A STUDY ON BIOLOGICAL OCCUPATIONAL HAZARDS IN EMERGENCY MEDICINE IN HOSPITAL UNIVERSITI SAINS MALAYSIA

by

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ABSTRACT

Biological Occupational Hazards in Emergency Department, Hospital Universiti Sains Malaysia, Kubang Kerian, Kelantan, Malaysia

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Introduction: Hazards in working environment have posed significant risk to health care workers (HCWs). Biological hazard is one of the hazards and exists in most departments in hospital, including Emergency Department (ED). The objectives of this study were to look at the prevalence of biological hazards in ED, determine the association of different work shift and different triage zones with type of biological hazards. The associated factors of blood-borne and non-blood-borne diseases were also being determined.

Objective: The of this study were to determine the biological hazards that could be found in ED which may infect the HCWS at ED through different ways e.g. air-born and

blood borne route. In this study we would look into the distribution of biological hazards through different work shift phase and different triage zones.

Methodology This was a prospective study conducted from 1st August 2013 to 30th November 2013. All patients who presented to ED, Hospital Universiti Sains Malaysia (HUSM) were reviewed based on the ED records. Hospital records of the patients with biological hazards were traced and reviewed. Demographic data and type of biological hazards were collected and association of work shift and triage zone were also analysed. Final diagnosis of those with biological hazards was also being determined by reviewing discharge note of the patients. All the data were entered using SPSS based on the sample size of each type of biological hazards. In order to avoid missing data, work sheet form year 2013 from Microbiology department was reviewed for all patients with blood-borne biological hazards. Based on the registered number of the patients, their visits to ED HUSM were traced and correlated with the study period. All the data was collected using a standardised proforma form.

Results: A total of 200 cases that presented to ED HUSM had biological hazards. Majority of the cases was Malay (96.5%) and community acquired pneumonia .Apart from CAP and scabies there were no statistically significant association between biological hazards and the different time of the work shift. Majority of CAP and scabies cases came during PM shift with the percentage of 42.6% and 78.1% respectively. Most of the biological hazards had statistically significant association with triage zone except Human immunodeficiency virus (HIV) and Hepatitis B virus (HBV). Majority of tuberculosis (TB), CAP and Hepatitis C virus (HCV) cases presented to yellow zone with the percentage of 54.6%, 42.6% and

48.7% respectively. Majority of scabies and impetigo cases presented to the green zone. Age and gender were significant association factors of blood-borne diseases.

Conclusion: Yellow zone had higher biological hazards exposure for CAP, TB and HCV while green zone had higher exposure for scabies and impetigo to HCWs in ED HUSM. PM shift had higher exposure for CAP and scabies. Age and male gender were the only significant predictors for the blood-borne biological hazards exposure to the HCWs in ED HUSM.

Associate Professor Dr Kamarul Aryffin Baharudin: Supervisor

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ABBREVIATIONS

ED	Emergency Department
EDHUSM	Emergency Department Hospital Universiti Sains Malaysia
HUSM	Hospital Universiti Sains Malaysia
ICU	Intensive care unit
CAP	Community-acquire pneumonia
PORT	pneumonia Patient Outcomes Research Team
BTS	British Thoracic Society.
PTNA	Percutaneous transthoracic needle aspiration
HIV	Human immunodeficiency virus
HBV	Hepatitis B virus
HCV	Hepatitis C virus
TB	Tuberculosis
CAP	Community acquired pneumonia
WHO	World health organization
OSHA	Occupational safety and health adminstration
NSIs	Needlestick injuries
SARS	Severe acute respiratory syndrome
CDC	Centres for disease control
HCWs	Health care workers
OSH	Occupational safety and health
OHS	Occupational health and safety
WHS	Work place health and safety
ILO	International labour organization

RSI	Repetitive strain injery
AIDS	Acquired immunodeficiency syndrome
PPD	Purified protein derivatives
FAD	Food and drugs adminstration
PCR	Polymerase chain reaction
RNA	Ribonucleic acid
VZV	Varicella zoster virus
DNA	Deoxyribonucleic acid

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ABSTRAK

Latar belakang: Ancaman dalam suasana kerja boleh memberi risiko yang besar kepada pekerja kesihatan (HCWs). Ancaman biologi adalah salah satu daripadanya dan wujud di kebanyakan jabatan di hospital termasuklah Jabatan Kecemasan (ED). Objektif-objektif kajian ini adalah untuk melihat kelaziman ancaman biologi di ED, menentukan perkaitan antara waktu-waktu shif yang berbeza dan zon triage yang berbeza dengan jenis ancaman biologi. Faktor-faktor perkaitan untuk penyakit bawaan darah dan penyakit bukan bawaan darah juga ditentukan.

Metodologi: Ini adalah kajian prospektif (kehadapan) yang dijalankan dari 1 Ogos 2013 sehingga 30 November 2013. Semua pesakit yang datang ke ED, Hospital Universiti Sains Malaysia akan dilihat berpandukan kepada rekod ED. Rekod hospital bagi pesakit-pesakit yang mempunyai ancaman biologi dikesan dan diulas. Data demografi dan jenis ancaman biologi dikumpulkan dan perkaitan kerja shif dan zon triage juga dianalisis. Diagnosis akhir untuk mereka dengan ancaman biologi juga ditentukan dengan melihat kepada nota keluar wad pesakit tersebut. Kesemua data ini dimasukkan menggunakan SPSS berdasarkan saiz sampel untuk setiap jenis ancaman biologi. Bagi mengelakkan kehilangan data, kertas kerja dari tahun 2013 daripada Jabatan Mikrobiologi telah dikaji untuk semua pesakit yang mempunyai ancaman biologi bawaan darah. Berdasarkan nombor pendaftaran pesakit, kunjungan mereka ke ED HUSM dicari dan dikaitkan dengan tempoh kajian. Kesemua data ini dikumpulkan menggunakan bentuk proforma standard.

Keputusan: Sejumlah 200 kes yang datang ke ED HUSM didapati memiliki ancaman biologi. Majoriti kes adalah di kalangan kaum Melayu (96.5%) dan jangkitan kuman paru-paru komuniti (CAP). Selain daripada CAP dan scabies, tiada perkaitan yang ketara antara ancaman biologi dengan perbezaan waktu kerja shif. Majoriti kes CAP dan scabies datang pada waktu shif petang (PM) dengan peratusan sebanyak 42.6% dan 78.1%. Kebanyakan kes ancaman biologi memiliki perkaitan yang ketara daripada segi statistik dengan zon triage kecuali virus HIV dan Hepatitis B (HBV). Majoriti kes tuberculosis/batuk kering (TB), CAP dan virus Hepatitis C (HCV) datang ke zon kuning dengan peratusan sebanyak 54.6%, 42.6% and 48.7% bagi setiap satu. Majoriti kes scabies dan impetigo datang ke zon hijau. Umur dan jantina merupakan faktor-faktor perkaitan yang ketara bagi penyakit bawaan darah.

Kesimpulan: Zon kuning mempunyai pendedahan ancaman biologi yang lebih tinggi bagi CAP, TB dan HCV manakala zon hijau mempunyai pendedahan yang lebih tinggi untuk skabies dan impetigo kepada HCWs di ED HUSM. Shif petang (PM) pula mempunyai pendedahan yang lebih tinggi untuk CAP dan skabies. Umur dan jantina lelaki merupakan satu-satunya peramal yang ketara untuk pendedahan ancaman biologi bawaan darah kepada HCWs di ED HUSM.

Kata kunci: ancaman biologi, penyakit bawaan darah, zon triage, kerja shif

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Conclusion: Yellow zone had higher biological hazards exposure for CAP, TB and HCV while green zone had higher exposure for scabies and impetigo to HCWs in ED HUSM. PM shift had higher exposure for CAP and scabies. Age and male gender were the only significant predictors for the blood-borne biological hazards exposure to the HCWs in ED HUSM.

Keyword: biological hazards, blood-borne diseases, triage zones, work shift.

CHAPTER I - INTRODUCTION

1.1 INTRODUCTION

A healthy workplace is vital for sustainable social and economic development on global, national and local level. The classical approach to ensuring health and safety in the work place has depended mainly on the enactment of legislation and inspection of workplace to ensure compliance with health and safety standard(WHO, Occupational health, 2001) .

Occupational health problems have gradually increased in type and magnitude and have led to or aggravated diseases resulting from exposure to several risk factor, only one of which being the work environment (*Occupational health annual for PHC workers, 2001*) .

Working in health care and community care, staff may be exposed to a large number of biological hazards. If proper controls are not in place, health workers may unknowingly be exposed to viruses such as hepatitis B virus (HBV), bacteria and other biological agents.

Biological hazards can pose a significant risk to health care and community care workers if not properly controlled (Ontario Safety Association for Community & Healthcare, 2005). Worldwide, it is estimated that around 320,000 workers die each year from communicable diseases caused by work-related exposures to biological hazards (*OSHA, 2007*).

Biological hazards pose risks for many workers in a wide variety of ways. For example, workers in health care professions are exposed to biological hazards via contact with human blood, tissues, saliva and mucous . These substances have a high risk of containing viral or bacterial diseases. (*Driscoll et al., 2005*).

Occupation has important influence on exposure to biological hazards among workers. Exposures to biological hazards were most common amongst community and personal service workers (56% reported exposure), professionals (31% reported exposure) and Laborer's (20% reported exposure). Community and personal service workers and Professionals together accounted for more than 60% of all the workers who reported exposure to biological hazards , health workers are 45% . (*National Hazard Exposure Worker Surveillance Survey, 2011*).

Emergency departments (EDs) serve as the frontline for patients with communicable respiratory diseases, skin disease and bloodborne diseases because of the acute nature of these illnesses and because the ED serves as the principal site of health care for many of those at highest risk for these diseases .

Blood-borne pathogenic exposures (HIV, HCV, HBV): due to percutaneous needlestick injuries (NSIs). The top three exposures between 600,000 and 800,000 NSIs occur each year in all healthcare settings were injections (21%), suturing (17%), and drawing blood (16%) (*Perry, et al., 2003*).

Airborne exposure from various diseases such as Severe Acute Respiratory Syndrome (SARS), (TB), Methicillin Resistant Staph also are common : During 2003, CDC received 34 reports of TB outbreak activity (*Department of Health and Human Services, 2004*). In June 2004, a healthcare worker died of TB (*Simpson, 2004*). Other or combination exposures such as vector borne or contact diseases like scabies also was major problem (*Obasanjo et al., 2001*).

CHAPTER II - LITERATURE REVIEW

2.1 INTRODUCTION

It is widely acknowledged that emergency medicine personals are crucial components in healthcare system. In their roles, they are regularly exposed with a variety of biological, physical, and chemical hazards during the course of performing their duties (*Samuel D, te al., 2000*) . Table 2.1 showed different types of occupational hazards .

In general hazards in the working environment may be divided into five main types; chemical, physical, biological, ergonomic and psychological(*Steven S et al., 1999*) . These hazards may produce an immediate or delayed response, dictated largely by their inherent characteristics and the intensity and frequency of exposure, the characteristics of the hazards will also depend on the process type, process condition and the environment in which they are generated (*Steven S. et al., 1999*) .

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Work environment is an important determinant of health. It can influence heath positively or negatively. For most people, work is essential for social as well as physical well-being. Like all HCWs, emergency doctors and nurses are exposed to a wide range of occupational hazards. Because of emergent nature of their conditions, the ED environment may be less controlled than other clinical settings. In the chaos of evaluating and treating life-threating conditions, well established preventive procedures may not be applied by HCWs. In addition, the rapid turnover of patients during a single shift in a busy ED allows HCWs to come into contact with a large number of sick patients and a wide variety of hazardous circumstances (*Dorevitch and Forst, 2000*).

Table 2. 1 Occupational hazard types

Hazard type	Example
Chemical	Dusts, fibers ,fumes, gases , vapors , liquids
Physical	Noise, vibration, ionizing and non-ionizing radiation, extremes of temperature and pressure, electricity, illumination and visibility
Biological	Viruses, bacteria, fungi protozoa, nematodes
Ergonomics and mechanical	Overexertion, repetitive actions posture traps, impact, contact, entanglement, ejection
Psychosocial and organizational	The individual, work demand and conditions, work environment, organization

Occupational hazard types (*Steven S. Sadhra et al., 1999*).

2.2 Occupational health and safety

Occupational safety and health (OSH) also commonly referred to as occupational health and safety (OHS) or workplace health and safety (WHS) is an area concerned with the safety, health and welfare of people engaged in work or employment. It is goals is to foster a safe and healthy work environment(oka ridge national lab saftey decument, 2014) .OSH may also protect co-workers, family members, employers, customers, and many others who might be affected by the workplace environment. In the United States the term occupational health and safety is referred to as occupational health and occupational and non-occupational safety and includes safety for activities outside of work*(Fanning, et al., 2003).*

2.2.1 Definition

The World Health Organization (WHO) defined occupatinal health as occupational health deals with all aspects of health and safety in the workplace and has a strong focus on primary prevention of hazards(WHO, 2014). Health has been defined as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity(WHO ,2013) .Occupational health is a multidisciplinary field of healthcare concerned with enabling an individual to undertake their occupation, in the way that causes least harm to their health. Health has been defined as It contrasts, for example, with the promotion of health and safety at work, which is concerned with preventing harm from any incidental hazards, arising in the workplace .

The International Labour Organization (ILO) and WHO have shared a common definition of occupational health. It was adopted by the Joint ILO/WHO Committee on Occupational Health at its first session in 1950 and revised at its twelfth session in 1995. The definition: Occupational health should aim at: the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations; the prevention amongst workers of departures from health caused by their working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; the placing and maintenance of the worker in an occupational environment adapted to his physiological and psychological capabilities; and, the adaptation of work to man and of each man to his job .

2.2.2 Objectives of occupational health

The Joint ILO/WHO Committee on Occupational Health determined three different objectives of occupational health: (i) the maintenance and promotion of workers' health and working capacity; (ii) the improvement of working environment and work to

become conducive to safety and health and (iii) development of work organizations and working cultures in a direction which supports health and safety at work and in doing so also promotes a positive social climate and smooth operation and may enhance productivity of the undertakings.(WHO Collaborating Centers in Occupational Health, 1995).

2.3 Occupational hazards in ED

ED workers are at particular risk for exposure to blood-borne , airborne and dermal diseases because busy nature of emergency treatment.

Although work provides many economic and other benefits, a wide array of workplace hazards also present risks to the health and safety of people at work. These include but are not limited to, "chemicals, biological agents, physical factors, adverse ergonomic conditions, allergens, a complex network of safety risks," and a broad range of psychosocial risk factors(*Concha-Barrientos et al., 2004*) .

ED as awork place has many hazards that influnced to HCWs by many ways . U.S. Department of Labor , Occupational Safety & Health Administration introduce Checklist of Highlighted Hazards in ED , which help to assecc exposure hazards facing ED staff .

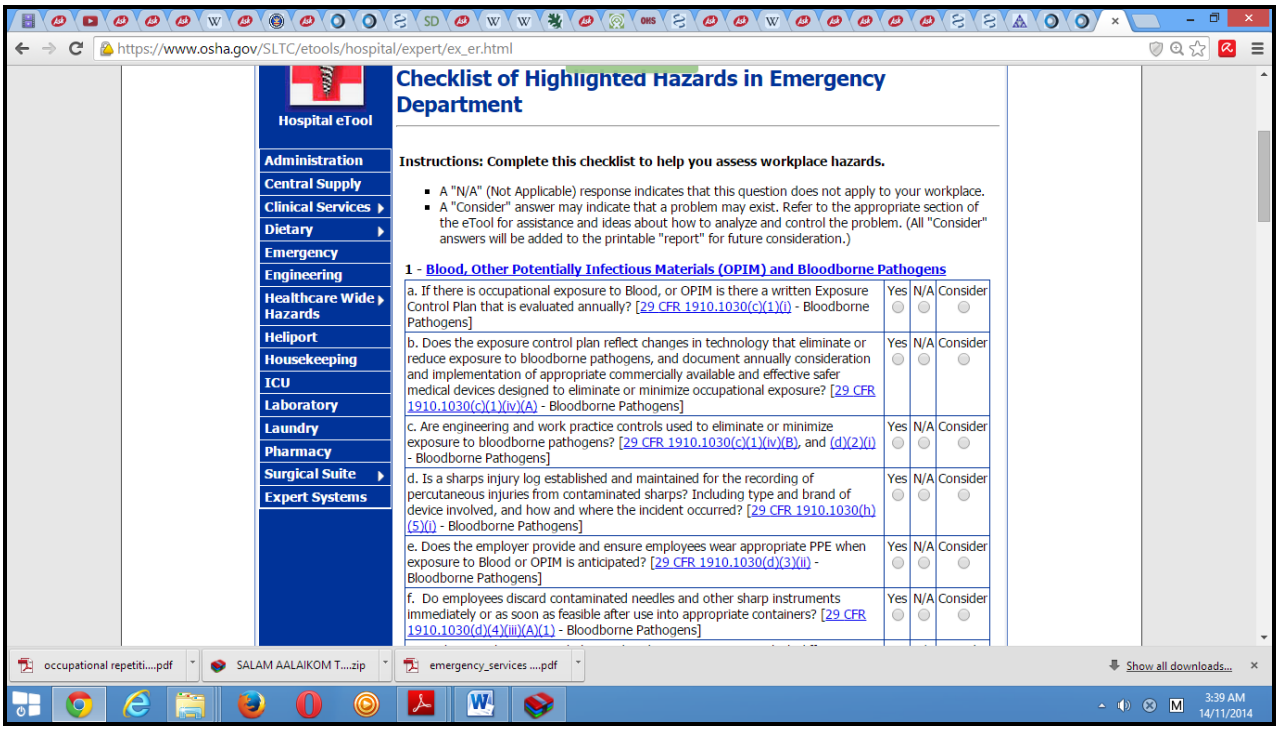

Figure 1. 1 Showes checklist of hazards ED (Adapted from OSHA website).

2.3.1 Infectious Diseases

Infectious diseases can be caused by coming into contact with bacteria, viruses, funguses or parasites when handling patients, contaminated objects, body secretions, tissue or fluids. HBV, HCV and HIV can be spread by infected blood and body fluids when they come into direct contact with broken, scraped, chapped or inflamed skin or when skin is punctured by a sharp object such as a needle. Injuries from contaminated needles and others sharp devices have been associated with transmission of more than 20 different pathogens to HCWs (*Chiarello, L. A. et al ., 1995*).

2.3.2 Back injuries

Work-related musculoskeletal disorders are the leading occupational health problem (*De Castro, 2004*). Back injuries are the most frequent injury in hospitals. Heavy lifting and frequent bending or twisting when moving objects or patients increases the risk of back injury.

2.3.3 Violence

Health care workers are at risk from violence when dealing with angry and stressed patients and their families. Workplace violence can result in loss of sleep, fear or depression, post traumatic stress disorder, and sometimes even death. It is, therefore, very important for workplaces to develop strategies to prevent violence. Rates for both physical and non-physical violence are on the rise of ED, home/long term care, intensive care, and psychiatric/behavioral care nurses (*Gerhrich et al., 2004*).

2.3.4 Shift work

Changing shifts and working at night disrupts your body's natural rhythms. It can contribute to digestion problems, problems. It also makes participation in social activities and family life difficult. After controlling for ages, cigarette smoking and 11 other risk factor, nurses who worked rotating night shifts for 1-2years had 25% increased risk of coronary heart disease (*Knulsson A., 1985*). And those who worked at least three night shifts per month in addition to either day or evening shift were found to have higher rates of coronary heart disease (*Kawachi et al., 1995*).

2.3.5 Repetitive Strain Injuries

A repetitive strain injury (RSI) is a common and serious occupational health problem. About 60% of all occupational injuries are caused by repetitive strain(*O'Neil BA, et al., 2001*).

The injury is characterised by discomfort or persistent pain in muscles, tendons, and other soft tissues. Repetitive strain injuries are caused by repetitive movement, sustained or constrained postures, and forceful movements as well as stress and unfavourable working conditions(*B Fung et al., 2008*).

2.3.6 Radiation

Radiation is used in diagnostic procedures such as x-ray, fluoroscopy and angiography. It is also used in treatments using radioactive material. Other forms of radiation are used in microwaves, magnetic fields and lasers. Long term and repeated exposure to radiation can cause genetic dam age and reproductive health problems. Light beams from lasers can harm the eyes and skin. Portable radiography is frequently performed on patients in the ED who are not stable enough for transport to and from the radiology department, and this put ED staff at risk of radiation exposure (*Samuel et al., 2000*).

2.3.7 Chemicals

Chemicals found in hospitals can be in the form of dusts, vapours, gases or liquids. A chemical can enter your body in three main ways:

- It can be breathed in
- It can go through your skin
- It can be swallowed

HCW exposure to hazardous chemicals in ED by different ways (e.g., while decontaminating ED patients after a chemical spill) or exposure to hazardous drugs (e.g., during administration)(OSHA, 2008) .

Many chemicals can cause serious illness and in some cases, death. Often the effects are not noticeable right away.

2.3.8 Noise

Occupational exposure to high noise levels can be found in different areas of the hospital. Noise can distract workers and make it difficult to Communicate and concentrate.. HCW exposure to noisy machinery, or equipment, may induce hearing loss, hearing impairment, hypertension, elevated blood pressure levels . Long term exposure to high levels of noise (more than 80 decibels) can cause permanent hearing loss(OSHA, 2008) .

2.4 BIOLOGICAL HAZARD IN ED

2.4.1 Definition

Biological hazards exist throughout all healthcare settings and include airborne and blood borne pathogens (*Ayatollahi, J. et al., 2007*), or contact skin disease.

Biological hazards defined as infectious agent or products of such agent that cause human disease , and biological agents as any microorganism, which may cause any infection, allergy toxicity or otherwise create hazards to human health (*Biological Hazard, CDC, 2012*).

2.4.2 Levels of biological hazard

The United States Centers for Disease Control and Prevention (CDC) categorizes various diseases in levels of biohazard, Level 1 being minimum risk and Level 4 being extreme risk. Laboratories and other facilities are categorized as BSL (Biosafety Level) 1-4 or as P1 through P4 for short (Pathogen or Protection Level).

Biohazard Level 1

Bacteria and viruses including Bacillus subtilis, canine hepatitis, Escherichia coli,scabies, varicella (chicken pox), as well as some cell cultures and non-infectious bacteria. At this level precautions against the biohazardous materials in question are minimal, most likely involving gloves and some sort of facial protection.

Biohazard Level 2

: Bacteria and viruses that cause only mild disease to humans, or are difficult to contract via aerosol in a lab setting, such as hepatitis A, B, and C, influenza A, Lyme disease, salmonella, mumps, measles, scrapie, dengue fever.

Biohazard Level 3

Bacteria and viruses that can cause severe to fatal disease in humans, but for which vaccines or other treatments exist, such as anthrax, West Nile virus, Venezuelan equine encephalitis, SARS virus, tuberculosis, typhus, Rift Valley fever, HIV, Rocky Mountain spotted fever, yellow fever, and malaria. Among parasites Plasmodium falciparum, which causes Malaria, and Trypanosoma cruzi, which causes trypanosomiasis, also come under this level.

Biohazard Level 4

Viruses and bacteria that cause severe to fatal disease in humans, and for which vaccines or other treatments are not available, such as Bolivian and Argentine hemorrhagic fevers, Marburg virus, Ebola virus, hantaviruses, Lassa fever virus, Crimean–Congo hemorrhagic fever, and other hemorrhagic diseases. Variola virus (smallpox) is an agent that is worked with at BSL-4 despite the existence of a vaccine..

2.4.3 Portal of exposure

Portals of exposure can be divided to blood-borne , dermal and air-borne or respiratory exposures (*Tintinallis, 2011*). The risk of infection in exposed health care provider depend on the route of exposure, the concentration (number of organism) of pathogen in infectious material, the infectious characteristic (virility of the pathogen, the volume (dose) of infectious material, and immunocompetence (susceptibility) of the exposed individuals (*Tintinallis, 2011*).

Respiratory exposure

Respiratory infections are the most common communicable infectious diseases (*World Health Organization, 1999*), result from the inhalation of airborne or droplet particulate materials. Health care workers risk respiratory exposure when they confined with an expectorating, coughing, or sneezing patient.

blood-borne exposure

Percutaneous injuries poses the highest risk for the contraction of blood borne disease. Needle sticks or cuts by sharp objects account for the majority of percutaneous injuries.

Workplace activities that put personnel at risk for percutaneous injuries include initiation of IV access, manipulation of access devices, suturing, and medication injection. The risk of percutaneous or mucous membrane exposure to the blood of an HCV-positive source patient has been reported to be twice as likely in the ED than in other parts of the hospital (*Lanphear BP et al., 1994*).

Dermal exposure

It involves skin contact with patients (direct contact) environmental surfaces or objects that are contaminated with infectious materials (indirect contact). The risk of infection is increased if worker contact involves a large surface area or if the dermis in not intact (abraded, chapped, or excoriated) (*Tintinallis ,2011*) . Drugs – resistant organisms, such as methicillin- resistant staphylococcus aureus and vancomycin – resistant enterococci, pose additional dermal exposure risk. transmission may be related to contact with infected patients and medical equipment used on them .workplace activities that place the health care worker at risk include patient examination, turning or moving patients, and changing lines or wound dressings. Parasites of the integument (e.g., scabies, lice etc) are also agent of dermal exposure (*Tintinallis, 2011*).

2.5 COMMON OCCUPATIONAL EXPOSURES

2.5.1 Respiratory exposures

EDs serve as the frontline for patients with communicable respiratory diseases because of the acute nature of these illnesses and because the ED serves as the principal site of health care for many of those at highest risk for these diseases(*Richard E et al., 2006*).

TB

TB is an infectious disease caused by bacteria called Mycobacterium tuberculosis. It is the second most common cause of infectious disease–related deaths worldwide, after HIV/ aquired immunodefecicincy syndrome (AIDS) (*Frieden T, et al., 2003*), with 8.8 million incident cases per year and 1.7 million deaths per year (*WHO. Global TB control—surveillance, 2005*). The bacteria usually cause an infection in the lungs, but it can affect other parts of the body such as the kidney, spine, and brain. If not treated properly, TB can be fatal .

The different types of tuberculosis infection

Four subspecies of mycobacteria exist, each of which can cause tubercular disease; Mycobacterium africanum, M. microti, M. bovis, and M. tuberculosis. M. tuberculosis is the primary cause of TB in humans(*Richard E et al., 2006*).

TB infection can classified as either "latent" or "active". A latent TB infection means a person is infected with the bacterium, but the disease does not develop and no symptoms are experienced. Latent infection occurs when the immune system of the infected person is able to keep the bacteria under control. The TB bacteria can remain dormant for years without causing the disease or symptoms (*Richard E et al., 2006*). The WHO states that about 5 to 10% of people who are infected with TB (but who are not also infected with HIV) will become sick or infectious at some time during their life. However, in some cases, the TB disease may develop later. If the immune system weakens, the TB bacteria that were dormant may become activated. Activation causes the TB disease and associated symptoms. People with HIV and TB infection are much

more likely to develop active TB. For some individuals, active TB disease may develop within weeks of the initial infection(*Richard E et al., 2006*).

Diagnosis of Tuberculosis

ED diagnosis and public health control measures are challenging because clinical presentation of TB can be highly variable and culturing the organism takes days to weeks. Primary TB is most frequently asymptomatic and identifiable only by a positive skin test , purified protein derivative (PPD). In rare cases, active disease may develop, which is clinically similar to reactivation TB .

Signs and symptoms of reactivation TB can be either pulmonary only (80% of cases) or systemic. The most common symptoms of TB are fever, productive cough, and dyspnea. Other symptoms include night sweats, malaise, fatigue and weight loss, hemopytysis, and pleuritic chest pain. In one ED-based study of a series of patients who later were identified as having contagious TB, cough was present in only 64% of cases and was the chief complaint in less than 20% of cases. Furthermore, only 36% of patients reported any pulmonary complaints at triage (*Sokolove P, et al., 2000*).

TB can involve nearly every organ system but the most common extrapulmonary sites infected are the lymph nodes, central nervous system (CNS), bones, and joints. CNS presentations are usually subacute with findings including indolent headache, fever, and occasionally altered mental status(*Richard E et al., 2006*). Although TB can affect nearly every joint, the spine is the most commonly affected site (Pott's disease). Disseminated TB can involve multiple organ systems, including the lungs. Diagnosis

should be suspected in those with a miliary pattern on chest radiographs(*Richard E et al., 2006*).

Patients with suspected TB should be isolated in negative pressure isolation rooms as early as possible until TB has been ruled out with certainty. Definitive diagnosis is not possible in the ED, since culture is the gold standard and requires several weeks for growth. A presumptive diagnosis of TB can be made by Ziehl-Neelson staining, which identifies acid-fast bacilli; sensitivity of this method is only 50% to 80%, however, and requires obtaining multiple positive sputum samples for confirmation(*Richard E et al., 2006*). New laboratory-based molecular diagnostics such as polymerase chain reaction hold promise for rapid definitive diagnosis, but are not yet accepted as routine for clinical decision making (*Schluger N et al., 2003*). Chest radiographs should be obtained on patients with suspected TB. Classic radiographic findings are upper-lobe infiltrates, cavitary infiltrates, and hilar or paratracheal adenopathy. The radiographic findings of TB are highly variable, with atypical findings more common in those with immunosuppressive states, such as advanced HIV (*Sepkowtiz K. et al., 1996*) .

TB transmission

Transmission of TB occurs through inhalation of aerosolized bacilli. As few as 1 to 10 bacilli can cause infection, but only approximately 20% of exposed individuals become infected (CDC, 2005).

There are four factors that determine the probability of transmission of M. tuberculosis (Table 2.2) .And also transmission of M. Tuberculosis depend on proximity and length of Exposure Factors (Table 2.3).

Environmental Factors also enhance the probability of M. tuberculosis to Be Transmitted(Table 2.4).

Table 2. 2 Factors that Determine the Probability of M. tuberculosis Transmission

factor	**Description**
Susceptibility	Susceptibility (immune status) of the exposed individual
Infectiousness	Infectiousness of the person with TB disease is directly related to the number of tubercle bacilli that he or she expels into the air. Persons who expel many tubercle bacilli are more infectious than patients who expel few or no bacilli
Environment	Environmental factors that affect the concentration of M. tuberculosis organisms
Exposure	Proximity, frequency, and duration of exposure

Adapted from CDC. Guidelines for preventing the transmission of Mycobacterium tuberculosis in health-care 2005

Table 2. 3 Proximity and Length of Exposure Factors that Can Affect Transmission of M. tuberculosis

Factor	Description
Duration of exposure to a person with infectious TB	The longer the duration of exposure, the higher the risk for transmission
Frequency of exposure to infectious person	The more frequent the exposure, the higher the risk for transmission
Physical proximity to infectious person	The closer the proximity, the higher the risk for transmission

Adapted from CDC. Guidelines for preventing the transmission of Mycobacterium tuberculosis in health-care 2005

Occupational concern of TB

In the workplace, employees can contract TB directly from actively infected persons or from breathing in air that contains the bacteria. While the risk of workers contracting TB is higher in health care where people with TB may be treated, all workplaces should be aware of how TB can spread. General preventative measures include education to raise awareness in workers about TB, and encouraging workers to seek medical help when TB-like symptoms are noticed.

Table 2. 4 Environmental Factors that Enhance the Probability that M. tuberculosis will Be Transmitted

Factor	Description
Concentration of infectious droplet nuclei	The more droplet nuclei in the air, the more probable that M. tuberculosis will be transmitted
Space	Exposure in small, enclosed spaces
Ventilation	Inadequate local or general ventilation that results in insufficient dilution or removal of infectious droplet nuclei
Air circulation	Recirculation of air containing infectious droplet nuclei
Specimen handling	Improper specimen handling procedures that generate infectious droplet nuclei
Air Pressure	Positive air pressure in infectious patient's room that causes M. tuberculosis organisms to flow to other areas

Adapted from CDC. Guidelines for preventing the transmission of Mycobacterium tuberculosis in health-care 2005

The risk of HCWs converted to PPD testing for TB has been reported to be 12% of ED staff during two years' period. A study that relied on a self – reporting found that 31% of ED staffs become PPD positive during a 3.5 years period (*Sokolove P. E. et al., 1994*).

Emergency departments are particularly vulnerable to the threat of TB, and represent high-risk sites for potential propagation of disease (*Frieden T. et al., 2003*). Contributing factors include characteristics of the patient populations served, ED

infrastructure, and the inherent nonspecific clinical features and highly contagious nature of the disease (*Behrman A. et al 1998* ; *Dorevitch S. et al., 2000*).

Busy inner-city waiting rooms and overcrowded conditions with long wait times and lack of adequate isolation rooms and personal protective equipment further contribute to the potential spread of TB (*Moran G et al., 1995*).

One recent retrospective study from an urban teaching hospital found that 44 active TB patients made 66 contagious ED visits over a 30-month period that went unrecognized before diagnosis (*Sokolove P, et al., 2000*); a similar retrospective study found that nearly 50% of newly diagnosed TB cases had an antecedent visit within 6 months of diagnosis (*Long R, et al., 2002*).

Several studies from high-risk urban EDs have demonstrated delayed disease recognition with reports of lengthy ED stays (median 13 hours) (*Stricof R. et al., 1998*), and significant delays in time to isolation (median time of 8 hours from triage to isolation) (*Moran G, McCabe F, Morgan M, et al., 1995*) .

Increased risk of TB infection among HCWs versus the general population is evident. The results are principally derived from the evaluation of PPD conversion studies, with one recent review reporting an overall incidence of PPD positivity 100 times higher in HCWs versus that found in the general population (*Menzies D, Fanning A, Yuan L, et al.,* 1995) .

Risk of TB infection significantly increases when clinical procedures that produce large amounts of aerosol are performed, such as induced sputum or intubation (*Beggs C, Noakes C, Sleigh P, et al., 2003*).

ED staff reportedly have PPD conversion rates up to six times higher than other hospital workers, with rates of conversion ranging from 1% to 12% (*Liss G, Khan R, Koven E, et al., 1996*) . Principal explanations for the high rates of ED HCW PPD conversion include the high frequency of atypical presentations for patients with TB at initial presentation, the lack of consistent implementation of triage screening for TB, and the lack of availability of adequate infection control facilities in EDs (*Moran G et al., 1995*).

CAP

CAP is a common illness and potentially life threatening especially in older adults and those with co-morbid disease. It is a major cause of morbidity and death worldwide (*C K Liam, 2005*).

CAP is an acute lower respiratory tract infection in a person who has not been admitted to hospital or a health care facility in the previous 14 days for 48 hours or more.

The microbial aetiology of community acquired pneumonia. Although many microorganisms have been associated with CAP, it is a small range of key pathogens that cause most cases.

Streptococcus pneumoniae (pneumococcus) is the most frequently identified pathogen, with the highest incidence of this organism reported in studies that used urinary antigen detection (*British Thoracic Society, 2001*).

Apart from Streptococcus pneumoniae, a great deal of literature in Western countries (*Jokinen C et al., 2001*), (*Dowell SF, 1996*), has reported Haemophilus injluenzae, atypical pathogens Chlamydia pneumoniae, Mycoplasma pneumoniae, Legionella pneumophila and viruses (influenza virus, adenovirus, respiratory syncytial virus, parainfluenza virus coronavirus) as the common pathogens of CAP(*Marx A. et al., 1999 ; Bartlett G et al., 2000).* Gram-negative bacilli (Enterobacteriaceae and pseudomonadas) are the cause of CAP in patients who have had previous antimicrobial treatment or who have pulmonary comorbidities) (*Philippine Society for Microbiology and Infectious Diseases, 1998*).

In one study, 33% of hospitalized CAP patients with unknown aetiology diagnosed by routine methods were found to due to Streptococcus pneumoniae based on findings from transthoracic needle lung aspiration, suggesting that many patients without a known pathogen have pneumococcal infection (*Ruiz-Gonzalez, A et al., 1999*).

Clinical course

In a study of ambulatory patients with CAP, median time to resolution of fever was 3 days; 5 days for myalgia, 6 days for dyspnoea, and 14 days for both cough and fatigue (*Metlay JP, et al., 1998*) Symptoms can last even longer in seriously ill patients. Fine and colleagues (*Fine MJ, et al., 1999*) have noted that 86% of patients had at least one persisting pneumonia , related symptom at 30 days.

Death rates associated with CAP have not changed greatly over the past two decades in part because of the increased number of patients at risk of the disease, such as elderly people and patients with multiple comorbid conditions.

In a prospective study (*J Inf Di,s 2000*) of prognostic factors of CAP caused by bacteraemic pneumococcal disease in five countries, death rates ranged from 6% in Canada to 20% in the USA and Spain (13% in the UK and 8% in Sweden). Independent predictors of death were age greater than 65 years, residence in a nursing home, presence of chronic lung disease, high acute physiology and chronic health evaluation (APACHE) score, and need for mechanical ventilation.

Disease severity and frequency of underlying conditions were factors that affected outcome. Mortensen and colleagues (*Mortensen EM, 2002*) noted that about half of deaths in patients with CAP were attributable to the worsening of pre-existing conditions.

Diagnosis

Diagnostic evaluation of patients with symptoms suggestive of pneumonia is important for several reasons: the accurate diagnosis of CAP, appropriate assessment of severity of illness, and appropriate use of microbiological analyses to establish the cause of the illness.