CHAPTER II

LITERATURE REVIEW

2.1 History of infection control practices

According to Ignaz F, Semmelweis and Florence Nightingale are considered to be the Models for infection control practices, even if, many models exist. In 1847, Semmelweis' observed that women whose babies were delivered by students and physicians consistently had a higher mortality than those delivered by midwives at the Maternity Clinic of the Allgemeine Krankenhaus (General Hospital) in Vienna. And he assumed that the high rate of maternal mortality was caused by "cadaverous particles" transmitted from the autopsy to the delivery room via the hands of students and physicians. Semmelweis insisted that they scrub their hands in a chlorinated lime solution prior to every patient contact. Subsequently, maternal mortality rates dropped dramatically and remained low. This is the first evidence suggested that cleaning hands with an antiseptic agent between patient contacts may reduce cross transmission of infectious agents. Today, he is considered as the father of hand hygiene due to his intervention as a model of epidemiology-driven infection prevention strategy developed from observation, careful analysis, deductive hypothesis, and actions to stop the disease process.

In 1863 Florence Nightingale wrote a book known as "Notes on Hospitals". Her writing consists of arguments for a direct association between sanitary condition

and post operative complications as well as comprehensive description of ward construction and the concept of air control. Furthermore, she observed high mortality rate among hospital nurses compared to the general population from contagious diseases and emphasized nurses to do a survey on hospital acquired infections. Hence, she was considered as the first nurse epidemiologist (Pittet, 2005).

Transmission of infectious agents within a health care setting requires three agents; a reservoir, susceptible host, and a mode of transmission. Patients' health care workers and visitors are susceptible host in the hospital environment. The complex interrelationship between a potential host and an infectious agent produces infection. The mode of transmission may vary by type of organism as some types of organism may be transmitted more than one route. The complex interrelationship between a potential host and an infectious agent produces infection (Siegel et al. 2007).

2.2 Infection control guidelines

According to GAO (Government Accountability Office, 2008) centre for disease control (CDC) developed 13 guidelines recommending almost 1,200 practices among over 500 strong recommendations. The latest guidelines on infection control practices have been published in June 2007. According to Siegel et al. (2007) the *'Guidelines for isolation Precautions: Preventing transmission of infectious Agents in Healthcare settings 2007'* is an updated and expanded series of isolation and infection prevention documents established since 1970. Revision was done based on relevant evidence-based studies published since 1996.

Objectives of the above guideline

Provide infection control recommendations to all components of health care deliver system, including hospitals, long term care facilities, ambulatory care, home care and hospice.

To reaffirm Standard Precaution as the foundation of for preventing transmission during patient care in health care settings.

Reaffirm the importance of implementing Transmission-Based precautions based on the clinical presentations or syndrome and likely pathogens until the infectious etiology has been determined.

Provide epidemiologically sound and, whenever possible, evidence based recommendations.

2.3 Standard precaution

Basic infection control practices are compulsory precautions for anyone in any health care facility. *Standard precautions consist* of a group of infection control practices required to all patients in spite of suspected or confirmed infectious status in any place where health care is provided (British Columbia Centre for Disease Control [BCCDC], 2004).

Standard precaution is based on the principle that all blood, body fluids, secretions and excretions except sweat, non intact skin, and mucous membranes which may contain transmissible infectious agents. Standard precautions are merged with major features of universal precaution. They are hand hygiene, use of gloves,

gown, mask, eye protection or face shield depending on the anticipated exposure and safe injection practices. (Siegel et al., 2007)

2.4 Transmission - based precaution

Transmission – based precautions are usually used for patients identified or suspected to be colonized with an infection. Transmission-based precautions are applied when standard precaution is not sufficient to interrupt the route(s) of transmission of a disease. The three categories of transmission based precaution are contact precautions, droplet precautions and airborne precautions (Siegel et al., 2007). They may be combined for diseases that have multiple routes of transmission. When used either singularly or in combination, they are to be used in addition to Standard Precautions.

2.4.1 Airborne precautions

Airborne precautions are designed to prevent diseases that can be transmitted through airborne route. Airborne transmission may occur either by airborne droplet nuclei of evaporated droplets or dust particles containing the infectious agent (Garner, 1996). Examples of diseases that can be spread through this route are mycobacterium tuberculosis, measles virus, chicken pox virus etc.

2.4.2 Droplet precautions

Droplet Precautions are planned to reduce the risk of droplet transmission of infectious agents. Droplets are generated from the source person primarily during coughing, sneezing, or talking and during the performance of certain

procedures such as suctioning and bronchoscopy (Garner, 1996). Diseases that can be spread through this route are mumps, rubella, pertuisis etc.

2.4.3 Contact precautions

Contact Precautions help to reduce the risk of transmission of epidemiologically important microorganisms by direct or indirect contact. Direct-contact transmission occurs during patient care activities require physical contact (Garner, 1996). One of the example is Methilene resistant staphylococcus aurous (MRSA).

2.5 Elements of infection control practice

2.5.1 Hand hygiene

From ancestors to modern scientists hand washing is known to be the single most important measure to prevent spreading of pathogenic micro organism from one to another person. This is a known fact, often neglected by health care providers. According to Siegel et al. (2007) the term "hand hygiene" consists of hand washing with either plain or antiseptic containing soap and water, and use of alcohol based products (gels, rinses, foams) that do not require the use of water.

2.5.2 Personal protective equipment (PPE)

These are special devices (clothing or equipment) worn for protection against infectious materials. PPE prevents contact with an infectious agent or body fluid which may contain an infectious agent, by creating a barrier between the potential infectious material and the healthcare worker.

2.5.2.1 Gloves: Gloves help to protect when directly handling potentially infectious materials or contaminated surfaces.

2.5.2.2 Gowns: Gowns help to protect from the contamination of clothing with potentially infectious material.

2.5.2.3 Masks and Respirators: Surgical masks help protect your nose and mouth from splattered of body fluids, respirators filter the air before you inhale it.

2.5.3 Safe injection practices

Needles should not be re - sheathed unless an approved recapping device is used. Needles contaminated with blood or other body substances should not be bent and should be discarded in a clearly labeled puncture resistant container .These containers should be clearly labeled with black lettering and yellow background with A BIO HAZARD symbol. And the container should never be over filled and should be sealed properly before disposal (The Australian college of Dermatologists, 2004).

2.5.4 Waste management

Hospital waste is a growing concern. One of the problems is improper segregation of infectious and non infectious waste. Waste product produced per bed per day is estimated 2 kg (Shaheen, 2005). The Australian College of Dermatologists (2004) describes that clinical waste includes sharps, human tissue, bulk of body fluids, visibly stained body fluids, and visibly blood stained disposable material and equipment.

In accordance with The Australian College of Dermatologists (2004) where there is a potential risk of contact with blood and body substances, standard precaution should be applied. Therefore standard precaution should be taken during activities such as contaminated instrument cleaning, spill cleaning, linen handling, waste handling etc.

Hand hygiene, use of personal protective equipment, safe injection practices along with sharp and waste disposal are considered as major components of standard and transmission-based precautions. Disinfection of equipments and environmental disinfection also move along with these practices. The consequences of negligence or poor performance of these activities are massive and hazardous.

According to a report of Siegel et al. (2007), in American hospitals alone, healthcare-associated infections account for an estimated 1.7 million infections and 99,000 associated deaths each year. Of these infections, 32 % of all healthcare-associated infections are urinary tract infections, 22 % are surgical site infections, and 15 % are pneumonia (lung infections) and 14 percent are bloodstream infections. They signify infections acquired during or associated with delivery of care in contrast to infections present or incubating at the time of the care delivery event. These complications of care involve expensive use of health care resources and they often lead to increased use of medication and supplies, to more laboratory studies, and to increased duration of hospitalization. Pittet & Donaldson (2006) also describes that that this is a huge financial burden to human resources and health care system.

Negligence of even one aspect of safe and sound infection control measures is a burden. Juni (2003) writes that contaminated sharps are potential source

of biohazard to the community. Therefore it is essential to dispose sharps in an efficient and environmental friendly manner. He also reports that overuse of injections in the developing world is evidential. Based on the statistics he further reports that sixteen thousand millions injections are administered each year for a ratio of 3.5 injections per individual. Moreover, findings indicate that unsafe injections are accounted for 32% of hepatitis B virus infection, 40% of hepatitis C virus infection, 28% of liver cancer, 24% of cirrhosis and 5% of HIV infections in the year 2000. Every year 500,000 deaths are attributable to contaminated injections in health care settings around the globe. Hauri et al. (2004) also reports that contaminated injections caused an estimated 21 million HBV infections, two million HCV infections and 260,000 HIV infections, accounting for 32%, 40% and 5%, respectively in the year 2000. Of new infections may occur for a burden of 9,177,679 DALYs between 2000 and 2030. Prevention of needle sticks and other sharps related injuries have always been a part of universal precaution and now standard precaution (Siegel et al., 2007).

All health care providers should be provided education regarding the epidemiology and specific precautions pertaining to the prevention of infectious diseases to make certain that they are educated properly and understood their duties. Written policies for infection control and prevention should be available, regularly updated and enforced. (BCCD, 2004)

2.6 Related research

Only a few studies had looked into health professionals' perception of infection control practices, and the consequences of those perceptions influence staff compliance with recommended guidelines even though infection control practice is a

cornerstone of present health care (Watkins et al., 2008). A study was conducted by these authors, on perceptions of infection control practices among health professionals, and found that the magnitude of both individual and organizational factors in assessing clinicians' levels of compliance with recommended infection control guidelines. They further reported that recognition of the factors that influence health professionals' compliance level can be used to develop strategies to support long-term compliance with infection control practices. In accordance to the Department of Health (2006) effective prevention and control of health care associated infections need to be incorporated into everyday practice and applied constantly to everyone. In addition, a well organized management is fundamental to establish high standards of infection control measures. A study was conducted by Yassi et al. (2007) in 16 health care facilities to assess determinants of healthcare worker's self-reported compliance with infection control procedures. Findings of this study have shown a strong correlation between organizational factors and self-reported compliance. No relationship was found between individual factors. Hence the researchers of this study concluded that compliance with infection control procedures is united to environmental factors and organizational characteristics. They also suggest that improving availability of equipments and establishment of a safety culture should be made as key efforts.

A qualitative and quantitative analysis was conducted by Kristi et al. (2004) regarding critical incidents of non-adherence with standard precautions guidelines among community hospital – based health care workers. In this study, 22% of participants believed that applying precaution would interfere patient care, 14%

viewed precautions were not necessary in a specific situation, 14% did not anticipate that they were potential for exposure, 11% accounted for high job demand and need to be hurry, 7% due to lack of availability of equipments, 6% of the respondents forgot, 4% thought that patients did not pose risk, and 3% said that available equipments were not effective.

Danchaivijitr et al. (2005) conducted a study in 57 hospitals of Thailand for the quality of nosocomial infection control with regard to structure and process. They found that each hospital had an infection control committee and infection control nurse. The findings of this survey had shown inadequate support and co-operation by doctors and nurses. Also doctors and nurses who are not directly involved in nosocomial control of infections were not satisfied with current practices.

Bocker et al. (2005) found that physician compliance for hand hygiene was 32.0% and education focusing on hand hygiene increased their compliance to 59.5% which was statistically significant with P value of 0.01. Ji et al. (2004) conducted a cross sectional survey for 137 on prevalence of risk factors for non compliance with glove utilization and hand hygiene among obstetricians and gynecologists working in rural china. It was reported that non – compliance with glove utilization was 61%, hand hygiene 40% and the rate of non compliance with both was 71%. He further reports that the reasons for non compliance were at institutional level support and knowledge. Stein et al. (2003) found that the most common reasons specified for not washing hands before and after patient contact were time constraints, including emergency situations (26/218 and 9/218 respondents, respectively). The most

commonly cited reasons for not wearing gloves was difficulty in feeling for veins and decreased dexterity with gloves (34/218 respondents).

A survey of doctors' and nurses' knowledge, attitude and compliance with infection control guidelines in Birmingham teaching hospitals was conducted by Stein et al. (2003). This was a cross sectional study conduced for seventy five doctors and 143 nurses. The results of this study indicated that overall knowledge regarding blood-borne virus transmission from an infected patient after needles stick injury was low [44.0% for hepatitis B virus, 38.1% for hepatitis C virus, and 54.6% HIV]. Significant differences showed between doctors and nurses concerning the estimations of hepatitis B virus ($P=0.006$) and HIV ($P<0.001$) transmission risks. Eighty-six percent of nurses stated that they treat each patient as if they are carrying a blood born virus compared with 41% of doctors. Doctors and nurses differed significantly in their attitudes about and reported compliance with washing hands before and after patient contact and with wearing gloves when taking blood ($P<0.001$ for all). Doctors constantly de-emphasized the importance of, as well as reported poor compliance with, these procedures. Doctors were also more likely to state that they re-sheath needles manually than nurses ($P<0.001$). Thirty-seven percent of respondents reported that they had experienced a needle stick injury with a used needle, with doctors more likely to be injured than nurses ($P=0.005$). Twenty-eight percent of these doctors and 2% of nurses did not report their needle stick injuries ($P=0.004$). According to the authors of this study; education, monitoring, improved availability of resources, and disciplinary measures for poor compliance are required to improve infection control practices in hospitals.

Based on the studies of various natures, compliance with infection control practices is a world wide concern. The consequences lead from disabilities to deaths.

2.7 Conceptual framework

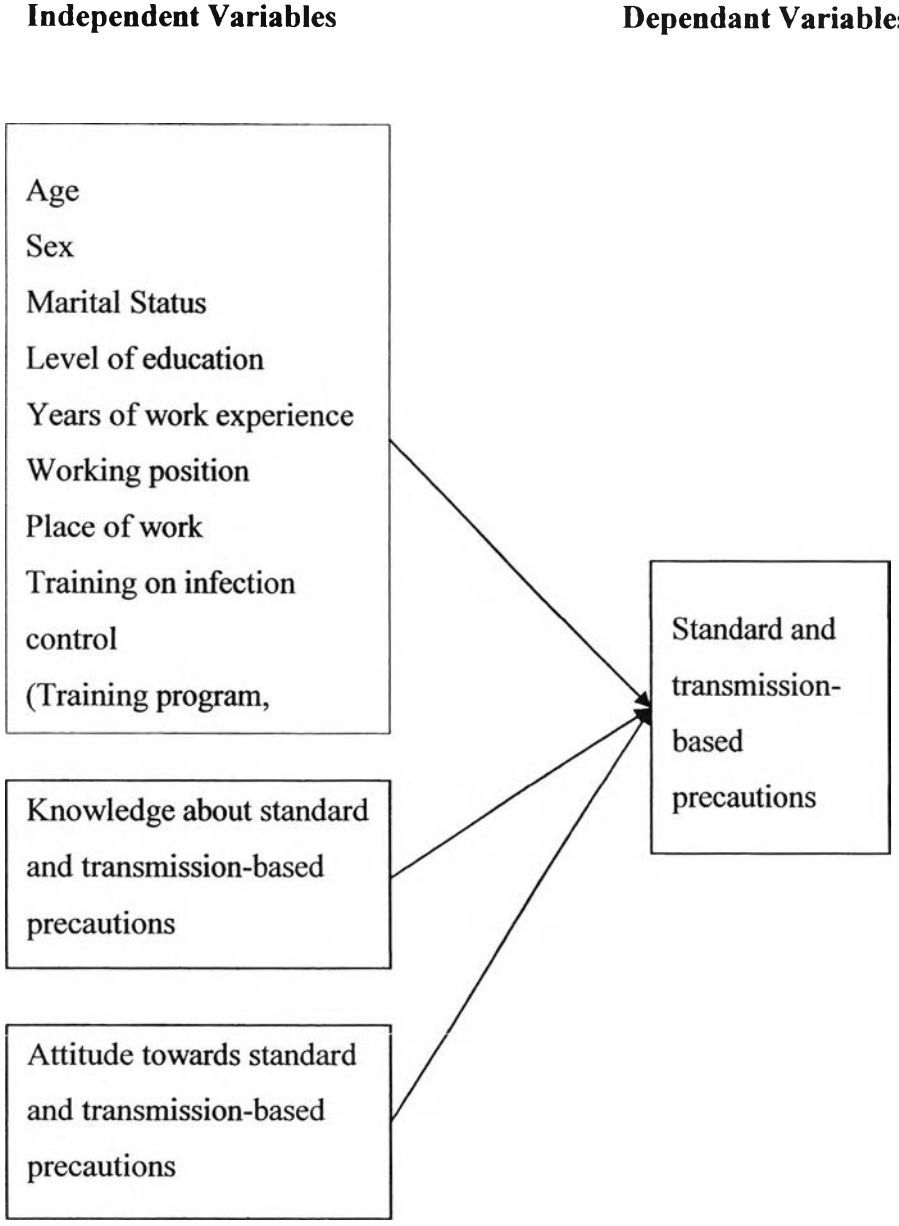

Figure 1: Conceptual framework