in whatever environment is included in nursing. Nursing involves both independent and collaborative care. Care for the sick, handicapped, and dying is part of the nursing profession, along with health education and disease preventive activities. According to the American Nurses Association (ANA) (2017), other important nursing jobs include advocacy, the promotion of a safe environment, research, engagement in the formation of health policy, and in patient and health systems management. Education is another important nursing duty. Nursing also involves the application of clinical judgement in the delivery of care to patients in order to assist them in improving, maintaining, or recovering their health, coping with their health, and achieving the highest possible quality of life, regardless of the disease or disability they are suffering from, right up until the moment they pass away. The practice of nursing includes the protection, promotion, and optimization of health and abilities; the prevention of illness and injury; the alleviation of suffering through the diagnosis and treatment of human responses; and advocacy in health care for individuals, families, communities, and populations. These responsibilities are carried out for a variety of clientele, including individuals, families, communities, and populations (Anarado, 2016).

The nurse provides assistance to the individual, whether they are sick or well, in the performance of those activities that contribute to the individual's health or its recovery (or to a peaceful death). These are activities that the individual would perform unaided if they had the necessary strength, will, or knowledge. However, the authority for the practice of nursing is built upon a social compact that outlines professional rights and obligations as well as systems for public accountability. Nursing practice may vary both via its numerous specializations and between nations. The practice of nursing is defined and controlled by legislation in almost all nations, and entry into the profession is regulated at the national or state level (Anarado, 2016).

**2.1.2 Nurses’ Code Of Conduct Regarding Nosocomial Infections Prevention And Control**

In order to respect the code of conduct of the nursing profession, registered nurses are obligated to practice infection prevention and control. According to the Nurses and Midwives Act No. 55 of 1970 in Zambia, which was reviewed in the late 1980s, the nursing profession would be permitted to improve the quality of nursing and midwifery services delivery through expanded scopes of education and practice in order to meet the demanding care trends and needs in Zambia. This was stated in the act. According to Sharp, Palmore, and Grady (2017), patients may be given the ability to make day-to-day choices if they are provided with information on hospital-acquired infections (HAI). Personal cleanliness, specialized procedures and interventions, engagement with care professionals, and adhering to advice are examples of such choices. On the other hand, there are many who believe that HAI information might cause unnecessary worry for patients without really broadening their range of reasonable decisions. However, even in the most severe circumstances, considerations of this kind are not sufficient to excuse one from the need to disclose risks (Sharp et al., 2017). According to Sharp et al. (2017), patients in health-care facilities should be informed about the danger of HAIs, methods for preventing them, and the policies of the hospital. Because of this, they will have the ability to participate as partners in the development of a more secure setting for the delivery of health care that is driven by respect for patient autonomy and the promotion of patient autonomy.

**2.1.3 Nursing Act**

The Health and Social Care Act of 2008 in the United Kingdom (UK) requires all trusts to have perfect measures for the effective prevention, detection, and control of hospital acquired infections. This requirement is part of the Code of Practice health and adult social care on the prevention and control of infections and related guidance (Royal Cornwall Hospitals, 2015). According to the Missouri nursing practice act, the purpose of the nursing practice act is to safeguard the general public from dangerous and unlicensed practice by regulating nursing practice and nursing education. This is stated as the goal of the nursing practice act. The Nursing Practice Act provides both a definition of nursing as a profession as well as standards for the nursing profession itself, as well as advice on problems relating to the scope of nursing practice. The profession of nursing needs particular knowledge, skills, as well as the ability to make autonomous decisions (Russell, 2016). According to Russell (2016), nursing practice encompasses not just behavior, attitude, and judgment but also physiological and sensory capacities in the use of information, services, and skills for the benefit of the client. In addition, Russell (2016) found that when health services are provided by professionals that lack the necessary skills, the general population is put in danger of experiencing adverse effects. In this respect, professionals are subject to the rules and norms that have been established to minimize the possibility of causing injury.

**2.1.4 Nursing standards**

According to Russell (2016), the education and standards offered by legislation aimed to safeguard the general public provide direction for nursing practice. The nursing profession may go in a variety of directions; the focus of practice can shift depending on the environment, the kind of patients being cared for, the sickness they are suffering from, and the type of therapeutic approach or degree of rehabilitation being provided (Russell, 2016). The unique role that nurses play in reducing the risk of nosocomial infections should not be underestimated. The use of the skills and information gained through nursing practice may help patients heal more quickly while reducing the risk of problems caused by infections. According to Benson and Powers (2018), some of the most fundamental approaches that result in positive patient outcomes include the following: practicing proper hand hygiene; routinely employing sterile technique; maintaining a clean and safe environment; employing universal precautions; providing patients with education; and providing patient nursing diagnosis and additional safety measures.

"Use of safe methods," "Avoiding use of needless intrusive equipment," "Use of bundle tactics," and "Fit for duty" are some of the things that should be practiced.

**2.1.5 Ethics In Nursing**

The basis for ethical behavior on the part of nurses is provided by the code of ethics for registered nurses (Canadian Nurses association 2018). According to the Canadian Nurses association (CAN, 2018), the code provides guides for ethical relationships, responsibilities, behaviors, and decision-making, and it is to be used in conjunction with the professional standards, laws, and regulation that guide practice. Additionally, the code is to be used in the context of the Canadian Nurses association. The code serves as an ethical framework from which registered nurses may advocate for clean and safe working conditions that enable the delivery of high-quality, empathic, competent, and fair care. When providing care for patients who may or may not be suffering from a communicable or contagious condition, nurses put themselves at danger. In the event of a natural or man-made catastrophe, as well as an epidemic of a communicable illness, nurses have a responsibility to continue providing care while adhering to the necessary safety procedures (CNA, 2018). The autonomy of the patient and the welfare of the patient are two intimately connected ethical issues that motivate the empowerment of patients for the purpose of preventing hospital acquired infections (Sharp, Palmore & Grandy, 2017). According to Sharp et al. (2017), hospitalized patients are often at risk, and there are significant information gaps between patients and physicians about their respective medical conditions. Because of these factors, proper consideration of the patients' values and interests may be compromised. Providing patients with the chance to act in light of their views and the best interests of themselves while also promoting patient autonomy. This approach places a strong emphasis on respecting patients' rights to receive information that is pertinent to the management of their medical conditions (Sharp et al., 2017). Patients who feel empowered are more likely to engage in actions that lower their risk of contracting nosocomial infections, which contributes to an overall improvement in patient safety and well-being. The prevention of healthcare-associated infections (HAIs) is mostly focused on encouraging healthcare workers to practice better hand hygiene (Sharp et al., 2017)

**2.1.6 Concept of** Healthcare-Acquired **Infections**

Infections that are acquired by a patient during the first 48–72 hours or 3 days after their admission to a hospital or other medical care facility are referred to as nosocomial infections. Patients who are unable to mount an immune response and those who are admitted to the Intensive Care Unit (ICU) have an increased likelihood of developing a nosocomial infection. It has been claimed that for every 10 patients, one of those patients will get a nosocomial infection, which will lengthen the amount of time the patient must spend in the hospital receiving treatment. Because of this, the overall cost of the therapy for the patient will be significantly increased. According to the findings of a research on nosocomial infections caused by Candida species that was carried out by Sahni et al.,(2015), it was found that out of the total of 200 recognized species of Candida, around 10 percent are the ones that cause infections in people. They examined 101 patients with symptoms of a nosocomial infection, ranging in age from 18 to 80 years, and found that 42.8 percent of patients were suffering from a condition caused by Candida albicans.

The patients' ages ranged from 18 to 80 years. They came to the conclusion, based on the findings of this investigation, that nosocomial infections brought on by Candida species are a substantial concern in hospitals (Sahni et al.,2015). The spread of nosocomial infections is one of the major contributors to morbidity and death in healthcare facilities. The incidence of nosocomial infections is highest in newborn hospitals, followed by burn hospitals as the facility with the next highest prevalence. The risk of death is significantly increased in patients with impaired immune systems, patients with multiple organ failure, and burn victims. In the newborn ward, S. aureus, Klebsiella, E. coli, and Staphylococcus epidermis are the most prevalent pathogens that cause nosocomial infections. Patients' stays in intensive care units (ICUs) may also put them at risk for nosocomial infections; variables contributing to this risk include lengthier ICU stays (more than 48 hours). mechanical ventilation, identification of trauma, catheterization of the central venous system, pulmonary artery, and urinary system, and stress ulcer prevention are some of the procedures that may be performed. Enterobacteriaceae, Staphylococcus aureus (of which 60 percent are resistant to methicillin), Pseudomonas aeruginosa, coagulase-negative Staphylococci, and fungus are the pathogens that have been identified as being responsible for the agents (Ki, 2018).

Fungi are also a contributing factor. The urinary tract infection, pneumonia, primary bloodstream, and use of contaminated mechanical ventilation are the most common infection sites linked with nosocomial infection; urinary catheters are a cause of nosocomial pneumonia and urinary tract infection respectively. Staphylococcus aureus and coagulase-negative Staphylococcus are the bacteria that are responsible for bloodstream infections. Gram-negative aerobic microorganisms, such as Pseudomonas aeruginosa and Staphylococcus aureus, are responsible for the spread of nosocomial pneumonia.

According to Richards (2019), an infection of the urinary tract may include Candida albicans. In addition, the transmission of nosocomial infections has been linked to the use of medical equipment. In addition, nosocomial infections may be spread via the use of stethoscopes. Sengupta et al.,(2020) have isolated bacteria from stethoscopes that are susceptible to ciprofloxacin, netilmicin, and amikacin. These bacteria include coagulase-negative Staphylococcus, coagulase-negative Staphylococcus, Enterococci, Escherichia coli, Klebsiella species, and Acinetobacter species. In neonatal intensive care units, nosocomial infections caused by extended-spectrum beta-lactamases (ESBL) producing Klebsiella species and methicillin-resistant Staphylococcus aureus (MRSA) affect the recovery of neonates and can also lead to prematurity, low birth weight, and hospitality stay. These infections are caused by extended-spectrum beta-lactamases (ESBL) producing Klebsiella species. Microbes such as Klebsiella species, Enterobacter species, E. coli and Citrobacter species, and Acinetobacter species are often seen in association with nosocomial infections. Gram-positive bacteria, such as methicillin-resistant Staphylococcus aureus (MRSA), have been shown to spread more rapidly in burn units than in areas that were not burned. Comparatively, the hospital's Burn Unit had a contamination rate of 64 percent, while the non-burn group had a contamination rate ranging from 1 to 18 percent. Pseudomonas aeruginosa, Vancomycin-resistant Enterococci (VRE), and Acinetobacter sp. are some examples of other gram-positive bacteria that may infect inanimate objects like mattresses and other such items.

The propagation of Gram-negative enteric bacteria via dry, inert environments is very uncommon. However, it has been shown that non-fermentative Acinetobacter baumannii bacteria may cause ventilator-associated pneumonia, as well as bloodstream infections that exhibited resistance to antibiotics and caused an epidemic of antibiotic-resistant nosocomial infections. Acinetobacter baumannii was found to be present in the beds that were colonized by patients and was almost at the surface. The bacterium Clostridium difficile has been recovered from a variety of surfaces and pieces of equipment, including washbasins, commodes, bedpans, blood pressure cuffs, walls, and floors. The increased usage of antibiotics also contributes to a rise in the prevalence of multidrug-resistant microorganisms. Non-fermenting Gram-negative bacilli are classified as an opportunistic pathogen since they are able to thrive in a variety of different environments. There is not a single drug that has been discovered to have a one hundred percent sensitivity rating against MDR bacteria (Bhuvaneshwari, 2017).

**2.1.7 Types of** Healthcare-Acquired  **Infections**

Infections that are connected with a central line in the bloodstream, urinary tract infections that are associated with a catheter, surgical site infections, and pneumonia that is related with a ventilator are the most common forms of infections. The following is an explanation of them in more detail:

* **Central line-associated bloodstream infections (CLABSI)**

Nosocomial infections such as CLABSI are very dangerous, with a fatality incidence rate ranging anywhere from 12 to 25 percent [Bhuvaneshwari, 2017]. However, continuous use of catheters may lead to significant bloodstream infections, which can endanger a patient's health and lead to an increase in the cost of treatment. Central lines are catheterized in order to administer hydration and medications. CLABSI rates have dropped by 46 percent in US hospitals between the years 2008 and 2013, however according to [Mirhoseini, 2016], there are still an estimated 30,100 cases of CLABSI that take place annually in the intensive care units and acute care wards of US hospitals.

* **Catheter associated urinary tract infections (CAUTI)**

The most common kind of nosocomial infection seen all over the world is called CAUTI [11]. [Kolmos,2016] reports that in acute care hospitals in 2011, urinary tract infections accounted for more than 12 percent of all infections that were recorded. CAUTIs are brought on by the endogenous bacteria that are local to the patients. Catheters put inside serve as a conduit for germs to enter the body, while the poor drainage from catheters causes some volume of urine to be retained in the bladder, which provides stability for bacterial residency. In males, CAUTI may lead to complications such as orchitis, epididymitis, and prostatitis; in females, CAUTI can lead to pyelonephritis, cystitis, and meningitis; and in males, CAUTI can lead to orchitis, epididymitis, and prostatitis.

* **Surgical site infections (SSI)**

Nosocomial infections, often known as surgical site infections or SSIs, affect between 2 and 5 percent of patients who have surgery. According to Atanda (2019), they are the second most prevalent form of nosocomial infections. Staphylococcus aureus is the primary pathogen that causes these infections, which may result in an extended hospital stay and an increased risk of mortality. It is the endogenous microflora of the patient that gives birth to the microorganisms that cause SSI. Depending on the process and monitoring criteria that are used, the incidence might be as high as twenty percent at any one time.

**Ventilator associated pneumonia (VAP)**

VAP is nosocomial pneumonia found in 9–27% of patients on mechanically assisted ventilator. It usually occurs within 48 h after tracheal incubation. 86% of nosocomial pneumonia is associated with ventilation. Fever, leucopenia, and bronchial sounds are common symptoms of VAP [Challenge, 2019].

**Nosocomial Pathogens**

Bacteria, viruses, and fungal parasites are the three types of pathogens that may cause infections in healthcare settings. These bacteria may differ from one patient group to another, from one medical facility to another, and even from one setting to another due to differences in the environment in which treatment is provided.

* **Bacteria**

Bacteria are the most frequent kind of pathogen that may cause infections to occur in healthcare settings. Some of these microorganisms are part of the patient's normal flora and will only produce an infection if the patient's immune system is compromised and unable to fight them off. In intensive care units (ICUs), infections are often caused by a kind of pathogenic bacteria called acinetobacteria. It is found in both the soil and the water, and it is responsible for around 80 percent of all reported illnesses. Bacteroides fragilis is a kind of commensal bacterium that lives in the colon and the digestive system. It is only infectious when mixed with other bacteria that cause diseases. Because it replaces helpful bacteria with pathogenic bacteria, Clostridium difficile may induce inflammation of the colon, which can then lead to antibiotic-associated diarrhea and colitis. This is mostly due to the eradication of beneficial bacteria. C. difficile is spread from an infected patient to other patients in the hospital setting by healthcare workers who do not properly clean their hands. Enterobacteriaceae are carbapenem-resistant bacteria that may cause infections if they spread to other regions of the body from the gut, which is where they are often found. Enterobacteriaceae comprise Klebsiella species and Escherichia coli. [Debnath, 2015] found that due to the bacteria's great resistance to carbapenem, it is difficult to mount an effective defense against them. Direct contact, open wounds, and contaminated hands are the most common ways for methicillin-resistant Staphylococcus aureus (MRSA) to spread. It may spread from organs or the circulation, which can lead to septic shock, pneumonia, and SSI. It has a high level of resistance to a class of antibiotics known as beta-lactams.

* **Viruses**

In addition to bacteria, viruses are also a significant factor in the development of nosocomial infections. The standard surveillance practices uncovered the fact that viruses are responsible for 5% of all nosocomial infections. They are capable of spreading through the hand-to-mouth route, the respiratory route, and the fecal-oral route. Hepatitis is a condition that lasts for a long time and is caused by viruses. The administration of medical treatment poses a risk of hepatitis virus transmission to both patients and healthcare personnel. Inappropriate injection techniques are a major risk factor in the spread of hepatitis B and C. Other viruses include the influenza virus, the human immunodeficiency virus (HIV), the rotavirus, and herpes simplex virus.

* **Fungal parasites**

Fungal parasites are opportunistic pathogens, which means they cause nosocomial infections in people who already have impaired immune systems. Infections may be caused by a variety of Aspergillus species if the environment is contaminated with them. Infections acquired when a patient is under medical care may also be caused by Candida albicans and Cryptococcus neoformans. Infections caused by Candida originate from a patient's endogenous microflora, while infections caused by Aspergillus are induced by inhaling fungal spores from polluted air during the building or remodeling of a health care facility.

**2.1.8 Epidemiology of** Healthcare-Acquired **Infections**

A considerable number of patients all over the world are afflicted with nosocomial infections, which leads to an increased death rate and significant financial losses. [Owens, 2015] the World Health Organization (WHO) has estimated that roughly 15 percent of all hospitalized patients suffer from these illnesses. According to Inweregbu (2015) and other researchers, the prevalence rate of these diseases is highest in South-East Asia and Sub-Saharan Africa. These infections are responsible for 4–56 percent of all mortality causes in neonates. The incidence ranges from 5.7 percent to 19.1 percent in nations with low incomes and between 3.5 percent and 12 percent in countries with high incomes. The incidence ranges from 3.5 percent to 12 percent in countries with high incomes. The total incidence of infections is three times greater in low income countries compared to high income nations, but the incidence of infections among newborns is three to twenty times higher in low income countries.

**2.1.9 Determinants of** Healthcare-Acquired **Infections**

The environment in which treatment is provided, the vulnerability and condition of the patient, and the lack of knowledge of such prevalent illnesses among staff and health care providers are the risk variables that determine whether or not nosocomial infections occur..

* **Environment**

Poor hygienic conditions and inadequate waste disposal from health care settings.

* **Susceptibility**

Immunosupression in the patients, prolonged stay in intensive care unit, and prolonged use of antibiotics.

* **Unawareness**

Incorrect use of injection procedures, inadequate awareness of fundamental infection control measures, incorrect use of invasive devices (catheters), and the absence of control regulations all contributed to the outbreak. In nations with a low per capita income, these risk factors are related with poverty, a lack of financial assistance, settings for health care that are understaffed, and an insufficient supply of equipment.

**2.1.10 Reservoirs and transmission of** Healthcare-Acquired  **infections**

* **Microflora of patient**

Infections may be caused by bacteria that are part of the patient's endogenous flora if those bacteria are moved to a place where there is tissue damage or where surgery has been performed. After abdominal surgery, SSI is caused by gram-negative bacteria that are found in the digestive system.

* **Patient and staff**

Transmission of infections during treatment via direct touch with patients (hands, saliva, and other bodily fluids, among other things), as well as transmission of diseases by staff members through direct contact or other environmental sources (water, food, other body fluids).

* **Environment**

Pathogens that are present in the healthcare setting, such as those in the water, food, and equipment, have the potential to act as a source of transmission. The transmission of the infection to another patient creates an additional reservoir for those who are not afflicted.

**2.1. 11 Preventive Behavior Towards** Healthcare-Acquired  **Infection**

Nosocomial infections may be avoided by limiting the transmission of infectious disease-causing agents, isolating patients who are afflicted with infectious diseases, and ensuring that hospitals and other medical care facilities are kept in a clean and hygienic state. In the current study, we have chosen five key areas in which efforts may be made to reduce nosocomial infections. Each of these areas is described below.

1. Upkeep of personal cleanliness;
2. prevention of infection at the surgical incision site
3. A unit for the isolation of patients who have been diagnosed with infectious diseases;
4. The sterilization of medical equipment; and

e) The validation and cleaning of the environment inside hospitals.

* **Maintain Hand Hygiene:**

The use of one's hands is recognized as being among the most significant means by which an infectious agent might spread illness. The World Health Organization recommends that anybody visiting a hospital should adhere to the normal operating procedures. Inadequate hand washing may not result in the total elimination of germs and may be the cause of infections in certain cases. Lack of knowledge, poor hygiene habits, a perceived lack of relevance, a lack of time, dry skin, skin irritation or dermatitis, the unavailability of a suitable cleaning solution, and insufficient hand washing were some of the factors involved (Pittet et al, 2016). Researchers have revealed that the spread of antibiotic-resistant forms of MRSA may occur via the hands. Simply adhering to good hand hygiene practices may make a significant dent in the rate at which infectious agents are transferred through the hands. The natural flora found inside the body does not often contribute to sickness. However, in the instance of an immunocompromised patient who has had surgery or another invasive operation, the vegetation travels to another place of the body and begins colonization. This may disturb the usual flora, which can lead to sickness.

* **Avoid Surgical Site Infection:**

Infection at the surgical site is referred to as a surgical site infection (SSI), and it may develop anywhere from 30 days to 1 year after the surgical procedure. SSI is one of the primary reasons of death; as a result, it is something that has to be avoided and taken under serious consideration (Owens, 2015).

* **Isolation Unit for Patient Infected by Communicable Disease:**

Isolation is the practice of physically separating a patient who has an infectious or communicable illness from other people. Patients are quarantined in groups that correspond to the method by which the illness is spread.

* **Strict Isolation:**

"In order to avoid the spread of extremely contagious diseases, such as chicken pox and rabies, which may be passed on by direct physical contact or through the spread of infectious droplets in the air."

* **Respiratory Isolation:**

"In order to stop the respiratory spread of the organism into the environment by droplets that were sneezed or breathed into by an infected patient." Illustrations of the influenza virus. Mycobacterium tuberculosis.

* **Protective Isolation:**

"To prevent contact between potentially pathogenic germs and the unaffected person who is getting a certain therapy that results in loss of immunity." "In order to avoid potentially dangerous germs from coming into touch with an individual who is not afflicted." Infection is more likely to occur in patients receiving chemotherapy as part of their treatment for leukemia, like this patient, who already has a preexisting infection.

* **Enteric Isolation:**

The sickness is passed on by oral contact, either direct or indirect, with infectious excrement or contaminated things. Hepatitis and dysentery are two examples of diseases.

* ** Wound and Skin Precautions:**

To stop the transmission of microorganisms that are present in contaminated items and infected wounds (including burns and open sores). It is important to exercise care while dealing with diseases that have purulent discharge, as well as burns and wounds that are infected. Herpes, impetigo, and ringworm are all included in this category.

*  **Blood Precaution:**

It involves the prevention of the spread of blood-transmitted illnesses that are caused by the use of infected blood-contaminated goods, such as the use of contaminated needles or razors, which may be a reason for the spread of blood-transmitted infections. HIV and HBV are two types of infections that fall within this category.

**2.1.13 Isolation Techniques Involved in** Healthcare-Acquired **Infections:**

1. Private room with minimum ventilation of six air changes per hour. Cross circulations of air are prohibited and only allowed if there are high air filters installed.
2. **An Anteroom For The Storage Of Gowns, Gloves, And Masks:**

They make a barrier between the isolated rooms and hall and possibly avoid air born spread of infectious agents from the rooms and corridors whenever the door is opened. Always maintain the negative pressure in the anteroom compared to the hall and separate air supply and exhaust for ventilation. Differential air pressure control to confine air outflow in a single direction so that cross-contamination could be avoided.

1. **Hospital Personnel Hygiene:**

Participants are required to wear various items such as masks, gowns, gloves, hats, and booties. After they have been utilized, you should not reuse them. Both the mouth and the nose should be covered by the mask. It is ideal to use high-efficiency disposable masks that both prevent the infectious agent from being breathed in and trap it outside the wearer's body. Before entering the isolation room, all individuals are expected to put on the mask along with the other essential items, which may include gowns, hats, and booties if necessary. It is suggested that patients who have substantial infected burns or large infected wounds put on a sterile garment prior to having their wounds dressed. In any of the isolation categories, wearing caps and booties is not necessary. Before coming into touch with the patient or any other potentially contaminated item, one must put on gloves, which should then be thrown away after usage. If a hat is being worn, it must completely cover the head, and any exposed ends of pants should be covered with booties.

1. Hands washing with soap before and after contact with the patient and other contaminated objects are must to prevent the rate of infection spread (Patel, 2019) .

* **Sterilization of Medical Equipment:**

If a patient is treated with a medical device or operated on with a surgical instrument that has not been properly sterilized or disinfected, there is a possibility that the patient might get a disease as a result of the device's or instrument's subsequent interaction with the patient. The process of sterilization is determined by the item to be sterilized, which may be categorized as either critical, semi-critical, or non-critical, depending on the level of sterility required. The medical personnel at the hospital has to be taught to prevent the spread of nosocomial infections, and more focus should be placed on the education they receive about infection control and prevention. General practices such as washing one's hands before and after providing care to patients, avoiding making physical contact with inanimate objects, donning gloves and a mask while cleaning contaminated goods, and acquiring knowledge regarding the sterilization of medical equipment are all recommended (Patel, 2019). Rotavirus is a common cause of diarrhea in children around the world, particularly in impoverished countries but even in industrialized nations. At this time, numerous different strong rotavirus vaccines are being studied as potential vaccines. Merial and GlaxoSmithKline (GSK) are the two businesses that have been granted licenses to produce rotavirus vaccines. RotaTeqTM, a vaccine developed by Merck, is a combination of five different strains of rotavirus. The GSK Rotarix TM vaccine is based on a human strain G1 of the rotavirus. These vaccines are made by attenuating the rotavirus such that it is no longer infectious but still produces immune responses.

* **Microbiological Validation and Cleaning of Hospitals Environment:**

The colony forming unit per cubic meter count is used to determine whether or not there is microbial contamination in the air. Either passive or active sampling approaches may be used to accomplish this goal. Passive air sampling includes the measurement of the Index of Microbial Air (IMA) Contamination. This is defined as the count of microbial fall out on a Petri plate of 9 cm diameter placed in an area according to the 1/1/1/ scheme (1 h / 1m above the floor, about 1 m away from walls or any major obstacle). General practices include washing your hands before and after caring for patients, avoiding touching inanimate objects, wearing gloves and a mask while cleaning contaminated goods, and learning than (Patel, 2019). Rotavirus is a common cause of diarrhea in children around the world, particularly in impoverished countries but even in industrialized nations. At this time, numerous different strong rotavirus vaccines are being studied as potential vaccines. Merial and GlaxoSmithKline (GSK) are the two businesses that have been granted licenses to produce rotavirus vaccines. RotaTeqTM, a vaccine developed by Merck, is a combination of five different strains of rotavirus. The GSK Rotarix TM vaccine is based on a human strain G1 of the rotavirus. Attenuated rotavirus is used in the production of these vaccines, which renders the virus harmless while preserving its immunogenicity (Patel, 2019).

Monitoring and surveillance of the air is an absolute need in healthcare facilities and other high-risk areas. Active air sampling included the use of an air sampler, which collected a known air volume by being blasted over a nutrient medium. This method was also known as "passive" air sampling. There are several different kinds of air samplers on the market today, including impingers, impactors (slit type), impactors (sieve type), filtration samplers, centrifugal samplers, electrostatic precipitation samplers, and thermal precipitation samplers, amongst others. Every one of them yields a different outcome at the exact same location and for the exact same amount of time. In an empty operating room that has air supplied by a conditioned and controlled ventilation system (CCVS), 500 L of air was sampled and compared to the one-hour exposure of a settling plate for sampling. This was done to determine whether or not there was a significant difference between the two. Air sampling has to be carried out at regular intervals of time since there are people present, and active sampling needs to be carried out for an hour at a different location inside operation room 30. There is a significant range of microbiological contamination with turbulent airflow, which spans from less than 35 cfu/m3 when the airflow is calm to less than 180 cfu/m3 in an operating room.

**2.1. 14 Control of** Healthcare-Acquired Infections ( HAIs )

There has been a substantial amount of work put into preventing healthcare-acquired infections, but there is still more work that needs to be done to manage these diseases. One in every 25 people admitted to a hospital has the potential to get at least one nosocomial illness in a single day (Patel, 2019).

* **Infection control programs**

The healthcare industry need to come out with prevention and treatment initiatives for these illnesses. The administration, personnel, and persons who are admitted to or visiting the hospital are required to take such programs into consideration in order to play their part in infection prevention. Ojulong, Mitonga, and Lipinge (2016) state that the purpose of infection control techniques is to cut down on the number of nosocomial infections that occur in healthcare settings. Ojulong et al. (2016) examined the health science students at the University of Namibia to determine their levels of knowledge and attitudes on infection prevention and control. According to the findings of the research, health science students have a limited understanding of infection prevention and control methods, as well as an inadequate appreciation for the significance of these topics. It was thus determined that major efforts are required to enhance or evaluate curricula in order to ensure that health science students get instruction on infection prevention and control at an early stage, before they are exposed to the wards (Ojulong et al., 2016).

* **Primary prevention and control**

Primary prevention is a method that may be used to protect against illness and damage before they ever manifest themselves. The Institute for Work and Health (IWH) (2015) defines primary prevention as the elimination of risk factors that might potentially result in an accident or illness. Education on healthy and safe behaviors (hand hygiene, for example), as well as immunization against infectious illnesses, are two examples of primary prevention, as described by the IWH (2015:). In this respect, the Centers for Disease Control and Prevention (CDC) (2016) suggests that vaccination of health-care employees against influenza is crucial to avoid catching the virus and transmitting it to others. The influenza virus is highly contagious and may quickly move from one person to another, even from healthcare professionals to their patients. According to the World Health Organization (2019), vaccination of the whole population is the single most effective strategy that can be taken to prevent diseases that are caused by hepatitis B infection. Injection methods that are not up to standard have the potential to result in the spread of a broad range of diseases, including viruses, bacteria, fungus, and parasites (WHO, 2019).

The use of injection techniques that are safe is one of the key preventative measures that may be used to stop the spread of infection. According to the World Health Organization (2019), a safe injection does not cause any damage to either the person receiving it or the person administering it, and it also does not cause any harm to other people when it is disposed of. An evaluation of the risk is carried out before choices can be made on the measures that need to be taken to both manage the danger and prevent the infection from spreading (Advisory Committee on Dangerous Pathogens- (ACDP, 2015). This comprises the actual execution of infection control measures, the supply of information, the training of personnel, and the monitoring of health conditions (ACDP, 2015). Another factor that contributes to the main infection prevention process is good hand hygiene. The Clean Hands Count campaign, which is run by the CDC, has the goal of increasing the number of health workers who adhere to the recommendations regarding hand hygiene. Additionally, the campaign encourages patients to play an active role by reminding health workers to practice proper hand hygiene (CDC, 2016). Primary prevention may be achieved by the implementation of measures designed to protect and promote people's overall health and well-being (Salama, 2015). According to Salama (2015), the first line of defense against occupational hazards is primary prevention. One example of this would be ensuring the safe handling of sharps by making use of a sharps container.

A further example of primary infection prevention is the practice of encouraging patients and healthcare staff to become aware of their HIV status in order to lessen the risk of contracting tuberculosis (T.B 4, 2015). Primary infection prevention consists of educating all staff members on how tuberculosis is transmitted and how to avoid it. Service providers should make sure that they have antimicrobial stewardship measures in place, including local antibiotic formularies for prescription antibiotics, in order to attempt to address the issue of antibiotic resistance.

* **Secondary prevention and control**

According to the Institute for Work and Health (IWH), 2015, the goal of secondary prevention is to reduce the negative effects of a disease or accident that has already taken place. It is possible to lessen the severity of the effects of a disease by ensuring that any signs of illness or injury are promptly diagnosed and treated, as well as by promoting self-care practices that limit the likelihood of future injuries (IWH, 2015). Use of personal protective equipment and proper ventilation are ideal examples of secondary infection prevention. Isolation of patients with tuberculosis, fast diagnostic diagnosis, and rapid commencement of therapy are all important components of secondary infection prevention (T.B 4, 2015). In order to lessen the severity of the condition, those who have tuberculosis are strongly urged to give up smoking and cut down on their use of alcohol (T.B 4, 2015).

According to Paryford (2015), patients should be instructed to follow the recommendations for respiratory hygiene and cough etiquette. This includes: - Using a disposable, single-use tissue to cover one's mouth and nose when coughing, sneezing, wiping one's nose, or blowing one's nose. - Keeping one's distance from other people while coughing. Put used tissues in the trash as soon as possible. After coughing, sneezing, or using tissues, you should fully dry your hands and then practice proper hand hygiene by washing your hands with soap and water and then thoroughly drying them. One further example of secondary infection prevention is keeping an indwelling catheter clean and functioning properly. According to the NICE recommendations from 2016, indwelling catheters need to be attached to either a sterile closed urine drainage system or a catheter valve. The urine drainage bag need to be positioned so that it is lower than the level of the bladder, and it ought not to be in touch with the ground. It is essential that the urine bag be emptied regularly enough to ensure continuous flow of urine and avoid reflux. Urine samples have to be taken using an aseptic approach and a sampling port, and the meatus has to be cleansed with soap and water every day as part of the usual daily personal hygiene practices (NICE guidelines 2016).

* **Tertiary prevention and control**

The goal of tertiary prevention is to lessen the impact of a continuing illness or injury that is having widespread repercussions. This is accomplished by assisting people in managing long-term conditions and injuries that are frequently challenging (for example, chronic diseases and permanent impairments), with the goal of increasing as much as is practicable their capacity to function, the value of their lives, and the length of their life expectancies (HIV, HAART) (IWH, 2015). According to T.B. 4, published in 2015, the BCG vaccine does not prevent tuberculosis infection; nevertheless, it does prevent severe forms of pediatric tuberculosis and is thus termed tertiary preventive. All people living with HIV are predisposed to a broad variety of opportunistic infections and are at an increased risk of contracting pathogenic organisms that are common in the general community (Haburchak, 2016). In order to achieve the best possible outcomes for HIV patients, it is critical to practice opportunistic infection prevention (Haburchak, 2016). According to Haburchak (2016), the prevalence of all HIV-related illnesses and malignancies as well as the morbidity associated with them increases when the absolute CD4 T-lymphocyte count decreases below 200 cells/l1/4L or lower. Patients living with HIV should be aware of both their CD4 count and the particular illnesses they are at risk for. Infection control and hospital epidemiology programs' primary aim is to stop the spread of illness, making it one of their most important responsibilities (Sydnor & Perl, 2016). Infection control may be achieved by measures such as monitoring, the investigation of outbreaks, the education and training of health care personnel, and the implementation of HAI preventive measures (Sydnor & Perl, 2016).

**Antimicrobial Use And Resistance**

Microbes are creatures that are so little that they cannot be seen with the naked eye, yet despite their invisibility, they are present everywhere on earth. Antimicrobial medications are used in the treatment of microbial infections caused by bacteria that are harmful to living beings. Antimicrobial resistance takes place when microorganisms acquire the capacity to withstand the effects of antibiotics, meaning that they are not eradicated and their development does not come to a halt.

* **Appropriate antimicrobial use**

Antibiotics have a significant role in the treatment of sickness. The use of antimicrobial agents should be justified by a correct clinical diagnosis or a microorganism that is causing an illness. According to estimates provided by the Centers for Disease Control and Prevention (CDC), office-based doctors write prescriptions for around 100 million courses of antibiotics each year, with nearly half of those prescriptions being unnecessary [Pittet, 2016]. When choosing an antibiotic treatment, it is important to take into account not only the kind of sickness but also the causative agent, which is the pathogen. In antimicrobial treatment, the goal is to employ a medicine that is selectively active against the most probable infection and has the lowest risk of causing resistance as well as undesirable effects [Aas, 2015]. Antimicrobial prophylaxis should be administered when it is suitable, which would be prior to surgery, in order to lower the frequency of surgical site infections that occur after surgery. Patients who have immune systems that are weakened get continued prophylactic treatment until their immunological markers are restored [Aas, 2015].

* **Antibiotic resistance**

In the South-East Asia area, antibiotic resistance is the cause of mortality for one kid every five minutes. The emergence of germs that are resistant to drugs is having the effect of diminishing the efficacy of drugs that were formerly used to cure fatal illnesses. The primary causes of the rise of antibiotic resistance include self-medication with antibiotics, inappropriate dose, chronic usage, a lack of guidelines for healthcare staff, and improper use in animal husbandry. Because of this resistance, an effective control against the bacteria that cause urinary tract infections (UTI), pneumonia, and bloodstream infections is under jeopardy. According to Banerjee (2016), high incidence rates of nosocomial infections are caused by highly resistant bacteria such as MRSA or multi drug-resistant Gram-negative bacteria. These infections may occur everywhere in the globe. According to data from the South-East Asian area, there is a significant level of resistance to third generation cephalosporin in E. coli and K. pneumoniae, and more than a quarter of S. aureus infections are methicillin resistant. According to Dr. Poonam Khetrapal Singh, Regional Director of WHO South-East Asia Region, "Immediate action is needed to stop the world from heading towards a pre-antibiotic era in which all achievements made in the prevention and control of communicable diseases will be reversed." "Immediate action is needed to stop the world from heading towards a pre-antibiotic era in which all achievements made in the prevention and control of communicable diseases will

* **Antibiotic control policy**

The global pandemic of antibiotic resistance demonstrates that it is driven by the overuse and abuse of antibiotics, which poses a danger to both the prevention and treatment of illnesses. According to the worldwide report on antibiotic resistance published by the WHO, it is possible to lessen the likelihood of contracting an illness by practicing better hygiene, drinking clean water, and being vaccinated. In order for healthcare facilities to keep one step ahead of ever increasing resistance, the development of new diagnostics and other technologies is essential. According to Banerjee (2016), pharmacists should fulfill their job by providing the appropriate antibiotic only when it is absolutely necessary, and policymakers should encourage collaboration and information sharing among all relevant parties.

**Nurses’ Role In Infection Prevention And Control**

Nurses, by virtue of the infection control training that they have received, play an important part in the culture of patient safety that is created (Stone, 2017). Stone (2017) asserts that nurses are on the front lines and are in the best position to assume the role of leader when it comes to explaining infection control practices to patients. According to NACNS (2020), research and demonstration projects have shown that the clinical nurse specialist's (CNS) role is uniquely suited to lead the execution of evidence-based quality development actions that also reduce costs throughout the health care system. This conclusion was reached as a result of the fact that the CNS role is uniquely suited to lead the execution of such actions. The CNS plays a major role in the organization of care and transitions of care, which leads to a shorter duration of stay in the hospital, fewer readmissions to the hospital, and fewer nosocomial diseases (NACNS, 2020). The professional nurse plays a vital role in the prevention of infections that are acquired while in the hospital (Benson & Powers, 2018). The nurse is a member of the medical staff who acts as a leader for the other members of the group when it comes to implementing preventative measures to protect the patient from infection (Benson et al., 2018). However, research conducted by Hakim, Mohsen, and Bakr (2015) found that hospital housekeepers had significantly greater knowledge than either physicians or nurses regarding the policies and systems used by the hospital for waste disposal, although they had less knowledge regarding the specifics of waste disposal. In addition, the housekeepers received the greatest overall ratings for attitudes toward trash disposal when compared to the nurses and doctors (Hakim et al., 2015). Patients in paediatric intensive care units face a substantial challenge in the form of infections that are related with medical treatment. These infections might result in severe morbidity, longer hospitalization, and an increase in the cost of medical care (Yasmine, John & Walaa, 2015). According to Yasmine et al. (2015), who evaluated the effect of a health education program regarding infection control measures on nurses' knowledge and attitude in pediatric intensive care units, it was found that the role of nurses is important in preventing the hazards and sequelae of health care-associated infections. Following the implementation of the educational program that was provided to the nursing staff, the research came to the conclusion that there is room for growth in both knowledge and attitude. Utilizing their knowledge and experience, as well as quickly applying choices to begin relevant interventions, all nurses, regardless of their function or the environment in which they work, have the potential to demonstrate leadership in the area of infection prevention and control.

According to Yamin, Jain, Mandelia, and Jayaram (2015), personnel in the healthcare industry are required to have knowledge of the numerous precautions that may be taken for their safety. To reduce the risk of occupational exposure, they need to strengthen the organization of the job, put in place standard measures, and dispose of biological waste in the appropriate manner. Workers in the health care industry should acquire the Hepatitis B vaccine for themselves and report any unintentional exposure to infected samples to the committee in charge of infection control (Yamin et al., 2015). The prevention of infections, the health and well-being of their patients, and the financial health of their employers are all areas in which nurses play an essential role.

**2.2 THEORETICAL FRAMEWORK**

**2.2.1 Environmental theory by Florence Nightingale’s**

When it comes to the prevention and management of infections, the nurse plays a significant part in the process of transferring information into attitudes and practices. Nightingale put the patient in the best possible position for recovery by putting into practice various preventive and control techniques, which she demonstrated via her knowledge and attitude about infection prevention and control (Hegge, 2013 and Gurler, 2014). The nurses' expertise, attitudes, and behaviors all have an impact on the atmosphere of the clinical setting. Nightingale emphasized the importance of cleanliness (hygiene, sanitation), as well as infection prevention and control techniques in the clinical setting, as contributing factors to the advancement of health care (Hegge, 2013 and Gurler, 2014). Patient: The knowledge, attitudes, and behaviors of nurses about infection prevention and control have an influence on the clinical environment, which in turn has an effect on the patient's risk of contracting infection-related disorders. Nightingale devoted her efforts to providing medical assistance to those who were ill and emphasized the need of hygienic practices and attentive treatment of patients in the fight against infectious diseases (Hegge, 2013 and Gurler, 2014).

**2.2.2 The Pathway of Survival Model Theory by Mosley and Chen (1984).**

The route of survival concept served as the foundation for this investigation. According to Leffler (2015), Mosley and Chen presented this paradigm for the first time in 1984, and the World Bank has only lately started using it as part of their life cycle strategy. In terms of one's knowledge on nosocomial illnesses, the model displays the connection between one's level of knowledge and the preventative actions they do. As a result, the Mosley Chen Framework takes into account both the social and biological aspects of infections and the role played by the health care system in combating them. It proposed that all of the consequences of infection at the individual, home, and community levels function through a set of similar mechanisms such as knowledge factors, preventative behavior, and social variables in the provision of health care.

According to Leffler (2015), the road of survival is a guide that differentiates between preventative activities such as vaccination that need more direct effort from the health care system. Specifically, the guide highlights the importance of recognizing that the highway of survival is a guide. He made the point that this approach demonstrates how the treatment of sickness may also be carried out at home in many circumstances, with the patient being responsible for taking key decisions about when they need assistance from outside sources. The World Bank, in adopting the model, included the more distal role of government policies and actions; consequently, the revised framework includes health system interventions as well as promotion of appropriate household and community behavior as necessary essential immediate steps between policy and outcome. Damani(2012). It acknowledges that integrated management of disease outbreaks, control of communicable and non-communicable diseases, and other factors contribute one set of influence on household behaviors; however, policies that determine the availability of health care support, food, and sanitation, in addition to other related amenities such as water supply, are equally as important. This approach acknowledges that the activities that take place in clinics and hospitals are the most immediate factors that determine how patients make use of the healthcare options that are accessible to them.

**2.2.3 The Health Belief Model (HBM) by Hochbaum, Rosenstock et al (1950)**

The Health Belief Model (HBM) developed by Hochbaum, Rosenstock, and colleagues serves as the foundation for this research (1950). In the 1950s, the Health Belief Model (HBM) was developed to help understand why people used or did not use preventive services offered by public health departments. Since then, the model has evolved to address newer concerns in prevention and detection (for example, vaccines), as well as lifestyle behaviors such as sexual risk behaviors and injury prevention. The Health Belief Model postulates that people's beliefs on their susceptibility to a disease or health problem and their perceptions of the advantages of taking action to prevent it affect their propensity to act. This is because people's beliefs on their susceptibility to a disease or health problem are based on their own experiences. Perceived susceptibility and perceived severity are two of the core characteristics of the HBM. Other core constructs include perceived benefits and perceived restrictions, action prompts, and self-efficacy (added more recently) The HBM has been used in the majority of cases to preventative and asymptomatic health problems, such as nosocomial infections. The Health Belief Model (HBM) was used to the current research project.

The choice to take preventive precautions is often made on the basis of elements that are the focus of the Health Belief Model (HBM), such as the perceived perceived efficacy of Nursing Students' perceptions, knowledge, and preventive behavior towards nosocomial diseases. Systematic studies on behavioural determinants have demonstrated that analyzing the variables that are included in the HBM has identified important determinants linked with the knowledge and preventative behavior towards nosocomial infections. In addition to this, the HBM investigates the variables that influence the attitudes of nursing students regarding nosocomial infections.

**2.3 EMPIRICAL FRAMEWORK**

Osonaike and Adeboye (2022) carried out a research on negative health associated with nosocomial infection. Assessing students’ knowledge about nosocomial infection may contribute to solving this issue. The present study aimed to assess the level of knowledge of nosocomial infection among student nurses and to identify their main sources of information on the topic. A total of 330 student nurses at Sultan Qaboos University completed the online survey, which included participants’ demographics and the Infection Control Standardized Questionnaire (ICSQ). The results of the study reveal the average total corrected score of the participants was 51.53 (SD=0.89) out of 100, with a minimum score of 16 and a maximum score of 96. Female students had a higher average score (13.9, SD=4.34) than male students (11.6, SD=3.2); t(328)=5.35. Conclusion: The student nurses did not have a sufficient level of knowledge about nosocomial infection. This calls for a review of nursing curricula to pave the way for more pragmatic teaching of infection control.

Chukwudi and Emenike (2021) examined the knowledge of Albanian medical students about infection control. The objectives of this study were to assess medical and nursing students' knowledge in clinical years at Medical University of Tirana about infection control. Two hundred twenty undergraduate health care students from four academic programs participated in the study. The infection control standardized questionnaire was used to assess the knowledge of students about three main domains, hand hygiene, nosocomial infections, and standard precautions. A total of 251 students were included. Overall mean percentage score of the students was 63.2±1.9. Mean percentage scores in all domains were 69.3±0.6 for medical, 63.1±1.8 for physiotherapy, 59.8±1.6 radiography, and 60.6±2.5 for nursing. The main source of information about the prevention of nosocomial infections as cited by participants was their routine formal training in class. There was no significant association between course of study and knowledge of students about preventive measures for nosocomial infections.

Michael, Adeoba and Ozekome (2022) carried out a study on the knowledge, attitudes and practices of nurses regarding infection prevention and control. The objectives were to determine the knowledge of nurses in infection prevention and control within a tertiary hospital within Zambia, the attitude of nurses in infection prevention and control within a tertiary hospital in Zambia, the practices of nurses in infection prevention and control within a tertiary hospital in Zambia and to make recommendations to the risk programme and policies of the tertiary hospital within Zambia. A quantitative descriptive study was conducted at a government tertiary hospital in Zambia. Sample: a Stratified random sampling was performed. A total of n= 196 nurses of all categories (70% from each category) were recruited in the study. Tools of data collection: a self-developed validated close-ended questionnaire guided by hospital policies, procedure standards, World Health Organization and Zambian Centres for infection prevention and control, was used to collect data. Results: During the main study, n= 196 questionnaires were distributed, n= 196 participants completed the questionnaires, a response rate of 100%. Most of the participants were female; 84.7% (n= 166) while 15.3 % (n= 30) were male. The majority of participants had good knowledge in infection prevention and control with the mean score of 83.21.The attitude towards infection prevention and control was good with the mean score of 81.37.The practice in infection prevention and control was poor with the mean score of 48.88. Stellenbosch University https://scholar.sun.ac.za iv Conclusion: Based on the findings of the current study, it can be concluded that, despite performing well in knowledge and showing a positive attitude towards infection prevention and control, nurses had unsatisfactory practice levels regarding infection prevention and control, exposing the patients to infection-related diseases. Strengthening infection prevention and control practice through regular in-service training/workshop; ensure that members of staff receive appropriate vaccinations regarding infection prevention and control; ensure that resources, e.g. personal protective equipment are available all the time; observing nurses’ practices (hand hygiene auditing and during invasive procedures) and provide feedback. Furthermore, research about the barriers in infection prevention and control practices.

**CHAPTER THREE**

**RESEARCH METHODOLOGY**

**3.1 Introduction**

In this chapter, we described the research procedure for this study. A research methodology is a research process adopted or employed to systematically and scientifically present the results of a study to the research audience viz. a vis, the study beneficiaries.

**3.2 Research Design**

Research designs are perceived to be an overall strategy adopted by the researcher whereby different components of the study are integrated in a logical manner to effectively address a research problem. This study was conducted from January to June 2017 and adopted a pretest–posttest quasi‑experimental design. This design was considered appropriate because the collection of baseline data allowed researchers to be relatively confident inferring that posttest differences occur as a result of the interventio

**3.3 Population of the Study**

According to Udoyen (2019), a study population is a group of elements or individuals as the case may be, who share similar characteristics. These similar features can include location, gender, age, sex or specific interest. The emphasis on study population is that it constitute of individuals or elements that are homogeneous in description. The population for this study included registered nurses in the two teaching hospitals in southwest Nigeria.

**3.4 Sample Size Determination & Technique**

A study sample is simply a systematic selected part of a population that infers its result on the population. In essence, it is that part of a whole that represents the whole and its members share characteristics in like similitude (Udoyen, 2019). Simple random sampling was used to select the experimental group and control group among the two teaching hospitals. The total number of nurses that met the inclusion criteria for the experimental group and control group were 125 and 190 participants, respectively. The sample size was calculated using Kish’s formula with Z = 95%, confidence level = 1.96, and Zβ 80% power = 0.84. The proportionate stratified random sampling technique was subsequently used to select the participants. Thirty‑five percent of the nurses in each ward or unit were used for the selection of the experimental group, whereas 24% nurses in each ward or unit were used for selecting the control group. Based on the abovementioned proportion, both the experimental intervention group and the control group had 45 participants each. The experimental and control groups were carefully selected to avoid possibility of contact across group and prevent risk of contamination.

**3.5 Instrumentation**

This study made use of self‑report questionnaire for data collection. The instrument has a reliability value of 0.92 using Cronbach alpha (R). The instrument consisted of three sections – A, B, and C. Section A elicited responses on demographic variables of participants such as age, gender, marital status, and educational qualification among others. Section B elicited information on the participants’ knowledge about standard precautions. The questionnaire elicited responses on hand washing, personal protective equipment (PPE), injection safety, cleaning, disinfection, and waste management. The total number of items was 33. Correct responses were scored as 1. The maximum obtainable score was 33. Scores 0–16 were classified as low knowledge, 17–27 as moderate knowledge, and 28–33 as high knowledge. Section C elicited information on participants’ perception about infection control. This section was developed by the researchers. The questionnaire elicited responses on perceived susceptibility, perceived seriousness or threat, perceived benefits, as well as self‑efficacy. There were 16 items and the maximum possible score was 64. Scores 0–31 were classified as poor perception, 32–54 as fair perception, and 55–64 as good perception.

**3.8 Pilot Study & Reliability**

A pilot study is a smaller version of a proposed study conducted to develop and refine the methodology such as the treatment, instruments or data collection process to be used in the larger study (Burns & Grove 2011:544).The questionnaire was pretested on 20 nurses at another teaching hospital in a different state in southwestern Nigeria. The data collected were used to estimate the reliability of the instrument using Cronbach alpha (R) to bring out the internal consistency and establish the validity of the instrument. The Cronbach alpha values for knowledge and perceptions were 0.79 and 0. 80, respectively.

**3.9Method of Data Collection**

Data were collected in three phases namely – pre‑intervention visits, intervention sessions, and evaluation of intervention sessions. Preintervention visits were made in the experimental group and control group. This was to enable the researchers to obtain the number of nurses and the wards/units where they were assigned to. During the pre‑intervention visits, the participants were informed about the date of commencement, and the time table for the training program was given to them through the nurse at charge in each ward/unit. The control group was also visited but they were not exposed to any training program. In the intervention sessions, the participants were exposed to four modules. Each module was held once a week and lasted for four consecutive weeks. The researchers met the experimental group as scheduled in the first week. The researchers introduced themselves to the participants; the pretest questionnaire was administered followed by the content of module one which included the importance of infection control, chain of infection, and components of standard precautions. The session lasted for 90 minutes. The method of teaching includes lecture, demonstration, and use of visual aids. In the second week, the participants were exposed to the contents of module two which consisted of hand hygiene, patient care equipment, and preparation of different strengths of JIK (3.5%) hypochlorite solution. The researchers visited the control group. No training was given to the participants. The researchers went to various wards/ units to meet the participants. The objectives of the study were communicated to all participants. Interested participants were given the written consent form to complete. This was followed by the administration of the pretest questionnaire and the same were collected on the spot after completion. Participants were also informed that they would complete the posttest questionnaire after 4 weeks.

In the third week, participants were exposed to the contents of module three which consisted of PPE. In the fourth week they were exposed to the contents of module four which consisted of injection safety and health care waste management. They were told to come back afte 4 weeks for the posttest which was the same used for the pretest. Evaluation of the intervention program was done 4 weeks post‑intervention. All the participants were given the posttest to complete and were retrieved immediately. The researchers also visited the control group in their various wards/units to administer the posttest, and the filled‑out questionnaires were collected immediately. Finally, the researchers held a brief meeting with the Director of Nursing Services to express their appreciation for the support. Completed questionnaires were collected, coded, and analyzed using SPSS version 21.0 (SPSS Inc. Chicago IL, USA). Descriptive statistics such as frequency counts, percentages, tables, mean scores, and standard deviation were used to analyze the demographic data of participants and provide answers to the research questions. Inferential statistics of *t*‑test was used to test one hypothesis generated at 0.05 level of significance.

**3.12 Ethical Consideration**

Ethical approval for this study was obtained from the institutional ethical committee with approval reference of BUHREC526/16. Participants were duly informed about the objectives of the study and participation was voluntary and all participants were informed of their rights to withdraw from the study at any point if they so desired. All participants signed the consent form and confidentiality of information was assured and upheld.

**CHAPTER FOUR**

**DATA PRESENTATION AND ANALYSIS**

**4.1 INTRODUCTION**

This chapter presents the analysis of data derived through the questionnaire and key informant interview administered on the respondents in the study area. The analysis and interpretation were derived from the findings of the study.

**4.2 DATA PRESENTATION**

**4.1.1 Demographic Information**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** | **Category** | **Experimental Group (*n*=42)**  **Frequency (%)** | **Control Group (*n*=45)**  **Frequency (%)** |
| Age in years | 24‑29 | 13 (31.00) | ‑ |
|  | 30‑35 | 14 (33.30) | 2 (4.40) |
|  | 36‑41 | 8 (19.00) | 6 (13.30) |
|  | 42‑47 | 3 (7.10) | 14 (31.10) |
|  | 48‑53 | 1 (2.40) | 14 (31.10) |
|  | 54‑59 | 2 (4.80) | 9 (20.00) |
|  | 60 and above | 1 (2.40) | ‑ |
|  | Total | 42 (100) | 45 (100) |
|  | Mean | 34.92 | 47.43 |
|  | Standard deviation | 8.99 | 6.60 |
| Gender | Male | 9 (21.40) | 2 (4.40) |
|  | Female | 33 (78.60) | 43 (95.60) |
|  | Total | 42 (100) | 45 (100) |
| Marital status | Single | 16 (38.10) | ‑ |
|  | Married | 24 (57.10) | 43 (95.60) |
|  | Widowed | 2 (4.80) | 2 (2.20) |
|  | Total | 42 (100) | 45 (100) |
| Religion | Christianity | 41 (97.60) | 40 (88.90) |
|  | Islam | 1 (2.40) | 5 (11.10) |
|  | Total | 42 (100) | 45 (100) |
| Years of experience | 1‑5 | 16 (38.10) | 3 (6.70) |
|  | 6‑10 | 15 (35.70) | 2 (4.40) |
|  | 11‑15 | 2 (4.80) | 5 (11.10) |
|  | 16‑20 | 2 (4.80) | 8 (17.80) |
|  | 21‑25 | 2 (4.80) | 9 (20.00) |
|  | 26‑30 | 2 (4.80) | 10 (22.20) |
|  | 31‑35 | 1 (2.40) | 8 (17.80) |
|  | 36 and above | 2 (4.80) | ‑ |
|  | Total | 42 (100) | 45 (100) |
|  | Mean | 10.42 | 21.89 |
|  | Standard deviation | 9.95 | 8.72 |
| Educational qualification | RN only | 1 (2.40) | ‑ |
|  | RN, RM | 12 (28.60) | 23 (51.10) |
|  | B.NSC. | 21 (50.00) | 11 (24.40) |
|  | M.SC | 2 (4.80) | 3 (6.70) |
|  | Others | 6 (14.30) | 8 (17.80) |
|  | Total | 42 (100) | 45 (100) |
| Position | NO II | 27 (64.30) | 4 (8.90) |
|  | NO I | 4 (9.50) | 1 (2.20) |
|  | SNO | 4 (9.50) | 2 (4.40) |
|  | PNO | 2 (4.80) | 9 (20.00) |
|  | ACNO | 2 (4.80) | 4 (8.90) |
|  | CNO | 2 (4.80) | 25 (55.60) |
|  | Ass. DIR. | 1 (2.40) | ‑ |
|  | Total | 42 (100) | 45 (100) |

Table 1 shows that the mean (SD) for age in the experimental group was 34.92 (8.99) whereas that of the control group was 47.43 (6.60); regarding gender, there were more females in the control group. The mean (SD) for years of experience in the experimental group was 10.42 (9.95) whereas it was 21.89 (8.71) in the control group.

**4.3 DESCRIPTIVE ANALYSIS**

**Table 2: Descriptive statistics showing pre‑ and post‑intervention responses of participants’ knowledge about infection control in the experimental and control group.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Knowledge about infection contro** | **Pre‑intervention** | |  | **Post‑intervention** | | ***p*** |
|  | **Experimental**  **Frequency (%)** | **Control**  **Frequency (%)** |  | **Experimental**  **Frequency (%)** | **Control**  **Frequency (%)** |  |
| Low knowledge | 22 (52.30) | 28 (62.20) |  | 1 (2.40) | 26 (57.80) | 0.001 |
| Moderate knowledge | 20 (40.70) | 13 (28.90) |  | 15 (34.70) | 16 (35.60) |  |
| High knowledge | ‑ | 4 (8.90) |  | 26 (62.90) | 3 (6.70) |  |
| Total | 42 (100) | 45 (100) |  | 42 (100) | 45 (100) |  |
| Mean | 21.00 | 13.80 |  | 28.24 | 14.30 |  |
| Mean difference between experimental and control | 7.20 | |  | 13.94 | |  |

Table 2 shows that in the post‑intervention, 26 participants (62.90%) had high knowledge compared to none in the pre‑intervention, whereas only 1 participant (2.40%) had low knowledge compared to 22 (52.30%) participants in the pre‑intervention. The mean difference was 7.24. This indicates that the training had an effect on participants’ knowledge.

**Table 3: Descriptive statistics showing pre‑intervention responses of participants on exposure or injury experience in experimental group and control group**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Items** | **Responses** | | | | |
|  | **Experimental** | |  | **Control** | |
|  | **Yes**  **Frequency (%)** | **No**  **Frequency (%)** |  | **Yes**  **Frequency (%)** | **No**  **Frequency (%)** |
| Have you received vaccination for Hepatitis B virus? | 25 (59.50) | 17 (40. 50) |  | 12 (26.70) | 33 (73.30) |
| Have you ever experienced sharp injury? | 28 (66.70) | 14 (33.30) |  | 20 (44.40) | 25 (55.60) |
| Have you ever experienced exposure of impaired skin to blood? | 23 (54.80) | 19 (45.20) |  | 12 (26.70) | 33 (73.30) |
| Did you report the experience of sharp injury? | 15 (35.70) | 13 (30.90) |  | 6 (13.30) | 14 (31.10) |
| Did you report your exposure of impaired skin to blood and other secretions? | 13 (30.90) | 10 (23.80) |  | 4 (8.80) | 8 (17.70) |

Table 3 shows that 25 participants (59.50%) have received hepatitis B virus vaccination in the experimental group whereas 12 participants (26.70%) received vaccination in the control group. Twenty‑eight participants (66.70%) experienced sharp injury in the experimental group as compared to 20 participants (44.40) in the control group.

**Table 4: Post‑intervention responses of participants on exposure or injury experience in experimental group and control group.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Items** | **Responses** | | | | |
|  | **Experimental** | |  | **Control** | |
|  | **Yes**  **Frequency (%)** | **No**  **Frequency (%)** |  | **Yes**  **Frequency (%)** | **No**  **Frequency (%)** |
| Have you received vaccination for Hepatitis B virus? | 32 (76.20) | 10 (23.80) |  | 12 (26.70) | 33 (73.30) |
| Have you experienced sharp injury (within the last 6 weeks)? | ‑ | 42 (100) |  | 5 (11.20) | 40 (88.80) |
| Have you experienced exposure of impaired skin to blood or other secretions (within the last 6 weeks)? | ‑ | 42 (100) |  | 8 (17.80) | 37 (82.20) |
| Did you report the experience of sharp injury (within the last 6 week)? | ‑ | ‑ |  | 3 (6.60) | 2 (4.40) |
| Did you report your exposure of impaired skin to blood and other secretions? | ‑ | ‑ |  | 4 (8.90) | 4 (8.90) |

Table 4 shows that 32 participants (76.20%) have received vaccination of hepatitis B virus in the experimental group while the number for the control group did not change from the baseline after the training program. Posttest results show that participants in the experimental group did not experience sharp injury within the 6 weeks whereas 5 participants (11.20%) in the control group had experience; only 3 participants (6.67%) reported the experience of needle stick injury. This indicates that the training had an effect on infection risk reduction in the experimental group (p = 0.001).

**Table 5: Statistics showing the effect of training program on perception about infection control among experimental and control groups**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Perceptions about infection control** | **Pre‑intervention** | |  | **Post‑intervention** |  | |  |
|  | **Experimental Group Frequency (%)** | **Control Group Frequency (%)** |  | **Experimental Group ControlGrou Frequency (% ) Frequency** | **t (df)** | | ***p*** |
|  |  |  |  |  |  | |  |
| Poor perception | 4 (9.60) | 5 (11.10) |  | - 29 (64.40) | 17.12 (85) |  | 0.001 |
| Fair perception | 35 (83.30) | 38 (84.40) |  | 10 (24.00) 16 (35.60) |  |  |  |
| Good perception | 3 (7.10) | 2 (4.50) |  | 32 (76.00) ‑ |  |  |  |
| Total | 42 (100.0) | 45 (100.0) |  | 42 (100.0) 45 (100.0) |  |  |  |
| Mean (SD) | 50.11 (4.16) | 43.77 (6.50) |  | 58.47 (4.67) 44.60 (4.14) |  |  |  |
| Maximum | 56.00 | 50.00 |  | 64.00 51.00 |  |  |  |
| Minimum | 41.00 | 15.00 |  | 45.00 29.00 |  |  |  |
| Range | 15.00 | 35.00 |  | 19.00 22.00 |  |  |  |

The findings listed in table 5 show the descriptive statistics indicating the effects of training on participants’ perceptions in the experimental and control groups. The mean pre‑intervention perception scores were 50.11 and 43.77 in the intervention and control groups respectively. After the intervention, the mean perception scores were 58.47 and 48.60 in the intervention and control groups respectively. The results in table 5 show that t = 17.12, df = 85, p = 0.001. This indicates that there is a significant difference in the mean perception score of infection control between the experimental and control groups.

**4.4 Discussion**

The mean knowledge difference was 7.24. This indicates that the training had a positive effect on participants’ knowledge about infection control. This result supports the findings of Burute et al. [10] in their study on the immediate impact of an educational intervention on knowledge about use of disinfectants, in which posttest percentage for use of disinfectants improved significantly. This result is also consistent with the findings of Adly et al. [5] in their study on knowledge and compliance with infection control among nurses. Similarly, Taha[11] found in a study in Sudan that a training program is effective in increasing participants’ knowledge and application of standard precautions during labor. Prior to the training, the scores for applying standard precautions were 40.90%, but after the training program, the score increased to 52.20% for knowledge and attitude. There was a reduction of risk to infection among the experimental group compared to the control group. This indicates that the knowledge acquired during the training made them to be conscious of their safety as indicated by the fact that they did not experience sharp injury within the 6 weeks of training program. On the other hand, in the control group, 5 participants (11.20%) had injury exposure or experience and only 3 participants (6.67%) reported the experience. These participants did not report because they were not exposed to any training programs that would have enhanced their knowledge about infection risk reduction. This finding supports a previous study by Ng et al. [12] conducted in Malaysia among interns. Their results showed that, after educational training, there was a significant reduction of bloodstream infection in the pediatric intensive care unit (PICU). They concluded that the intervention significantly reduced the risk of PICU‑acquired bloodstream infection.

This result is also groups. Therefore, this indicates that the training program has an effect on participants’ perception. This finding is similar to the findings of Allegranzi et al. [14] in a study conducted in Mali on hand hygiene improvement strategy. The results showed that knowledge was enhanced significantly, and perception survey showed a high appreciation of each strategy. The researchers explained that the effect was associated with the training program. From the discussions, it could be seen that the importance of training and retraining cannot be overemphasized. For instance, a previous study reported that a structured training program was effective in improving students’ knowledge about Ebola virus disease.[15] Also, Galal et al. (2014) came to similar conclusion in their study conducted in Egypt on the impact of an infection‑control program on nurses’ knowledge and attitude in PICU at Cairo University hospitals. Their findings showed that a significantly higher level of knowledge was revealed in the post‑intervention phase as compared with the pre‑intervention phase with regard to the types of nosocomial infections, the at‑risk groups for acquiring, and the measures, applied to control nosocomial infections Nurses in the post‑intervention phase had significantly more knowledge about the types of hand washing. A significantly higher percent of nurses in the post‑intervention phase knew about the importance of avoiding recapping syringes and believed that infection control measures could protect them completely from acquiring infection.

Statistically significant higher total knowledge and attitude scores were revealed in the post‑intervention phase compared with the pre‑intervention one. This clearly shows how effective an infection control training program can be in enhancing knowledge, attitude, and practice of infection control. Nwozichi (201 also reported that a training program was effective in enhancing students’ knowledge about testicular cancer and testicular self‑examination. Overall, it was the training program that led the experimental group to have a mean gain of 7.24 on knowledge and 8.36 on perception. When all the factors are addressed this would lead to infection risk reduction. It should be noted, however, that the most important limitation of this study is the small sample size which is just a fraction of registered nurses in the whole of Nigeria, which has reduced the generalizability of the findings.

**CHAPTER FIVE**

**SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

**5.1 SUMMARY**

The broad objective of this study focused on Nursing intervention for the promotion of infection control in two teaching hospitals. This study therefore examined the effects of a training programme in promoting infection control in two teaching hospitals in Ogun State. The study adopted a pretest-posttest quasi experimental design.  The sample consisted of 87 participants. They were made up of experimental group which consisted of 42 registered nurses from Babcock University Teaching Hospital (BUTH). Ilishan-Remo, Ogun State. The control group was 45 nurses from Olabisi Onabanjo University Teaching Hospital. The training programme consisted of 4 modules on infection control. The programme lasted 4 weeks. The instruments used for data collection were Knowledge about Infection Control Questionnaire (r = 0.79); Perceptions about Infection Control Questionnaire (r = 0.80); Attitudes towards Components of Infection Control Questionnaire (r = 0.62); Practice of Infection Control Questionnaire (both self-reported and observation checklist) (r =0.62). Four research questions were answered and three hypotheses were tested at 0.05 alpha level. Data were analysed using descriptive statistics and Students’ T-test.

**5.2 Major Findings**

Findings showed that the mean age in the experimental group was 34.92 and SD 8.99 while the control group was 47.43 and SD 6.60. The mean for years of experience in the experimental group was 10.42 and SD 9.95 while in the control group was 21.89 and SD 8.72.

On attitude, 30 participants (69.0%) had positive attitude in the experimental group compared to 21 participants (46.7%) in the control group. The mean difference was 4.02.

On perception, 32 participants (76.0%) in the post intervention had good perception compared to nonein the control group. The mean difference was 8.36. On knowledge, 26 participants (62.9%) in the post intervention had high knowledge compared to none participant in the pre intervention. The mean difference was 7.24.

On infection risk reduction in the intervention group, 28 participants (66.7%) have experienced sharp injury pre intervention and none post intervention. Significant differences were found between mean practice score of participants in the experimental and control (p = 0.001) and between self reported and observed practices (p = 0.000) but there was no significant difference between the mean knowledge score in the experimental and control group (p = 0.149).

Findings further revealed that 26 participants (62.90%) in the postintervention group had high knowledge level compared to the preintervention where none had high knowledge. A significant difference was observed between the mean perception score on infection control in the experimental and control groups (t = 17.12; p = 0.001).

**5.3 Conclusion**

Hospital Associated Infections (HAIs) have been associated with significant morbidity and attributable mortality, as well as greatly increased health care costs.Hospital acquired infections are of important wide-ranging concern in the medical field; they can be localized or systemic, can involve any system of the body and can be associated with medical devices or blood product transfusions. Health care workers, particularly nurses are at risk of infection because they constantly come into contact with infected tissues, fluid, blood and blood products. By complying with infection control measures a lot of infections can be prevented. Some survey studies have been conducted in Nigeria on knowledge, perception attitude and practice of infection control and they concluded that there was inadequate adherence to infection control practices and this could be addressed by organizing training and retraining programmes. The structured training program was effective in improving nurses’ knowledge and perception about infection control.

Findings from this study showed that,The training programme was effective in improving the level of knowledge, attitude, perception and practice of infection control. After this training program, their risk reduction practice was enhanced. This study also showed that a training program is very effective and all nurses should be exposed to infection control training to be equipped with necessary knowledge and skills with which to fight against the spread of infection in the healthcare setting

5.4  **Recommendation**

Based upon the scientific evidence generated during the study, the following recommendations are discussed below:

1. The Minister of Health to lobby for sufficient funds from the government so that the Permanent Secretary can allocate enough resources specifically for Infection Prevention and Control.
2. Resources should be allocated for Infection prevention and control conferences locally and internationally.
3. Nursing schools should emphasize the importance of infection prevention and control (Hospital acquired infections) in the syllabus.
4. The General Nursing Council of Nigeria should continue to emphasize on the introduced a Continuous Professional Development Booklet for Nurses.
5. Training on infection prevention and control be mandatory yearly and that it should be a requirement for yearly nursing registration.
6. Availability of personal protective equipment required for applying infection control measures at all the times.
7. The Tertiary Hospital should ensure that new members of nursing student and staff (nurses) receive in-service training in infection prevention and control as part of induction.
8. Teaching Hospital should ensure adequate facilities for hand hygiene. For example hand basins with running water available as well as disposable hand towels. This will help with compliance with hand hygiene among Nursing students.
9. Training and retraining should be organized for all nurses and other categories of healthcare workers to promote adherence to infection control.

**5.7 Implication of the Study to Nursing Practice**

Infection-related diseases are still the main cause of morbidity and mortality in Nigeria (WHO, 2015). Deaths related to nosocomial infection in teaching hospitals continue to be a health care priority. Nurses with inadequate knowledge, bad practices in infection control and prevention, jeopardize the safety of the patient. The WHO has indicated that nosocomial infection is a research priority especially for student nurses in other to prepare them for this profession and this coincides with the study.According to the European Centre for Disease Prevention and control (2014), the outbreak of infectious diseases like Ebola, Covid-19, Monkey-Pox in Nigeria is a public health risk as a neighbouring country and therefore preparedness in infection prevention and control measures should be strengthened. This study is of implication to to Nursing Practices because efficient knowledge, good attitude and best practices by the nurse in infection prevention and control may contribute to decreasing in infection rate in the hospital.

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**QUESTIONNAIRE**

**Question 1: pre‑ and post‑intervention responses of participants’ knowledge about infection control in the experimental and control group.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/N**  **ITEM STATEMENT** | **Pre‑intervention** | | **Post‑intervention** | |
| **Experimental** | **Control** | **Experimental** | **Control** |
| Low knowledge |  |  |  |  |
| Moderate knowledge |  |  |  |  |
| High knowledge |  |  |  |  |

**Question 2: Pre‑intervention responses of participants on exposure or injury experience in experimental group and control group**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Items** | **Responses** | | | | |
|  | **Experimental** | |  | **Control** | |
|  | **Yes** |  |  | **Yes** | **No** |
| Have you received vaccination for Hepatitis B virus? |  |  |  |  |  |
| Have you ever experienced sharp injury? |  |  |  |  |  |
| Have you ever experienced exposure of impaired skin to blood? |  |  |  |  |  |
| Did you report the experience of sharp injury? |  |  |  |  |  |
| Did you report your exposure of impaired skin to blood and other secretions? |  |  |  |  |  |

Question 3: **Post‑intervention responses of participants on exposure or injury experience in experimental group and control group.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Items** | **Responses** | | | | |
|  | **Experimental** | |  | **Control** | |
|  | **Yes** | **No** |  | **Yes** | **No** |
| Have you received vaccination for Hepatitis B virus? |  |  |  |  |  |
| Have you experienced sharp injury (within the last 6 weeks)? |  |  |  |  |  |
| Have you experienced exposure of impaired skin to blood or other secretions (within the last 6 weeks)? |  |  |  |  |  |
| Did you report the experience of sharp injury (within the last 6 week)? |  |  |  |  |  |
| Did you report your exposure of impaired skin to blood and other secretions? |  |  |  |  |  |

Question 4: What is the effect of training program on perception about infection control among experimental and control groups?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Perceptions about infection control** | **Pre‑intervention** | |  | **Post‑intervention** | |
|  | **Experimental Group** | **Control Group** |  | **Experimental Group** | **Control Group** |
| Poor perception |  |  |  |  |  |
| Fair perception |  |  |  |  |  |
| Good perception |  |  |  |  |  |