BIOLOGICAL HAZARD & NEEDLE STICK INJURY (NSI)

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3 BIOLOGICAL HAZARD

- Definition & Concern
- Magnitude
- Types & Classification of Risk Group
- Prevention & Control
- Laboratory Acquired Infections (LAIs)
OCCUPATIONAL HAZARDS

PHYSICAL AGENTS
- noise, vibration, radiation
- defective illumination
- temperature extremes

BIOLOGICAL AGENTS
- viruses, bacteria, fungi
- parasites, insects

PSYCHOLOGICAL
- Stress, boredom

CHEMICAL AGENTS
- dusts, gases, vapors
- fumes, mists

ERGONOMIC
- standing at work, awkward posture
- lifting heavy load
- monotonous job, working with VDU

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3 BIOLOGICAL HAZARD @ BIOHAZARD S

- an organism, or substance derived from an organism, that poses a threat to (primarily) human health.

- A naturally occurring substance that can be harmful to workers.

- This can include medical waste, samples of a microorganism, virus or toxin (from a biological source) that can impact human health. It can also include substances harmful to animals.

(Online Encyclopedia)
Potential for acquiring a laboratory-acquired infections (LAIs)

Contamination of the environment

Contamination of research
3 Occupational Exposure to blood borne pathogen

- 2 million exposure per year
- Among HCW:
  - 40% of Hepatitis B
  - 40% of Hepatitis C
  - 4% of HIV

⇒ Needle Stick Injury

WHO Environmental Burden of Disease No. 3
3 MALAYSIA

- **HEPATITIS B**
  1999 - 5295 cases reported & 9% were carriers

- **TB**
  2005 – 11 notification of HCW with MTB
3. Body fluids pathogen – Bacteria, Viruses, Fungi, Protozoa

3. Animal – insects, birds

3. Recombinant DNA – genetic engineering, cloning

3. Nano-technology
Microorganisms are categorized in risk groups (relative risk) based on the following factors:

- Pathogenicity of the organism
- Mode of transmission and host range
- Availability of effective preventive measures (e.g., vaccines)
- Availability of effective treatment (e.g., antibiotics)
RISK GROUP 1 (low individual and community risk)
This group includes those microorganisms which are unlikely to cause disease in healthy workers or animals (pose little or no risk) – *Lactobacillus sp, Bacillus subtilis*

RISK GROUP 2 (moderate individual risk, low community risk)
Can cause human disease, but under normal circumstances is unlikely to be a serious hazard to laboratory workers, the community, livestock or the environment. Effective treatment and preventive measures are available and the risk of spread is limited.
*E. Coli 0157, Measles, Mumps, Hepatitis B, HIV*
3 RISK GROUP 3 (high individual risk, low community risk)

A pathogen that **usually causes serious human or animal disease**, or which can result in serious economic consequences but does not ordinarily spread by casual contact from one individual to another, or that can be treated by antimicrobial or antiparasitic agents.

*Mycobacterium TB, Anthrax, Small Pox,*

3 RISK GROUP 4 (high individual risk, high community risk)

A pathogen that **usually produces very serious human animal disease**, often untreatable, and may be readily transmitted from one individual to another, or from animal to human or vice-versa directly or indirectly, or casual contact – *H5N1, Ebola virus*
WHO has long recognized that safety and in particular, biological safety are important international issues.

In 1983 - 1st edition of its *Laboratory Biosafety Manual* which encourages countries to prepare:

- Specific Codes of Practice for the safe handling of pathogenic microorganisms in laboratories within their geographical borders & provide expert guidance for developing such codes of practice.
References are made to the relative hazards of infective microorganisms by WHO Risk Groups 1, 2, 3 & 4.

This risk group classification is to be used for laboratory work only.

The risk assessment of the work to be done with a specific agent will determine the appropriate combination of these elements.
As the level \( \uparrow \) so does:

- the risk of the organism to humans, animals, plants and/or the environment
- the procedural and facility requirements
- the level of containment required
- the degree of protection for personnel, the environment and the community.
<table>
<thead>
<tr>
<th>No.</th>
<th>Infectious Agent</th>
<th>Recommended Biosafety Level</th>
<th>Minimum Equipped</th>
<th>Maximum Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ebola</td>
<td>4</td>
<td>BSL3</td>
<td>BSL4</td>
</tr>
<tr>
<td>2</td>
<td>Marburg Virus</td>
<td>4</td>
<td>BSL3</td>
<td>BSL4</td>
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<tr>
<td>3</td>
<td>Lassa Fever</td>
<td>4</td>
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<td>BSL4</td>
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<tr>
<td>4</td>
<td>Rabies Virus</td>
<td>2</td>
<td>BSL2</td>
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<tr>
<td>5</td>
<td>Yellow Fever</td>
<td>3</td>
<td>BSL3</td>
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<tr>
<td>6</td>
<td>Hepatitis</td>
<td>2</td>
<td>BSL2</td>
<td>BSL3</td>
</tr>
</tbody>
</table>
3 Up to 1999, over 5,000 reported cases of lab-acquired infections and 190 deaths worldwide.

(Health Canada Report)

3 80% of LAI's go undetected/unrecognised due to long incubation periods, mild symptoms, or symptoms common to everyday illnesses (i.e. flu-like symptoms).

3 Estimation of only 20% of infections can be attributed to any known, single exposure event.
   - 80% of which are caused by human error
   - 20% are caused by equipment failure
3. Top 4 accidents resulting in infection

- Spillages & splashes
- Needle and syringe
- Sharp object, broken glass
- Bite or scratch from animals

http://www.weizmann.ac.il/safety/bio2.html
LAB ACQUIRED INFECTIONS (LAI’s)

3 Several ways in which infectious substances can enter the body and cause infection:

- inhalation
- percutaneous inoculation
- direct contact
  - mucous membranes, eye
- ingestion

3 Infections are caused from exposure to infectious aerosols, spills, splashes, needle stick injuries, cuts, centrifuge accidents.
LAB-ACQUIRED INFECTIONS (LAI’s)

Routes of Transmission

Infection Source
- Specimens
- Culture & stocks
- Research animals
- Item contaminated with above

Susceptible Host
- Age
- Immune system
- Vaccination status
# LAB-ACQUIRED INFECTIONS (LAI’s)

<table>
<thead>
<tr>
<th>WHO</th>
<th>WHAT</th>
<th>WHERE</th>
<th>WHEN</th>
<th>HOW</th>
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<tbody>
<tr>
<td>Doctor, Nurse, Researcher</td>
<td>SARS</td>
<td>Singapore, Taiwan</td>
<td>December 2003</td>
<td>Contact</td>
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<tr>
<td>Microbiologist</td>
<td>West Nile Virus</td>
<td>US</td>
<td>August 2002</td>
<td>Laceration</td>
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<tr>
<td>Laboratory Worker</td>
<td>Meningococcal Disease</td>
<td>US</td>
<td>2000</td>
<td>Aerosol?</td>
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<tr>
<td>Laboratory worker</td>
<td>Vaccinia virus</td>
<td>Europe</td>
<td>2002</td>
<td>Contact</td>
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</table>
**HIERARCHY OF CONTROL**

3 Elimination/Substitution

3 Engineering control
   - Biosafety Cabinet (BSL)

3 Administrative control
   - Work Practice - SOP
   - Standard Precaution

3 PPE
   - Gloves, mask, gown
Every incident (no matter how small) must be investigated to determine if the risk of exposure exists, and what could be done to prevent the possibility of reoccurrence.
NEEDLE STICK INJURY (NSI)
3 NEEDLE STICK INJURY (NSI)

- Definition
- Prevalence
- Factors contributing to NSI
- Prevention & Control
NSI are injury caused by needles that accidentally puncture the skin.

Needles - hypodermic syringes and other needle equipment & can occur at any time when people use, disassemble, or dispose of needles.

Despite published guidelines and training program, NSI remain an ongoing problem.
Bilangan dan kadar kecederaan di kalangan anggota KKM 1998-2005

**Source:** OHU, MOH

**PREVALENCE**

- **Number of Injuries**
- **Injury Rate Per 10,000 Worker**

<table>
<thead>
<tr>
<th>Tahun</th>
<th>Bilangan kecederaan</th>
<th>Kadar Kecederaan setiap 10,000 Pekerja</th>
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<tr>
<td>1998</td>
<td>13</td>
<td>125</td>
</tr>
<tr>
<td>1999</td>
<td>37</td>
<td>377</td>
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<td>2000</td>
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<td>799</td>
<td>75</td>
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<tr>
<td>2002</td>
<td>972</td>
<td>85</td>
</tr>
<tr>
<td>2003</td>
<td>830</td>
<td>67</td>
</tr>
<tr>
<td>2004</td>
<td>842</td>
<td>64</td>
</tr>
<tr>
<td>2005</td>
<td>726</td>
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<tr>
<td>1</td>
<td>0.5</td>
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<td>3</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>4</td>
<td>0.0</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Source: OHU, MOH
3 Accidental punctures by contaminated needles:

- blood-borne viruses infection – HIV, Hepatitis B and C.
- The risk of transmission after exposure to:
  - HIV-infected blood is about 0.3%,
  - Hepatitis B - 30% (100x greater than HIV),
  - Hepatitis C virus – 10%.
- Others - hazardous drugs, chemical (CCOHS)
Several studies show that needles cause injuries at every stage of their use, disassembly, or disposal.

Nursing and laboratory staff usually experience 30 - 50% of all injuries during clinical procedures.
FACTORS CONTRIBUTING TO NSI

1. RECAPPING
   - Accounts for 23 – 30% of all NSI.
   - 3 ways:
     1. Needle misses the cap & pierce the hand holding it.
     2. Needle pierces the cap & pierce the hand holding it.
     3. The poorly fitting cap slips off of a recapped needle & st abs the hand.

2. STAFF EXPERIENCE
   - New staff or students > NSI than experienced staff

3. EQUIPMENT DESIGN
   - Safer innovative devices - accumulating evidence suggesting that syringes with safety features reduce NSI.
4. **NATURE OF PROCEDURE**
   - Injuries commonly occur when workers try to do several things at the same time, especially while disassembling or disposing of needles.
   - Critical situation eg: attending bleeding pt

5. **CONDITIONS OF WORK**
   - Understaffing – additional duties.
   - Difficult patients care situations.
   - Working at night – poor lighting
6. DISPOSAL

- Accidents occur at every step:
  3 while carrying the needle to the disposal container, especially when the needle is uncapped and mixed with other trash.
  3 while placing the needle into the disposal container, especially if the container is overfilled.
  3 while emptying disposal containers instead of sealing them for disposal.

7. OTHERS:

- Psychosocial factors – stress, fatigue (human error)
Preventing NSI is the most effective way to protect workers from the infectious diseases that needlestick accidents transmit.

3 Elimination/Substitution
   - Needles less injection

3 Engineering control
   - Safer needle device

3 Administrative control
   - Work Practice - SOP
   - Standard Precaution – no recapping

3 PPE
   - Gloves
A comprehensive NSI prevention program include:

A. Employee training – eliminate risk
B. Continued Innovation
C. Recommended guidelines.
D. Surveillance Programs
A. Employee Training

- need to know how to properly use, assemble, disassemble, and dispose needles.
- need to understand the risks associated with NSI and know the proper means to prevent them. Specifically, training programs should address:
  1. risk of injury.
  2. potential hazards.
  3. recommended precautions for use and disposal of needles.
  4. procedures for reporting injuries.
  5. the importance of vaccination where appropriate.
B. Continued Innovation

- There is a need for further investigation and innovation to develop means for preventing NSI; aiming:
  
  3 to identify the types and designs of needle instruments that are potentially capable of reducing NSI.
  3 to find methods that eliminate the need to move hands towards the tips of contaminated needles, or to manually disassemble contaminated needle equipment.
C. Recommended Guidelines
# Pocket Guidelines For STANDARD PRECAUTION

Occupational Health Unit, Ministry of Health Malaysia 2002

## Prevention & Control

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<td>2</td>
</tr>
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<td>2</td>
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<td>2</td>
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<tr>
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<td>1.4. Disinfectants</td>
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<tr>
<td>1.6. Collection and Transportation of Blood from Patients</td>
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## DISPOSABLE SHARP AND INFECTIOUS WASTES

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<th>ACTIVITIES</th>
<th>ACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2.6.1 Disposal of sharps</td>
<td>- Sharps should be picked with forceps.</td>
</tr>
<tr>
<td></td>
<td>- Discard into Sharp bin.</td>
</tr>
<tr>
<td></td>
<td>- You use it, you throw it.</td>
</tr>
<tr>
<td></td>
<td>- Do NOT recapped or manipulate sharps.</td>
</tr>
<tr>
<td></td>
<td>- Sharps bin should not be more than 2/3 full.</td>
</tr>
<tr>
<td></td>
<td>- Must be place at the work site.</td>
</tr>
<tr>
<td>1.2.6.2 Disposal of infectious</td>
<td>- Blood and soiled dressings to discard as clinical wastes and ensure</td>
</tr>
<tr>
<td>wastes</td>
<td>no leakage.</td>
</tr>
<tr>
<td></td>
<td>- Excrete and other body fluids discard direct into sluice.</td>
</tr>
</tbody>
</table>
WHAT TO DO?

3.2. IMMEDIATE ACTION FOR OCCUPATIONAL EXPOSURE

Sharp Injuries / Needle Sticks

- Squeeze out blood as much as possible.
- Wash hand with soap and water.
- Wipe site with antiseptic.
- Cover with dressing if necessary.

Splash

- On intact skin wash thoroughly with soap and water or shower.
- For eyes - rinse gently and thoroughly with water / normal saline immediately.

Mouth - spit out and rinse several times with water.

Report to Supervisor immediately

- Supervisor assess extend injury.
- Refer to Physician, Infections, Disease doctor or casualty doctor which ever applicable according to hospital protocol
D. Surveillance Programs

- Important tool to provide in-depth analysis of NSI:
  3 determining the rate of NSI.
  3 investigating the factors that cause the NSI.
  3 ensuring that injured workers receive proper treatment.
  3 identifying areas in which the prevention program needs improvement.
  3 eventually providing practical strategies for dealing with the problem.

3. Sharp Injury Surveillance Program

[‘Survelans Kecederaan Oleh Alatan Tajam’ bagi anggota KKM (Pekeliling Ketua Pengarah Kesihatan Bil.3/2007)].
THANK YOU