

INTRODUCTION

A blood-borne disease is one that can be spread through contamination by blood and other body fluids. The most common examples are the Human Immunodeficiency Virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), and Viral Hemorrhagic Fevers (VHFs). Diseases that are not usually transmitted directly by blood contact, but rather by insect or other vector, are more usefully classified as vector-borne disease, even though the causative agent can be found in blood (*Encyclopedia, 2016A*).

Many blood-borne diseases can also be contracted by other means, including high-risk sexual behavior or intravenous (IV) drug use. These diseases have also been identified in sports medicine. Blood and Body Fluid precautions are a type of infection control practice that seeks to minimize this sort of disease transmission. Blood poses the greatest threat to health in a laboratory or clinical setting due to needle-stick injuries (e.g., lack of proper needle disposal techniques and/or safety syringes). Blood for blood transfusion is screened for many blood-borne diseases. Needle exchange programs are an attempt to reduce the spread of blood-borne diseases between IV drug users (*Goodrich et al., 2006; Jason & Donald, 2007; Goodrich et al., 2009 and Encyclopedia, 2016A*).

Prevalence of HIV/Acquired Immune Deficiency Syndrome (HIV/AIDS) in Egypt is low – ranging from 2, 900 to 13, 000 individuals. Most reported HIV cases are transmitted through unprotected heterosexual sex. 90% of Egyptian women who live with HIV were infected within marriage. Girls and women are particularly vulnerable to HIV as societal norms in Egypt can hinder them from accessing information about sexuality (*United Nations International Children's Emergency Fund [UNICEF], 2010*).

Prevention of percutaneous injuries and other blood exposures is an important step in preventing the transmission of blood-borne viruses to healthcare personnel. Surveys of healthcare personnel indicate that 50% or more do not report their occupational percutaneous injuries (*CDC, 2005*). The Centers for Disease Control and Prevention (CDC) estimated that between 800, 000 and 1 million needle-sticks and other sharps injuries occur each year in the United States (U.S). However, these injuries tend to be dramatically underreported, by anywhere from 40 to 70% (*The National Institute for Occupational Safety and Health [NIOSH], 2006*).

Pediatric nurses must understand the mechanisms and pathway of exposure to environmental health hazards, basic prevention and control strategies, the interdisciplinary nature of effective intervention and the role of research and advocacy. Pediatric nurses' activities in primary, secondary, and tertiary

prevention strategies are expected to assume an even more important role in the prevention and treatment of disease in the future (*Lundy & Jeans, 2012*).

Significance of the study

Hepatitis B is now preventable due to the vaccine that must be offered to health care workers and is given to children at birth. Following regulatory and legislative efforts, including the Occupational Safety and Health Administration (OSHA) Blood-borne Pathogens Standard, cases of hepatitis B in health care nurses dropped from 17, 000 annually to 400 annually—and Continue to drop (transmission rate: 2–40 %) (*Moyer & Hodgson, 2002*).

Hepatitis B vaccination should be administered to adults in the deltoid muscle. Antibody response may be measured by anti-HBs levels 1 to 3 months after completing the basic course of vaccine, but this testing is not routine and not currently recommended. People at high risk, including nurses and other health care personnel exposed to blood or blood products, should receive active immunization (*Smeltzer et al., 2010*). The pediatric nurse emphasizes the importance of keeping follow-up appointments and participating in other health promotion activities and recommended health screenings (*World Health Organization [WHO], 2007*).

AIM OF THE STUDY

The Aim of this study is to assess the effect of a prevention program for blood-borne diseases on nurses' performance for infection control standard precautions through:

- Assessing nurses' performance toward infection control standard precautions for blood-borne diseases.
- Designing, implementing and evaluating the effect of a prevention program for blood-borne diseases on nurses' performance for infection control standard precautions.

Research Hypothesis

There will be a statistical significant difference between nurses' performance pre and post program for blood-borne diseases.

REVIEW OF LITERATURE

Part I: Infection and Infection Control

Nature of Infection:

Infection is a condition in which the host interacts physiologically and immunologically with a microorganism, which is capable of producing infectious diseases and can cause a disease such as a bacterium, virus, parasite, or fungus (*Public Health Agency of Canada [PHAC], 2011*).

Pathogenic” refers to the processes or mechanisms to generate an injury or illness, in this case induced by a viral infection. The results of a viral infection depend on factors related to the nature of the virus, the host and the environment. They include: number of infectious particles, the way to reach the target tissue, the rate of multiplication, the effect of virus on cell functions and the host’s immune response. Three requirements must be satisfied to ensure the infection of an individual host (*Manjarrez, 2012*).

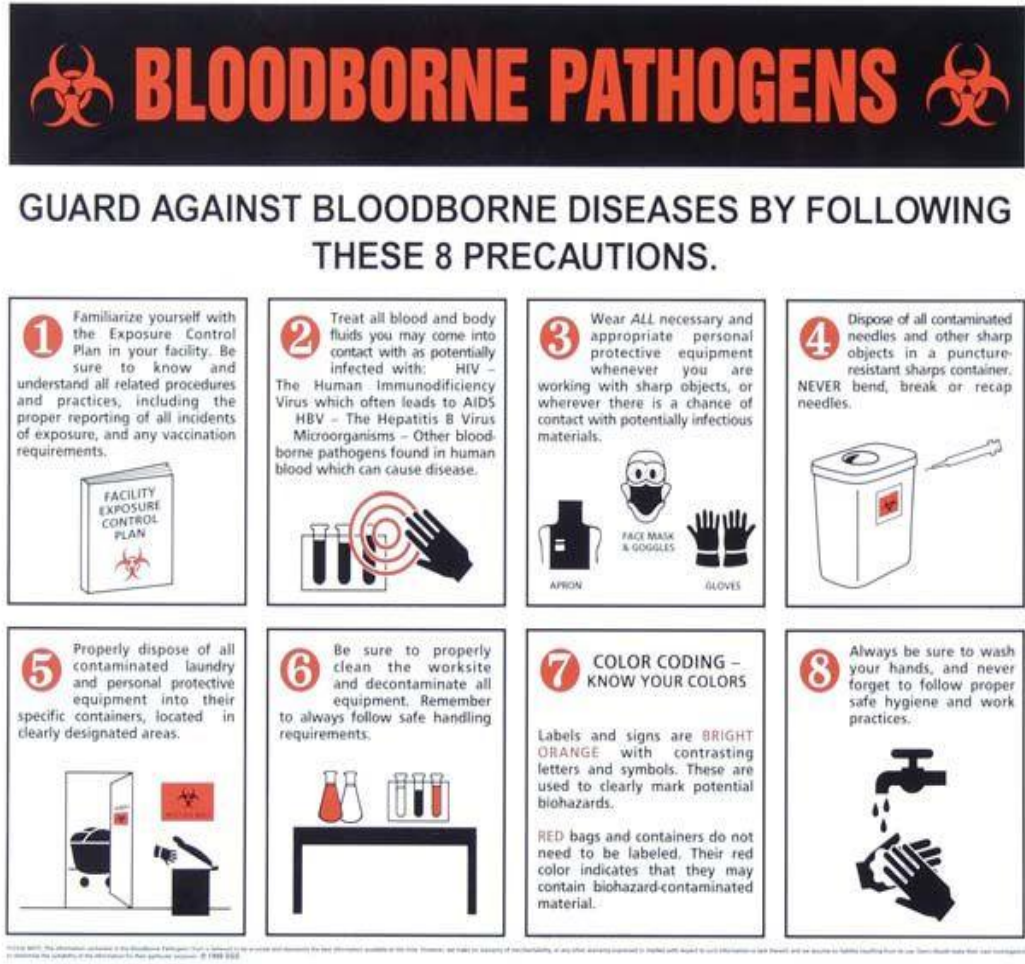
It is important to know the difference between an infection and a colonization; if a microorganism is present into a body surface of a host, grows and multiplies but does not invade the body or cause disease or infection, this is referred to as a colonization. While an infectious disease is a state in which the infected host displays a decline in wellness due to the infection (*Bond et al., 2010; Smeltze & Bare, 2010*).

Infection may be classified according to its extent into; localized, limited to a particular area such as wound infection, which is the most common in the areas of skin or mucous membrane and systemic or generalized infections, that affects the entire body instead of just a single organ or part such as septicemia (*Potter & Perry, 2008*).

Blood borne pathogens (Figure 1) include abroad spectrum of infectious conditions that reach their targeted tissue through the circulation of blood; that is defined as human blood, human blood components, and products made from human blood defined as Other Potentially Infectious Materials (OPIMs) e.g., human semen, vaginal secretion, Cerebro-Spinal Fluid (CSF) pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any body fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids (*Medical University of South Carolina [MUSC], 2011*).

However, infection can be classified as well according to its foundation in hospital into that brought into hospital, or being incubated at admission namely community-acquired infections" while that appeared in hospital after admission and due to it, namely Hospital-Acquired Infection (HAI) or Nosocomial Infection (NI) (*Meers et al., 2004*).

Figure (1): Blood-Borne Pathogens



Website: Blood-Borne Pathogens. Available at: [www.google.com.eg](http://www.google.com.eg/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKEwjU8rLv2tjNahWK1xQKHZc8D-)
[/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKE](http://www.google.com.eg/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKEwjU8rLv2tjNahWK1xQKHZc8D-)
[wjU8rLv2tjNahWK1xQKHZc8D-](http://www.google.com.eg/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&ved=0ahUKEwjU8rLv2tjNahWK1xQKHZc8D-)

Nosocomial infection constitutes a major public health problem in Egypt, which requires more interest and attention than it presently receives, it represents an important cause of morbidity and mortality in pediatric population especially in Pediatric Critical Care Unit (PCCU), but there is no available statistical records and no universal program or approach to control such infection (*CDC, 2010*).

Nosocomial infection can be defined as any clinical recognizable microbiological disease that affects children due to attending for treatment in the hospital, whether or not the symptoms of the disease appear or affect the hospital staff as a consequence of their work (*Simmon, 2005 & Philip, 2004*).

The incidence of nosocomial infection varies according to characteristics of the organization, service area within a hospital and anatomic site (*Tabish, 2009*). Some studies reported that, the incidence of nosocomial infection in Neonatal Intensive Care Unit (NICU), is 5-25%, and mortality associated with these infections is anywhere from 5-20%, depending on the geographic area (*Kenner et al., 2007; and Baker, 2010*), 'while the overall mortality rate attributable to pediatric nosocomial infection in PCCU has been estimated to be 11% National Nosocomial Infection (NNI). (*Survey, 2009*).

Nosocomial bloodstream infections

Nosocomial Bloodstream Infections (NBSIs) are an important cause of morbidity and mortality. The incidences of bloodstream infections (BSIs) are varied (1 to 36%) in different studies. The crude mortality is high, particularly for Intensive Care Unit (ICU) child (*Novella, 2010*).

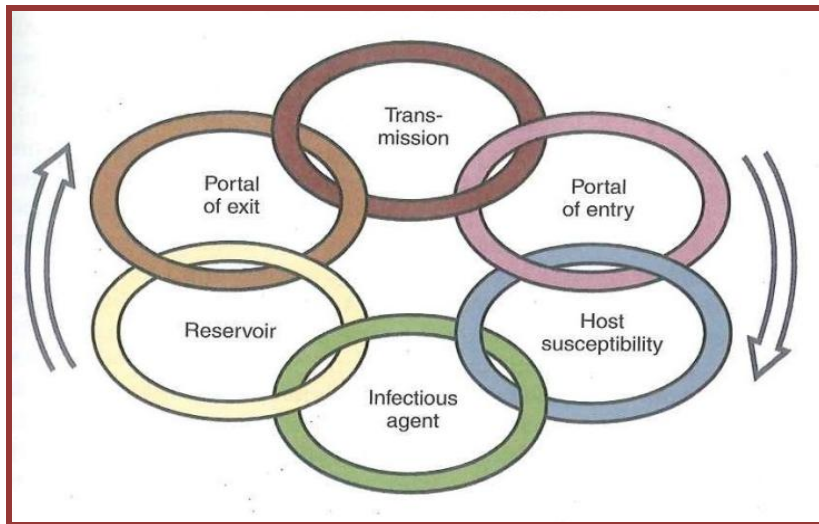
Current guidelines recommend broad-spectrum combination therapy with more than two antibiotics as the initial empirical therapy for some types of infections in patients at risk of being infected with resistant organisms. All antibiotics can potentially exert selective pressure and thereby drive resistance, yet appropriate empirical antimicrobial therapy is important, since it can decrease mortality in critically ill patients (*Marshall, 2010*).

Chain of Infection:

The chain of infection (Figure 2) is the process by which pathogens 'are transmitted from the environment to a host; invade the host and cause infection (*Igriatavicius et al., 2008*). The development of an infection occurs in a cyclical process that depends on the following elements: the infectious agent or pathogen, the source of infection or reservoir for pathogen growth and reproduction, portal of exit from the reservoir, means of transmission or vehicle, portal of entry and a susceptible host. Therefore infection develop if this chain stays

intact, the nurse's efforts to prevent and control infection are directed at breaking this chain (**Black & Jacobs, 2006; Craven & Hirnle, 2010**).

Figure (2): Chain of infection.



Lundy, S & Jeans. S., (2012): Community health nursing For the Public's Health, (2nd ed) London, Barb House Company.pp576- 560.

Infectious agent:

The first link in the chain of infection is the microbial agent; which may be bacterium, virus, fungus, parasites, rickettsia and mycoplasmas. There are some factors, which affect microbial growth such as, oxygen, nutrients, temperature, PH or chemical environment, light and moisture (**Craven & Hirnle, 2009**).

1) Reservoir (source of infection):

The sources of infection for pediatric patients include human beings, inanimate objects and animals. Human sources include other patients, healthcare personnel, family members, visitors (exogenous) or pediatric patients themselves (endogenous) (***The National Health Service Corps [NHSC], 2009; Christensen & Kochrow, 2010***). Inanimate objects include contaminated medication, fluids, blood, air, water, and food such as storage breast milk for pre-term infants that become contaminated during collection/ storage (***Craven & Hirnle, 2009***).

Outbreaks of PCCU infection have been contaminated by eyewash, resuscitation equipment (laryngoscope, stethoscope), scrub brushes, hand lotions, various disinfectants, topical ointments, all types of invasive devices such as Endo-Tracheal Tube (ETT) or waste contaminated material, also the viruses survive well on hard surfaces in the PCCU environment especially inside incubators, floors, walls and furniture (***Williams et al., 2009***).

2) Portal of exit:

It means exit by which microorganisms escape from the original reservoir, when present in or on the human body. The portal of exit includes all body orifices and skin discharges. Microorganisms may leave the body in any of its natural discharges such as; sputum, saliva, urine, stool and, vomits, or

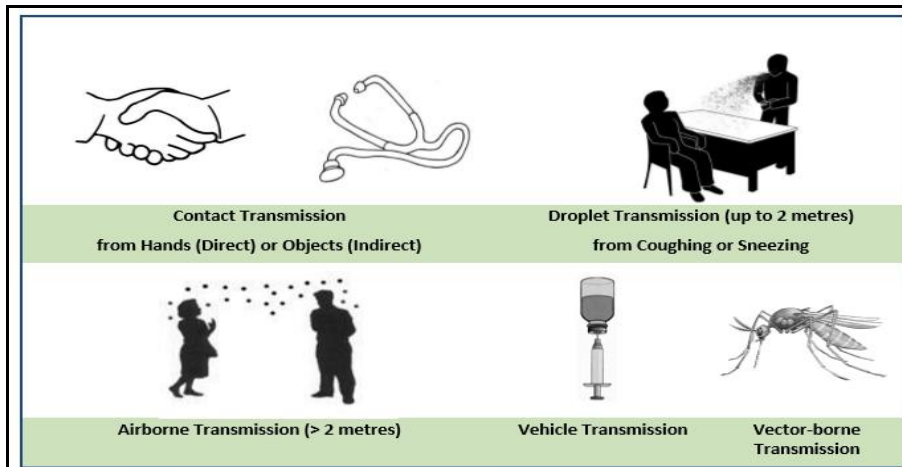
blood from breaks in the skin or wound drainage. Blood borne organisms carried by mosquitoes can also provide a means of escape (*PHAC, 2011*).

3) Mode of transmission:

The mode of transmission is the process that bridges the gap between the portal of exit of the biological agent from the reservoir or source and the portal of entry of the susceptible “new” host. The most important and frequent mode of transmission is contact transmission, which involves the direct physical transfer of an agent from an infected child to a host through direct contact with a contaminated object or close contact with contaminated secretions. The five main routes of transmission are contact, droplet, vehicle, air borne and vector borne (*Mohamed, 2006 & PHAC, 2011*).

Airborne transmission occurs when a susceptible host contacts droplet nuclei or dust particles that are suspended in the air. Vehicle and vector borne transmission are indirect modes of transmission, because transmission occurs by an intermediate source. Vehicle transmission occurs when an agent is transferred to a susceptible host by contaminated inanimate objects such as water, food, milk, drugs, and blood. Vector borne transmission occurs when an agent is transferred to a susceptible host by animate means such as mosquitoes, fleas, ticks, lice, and other animals (Figure 3) (*Lawrence & May, 2010*).

Figure (3): How microorganisms are spread.



Cruickshank , M & Ferguson , J (2008) . Reducing Harm to patients from Health care Associated Infection: The Role of Surveillance. Australian Commission for Safety and Quality in Health Care. p3.

4) Portal of entry:

It permits the organisms to gain entrance into the host. They can enter susceptible hosts through body orifices such as mouth, nose, ears, eyes, vagina, rectum or urethra, break in the skin or mucous membranes and puncture sites from injection, increase opportunities for organism to enter the host (*Whaley & Wong, 2007; Craven & Hirnle, 2009*).

5) Susceptible host:

Children become susceptible to infection when their defense mechanisms are diminished or impaired because their health is already compromised due to their illness, inactivity and hospitalization (*Leifer, 2007 & Timby, 2008*).

Stages of infection

The nurse can assist in preventing and controlling infection by observing and following a progressive course of infection to assess the risk of infection (*Potter & Perry, 2010*).

- ***Incubation period:***

It is an interval between entrance of pathogen into the body and appearance of first symptoms (e.g., salmonella sepsis, 12-36hr) (*Potter & Perry, 2010*).

- ***Prodromal stage of illness:***

It is the interval from the onset of nonspecific signs and symptoms (malaise, low grade fever, and fatigue) to more specific symptoms. They are generally lasting short from several hours to several days and they are not found in all infectious diseases. During this time, microorganisms grow and multiply (*Muscari, 2011*).

- ***Full stages of illness:***

It is when pediatric patients manifest signs and symptoms specific to the type of infection (*Muscari, 2011*).

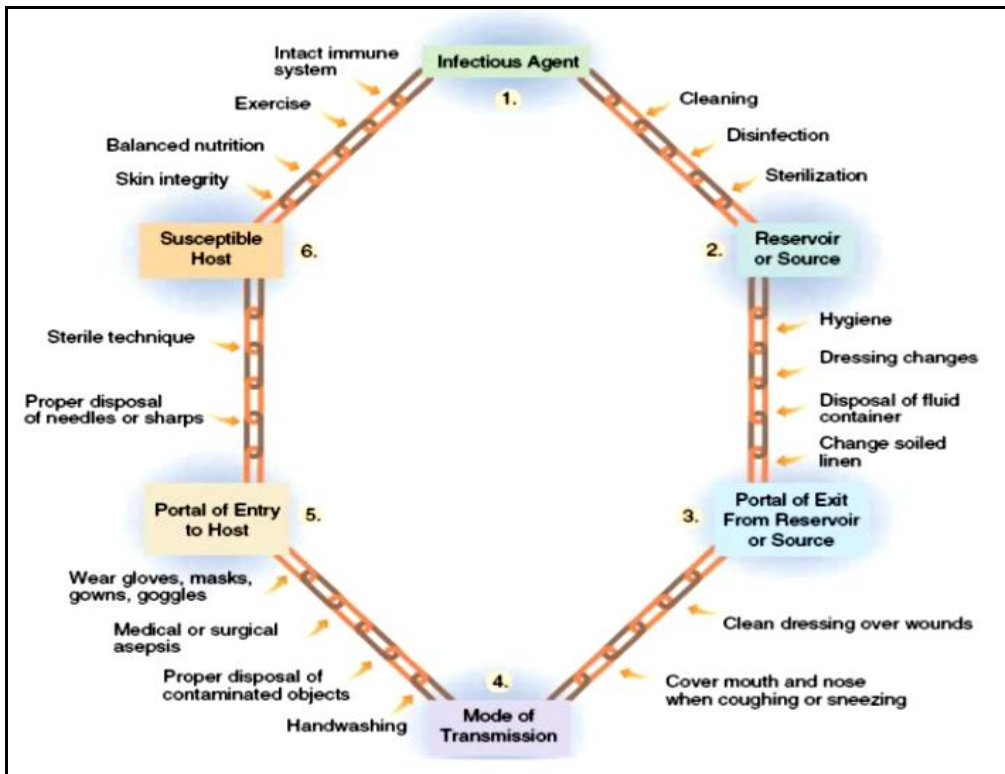
- ***Convalescence***

It is when acute symptoms of infection disappear. The length of recovery period depends on the severity of infection and the pediatric patients general state of health; recovery may take several days to months (*Muscari, 2011*).

Breaking the Chain of Infection:

Nurses focus on breaking the chain of infection (Figure 4) by applying proper infection control practices to interrupt the mode of transmission. The chain of infection can also be broken by interrupting or blocking the agent, portal of exit, or portal of entry or by destroying the agent or decreasing the host's susceptibility (*DeLaune, & Ladner, 2010*).

Figure (4): Breaking the chain of infection



Delaune, S and Lander, P, (2010). Fundamental of nursing standard & practice, 2nd edition, Delmar, USA, pp 722-789.