IN THE NAME OF GOD

Occupational Biological Agents

(Bloodborne and Airborne Pathogens)

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Biological Agents

Bacteria-Tetanus,Tuberculosis,Anthrax, Brucellosis,Gonorrhea,….

Virus – Hepatitis(B,C), HIV, COVID-19

Protozoal&Parasitic-Malaria,Hydatid(Dog handlers),Hookworms,tapeworms(Agri-workers), etc.

Fungi-(Agri-workers)-Tinea-infections, Coccidiomycosis, etc.

Bloodborne Pathogens

"Bloodborne Pathogens" means pathogenic microorganisms that are present in human blood and can cause disease in humans.

Example:
hepatitis B virus (HBV)
hepatitis C virus (HCV)
human immunodeficiency virus (HIV).

Bloodborne Infection among Healthcare Workers

- 3 million healthcare workers exposed to bloodborne pathogens each year
- > 90% of infections occur in developing countries
- 95% of HIV by needlestick injuries

Risk of Blood-borne Pathogen Transmission

- The risk of transmission of bloodborne pathogen from an infected patient to a HCW by a needlestick injury:
  - 30% for hepatitis B
  - 3% for hepatitis C
  - 0.3% for HIV

SOME WORKERS WHO ARE AT RISK

- ✓ Physicians
- ✓ Nurses
- ✓ Emergency Room Personnel
- ✓ Housekeeping Personnel
- ✓ Laundry Workers
- ✓ Laboratory Personnel
- ✓ Blood Bank Personnel
- ✓ Paramedics
- ✓ Emergency Medical Technicians
- ✓ Medical Waste Handlers
- ✓ Home Healthcare Workers
- ✓ Medical Examiners
- ✓ Dentists and Dental Workers

HOW DOES EXPOSURE OCCUR?

- ✓Needlesticks (most common)
  - 800,000 needlestick injuries occur each year in the U.S.
- ✓Cuts from other contaminated sharps (scalpels, broken glass, etc.)
- ✓Contaminated blood contact with the eyes, mucous membranes of the mouth or nose, or broken (cut or abraded) skin

Blood Borne Pathogens

- Human immunodeficiency virus (HIV)
- Hepatitis B virus (HBV)
- Hepatitis C virus (HCV)
- Covid-19 ???

Human Immunodeficiency Virus(HIV)

- HIV affects the body's immune system and can lead to AIDS
- Symptoms of early infection – night sweats, weight loss, swollen glands
- Risk of transmission **needlestick: 0.3%**
-

Blood Borne Pathogens

- HIV
  - virus that causes AIDS
  - incubation period 1 to 3 months
  - person is infectious from
  - onset of infection throughout life
  - all persons are susceptible

Blood Borne Pathogens

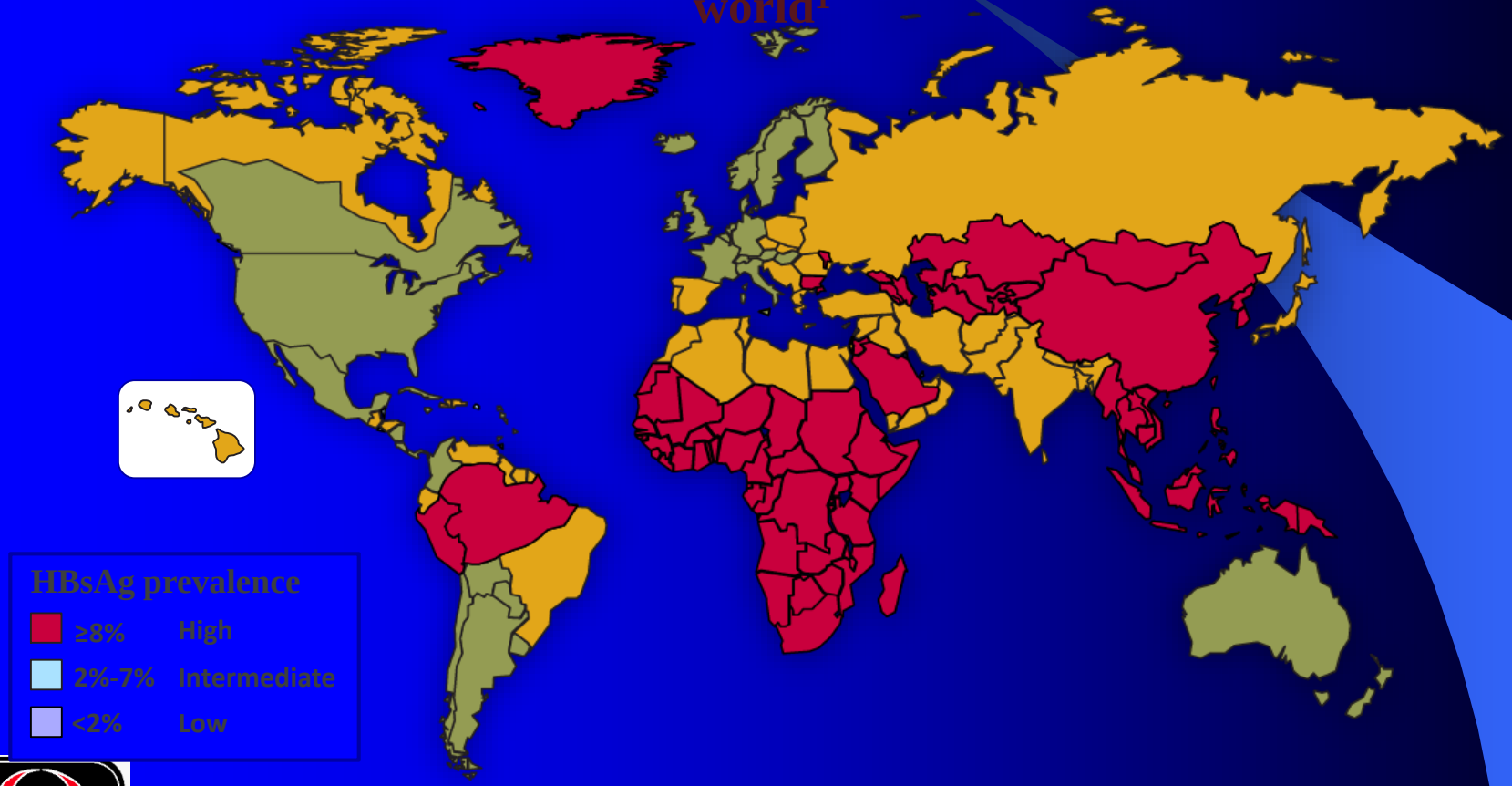
- HIV
  - risk of transmission
    - needlestick: 0.3%
    - splash/spray to mucuous membranes: 0.09%
    - non-intact skin: less than mucous membrane exposure

Human Immunodeficiency Virus

- HIV affects the body's immune system and can lead to AIDS
- Symptoms of early infection – night sweats, weight loss, swollen glands
- Very fragile virus and will not survive for a long period of time outside the body
- Risk of transmission through an exposure is 3-4%

Chronic Hepatitis B Is a Global Health Problem

HBV infection is the most common chronic viral infection in the world[1]



Map adapted from the CDC. [illegible] et al. *Lancet.* 2014;384;2053-2063; 2. WHO. Hepatitis B Fact Sheet. July 2014. www.who.int/mediacentre/factsheets/fs204/en/. Accessed March 25, 2015;

HBV=hepatitis B virus

3. CDC. *Morb Mortal Wkly Rep.* 2008;57:1-20; 4. Vijayadeva V, et al. *Am J Manag Care.* 2014;20:e98-e104.

Virology of HBV Infection

- HBV is a partially double-stranded DNA virus which primarily infects liver cells[1]
- Liver inflammation and fibrosis/cirrhosis are consequences of host's immune response[1]
- The virus can evade the immune system during early phases of infection
  - Therefore, acute infections are primarily asymptomatic[1]

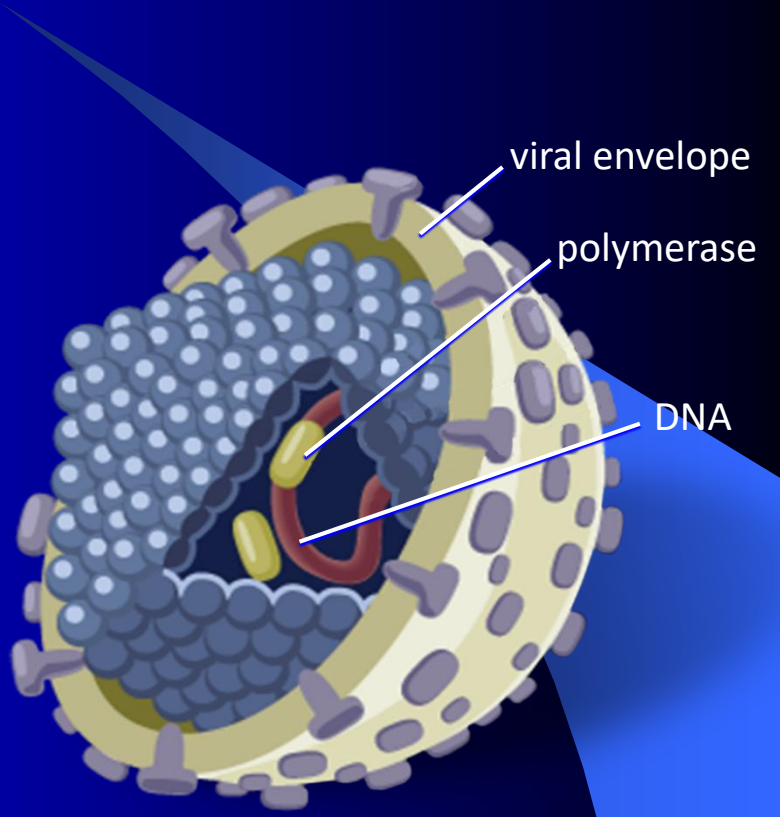
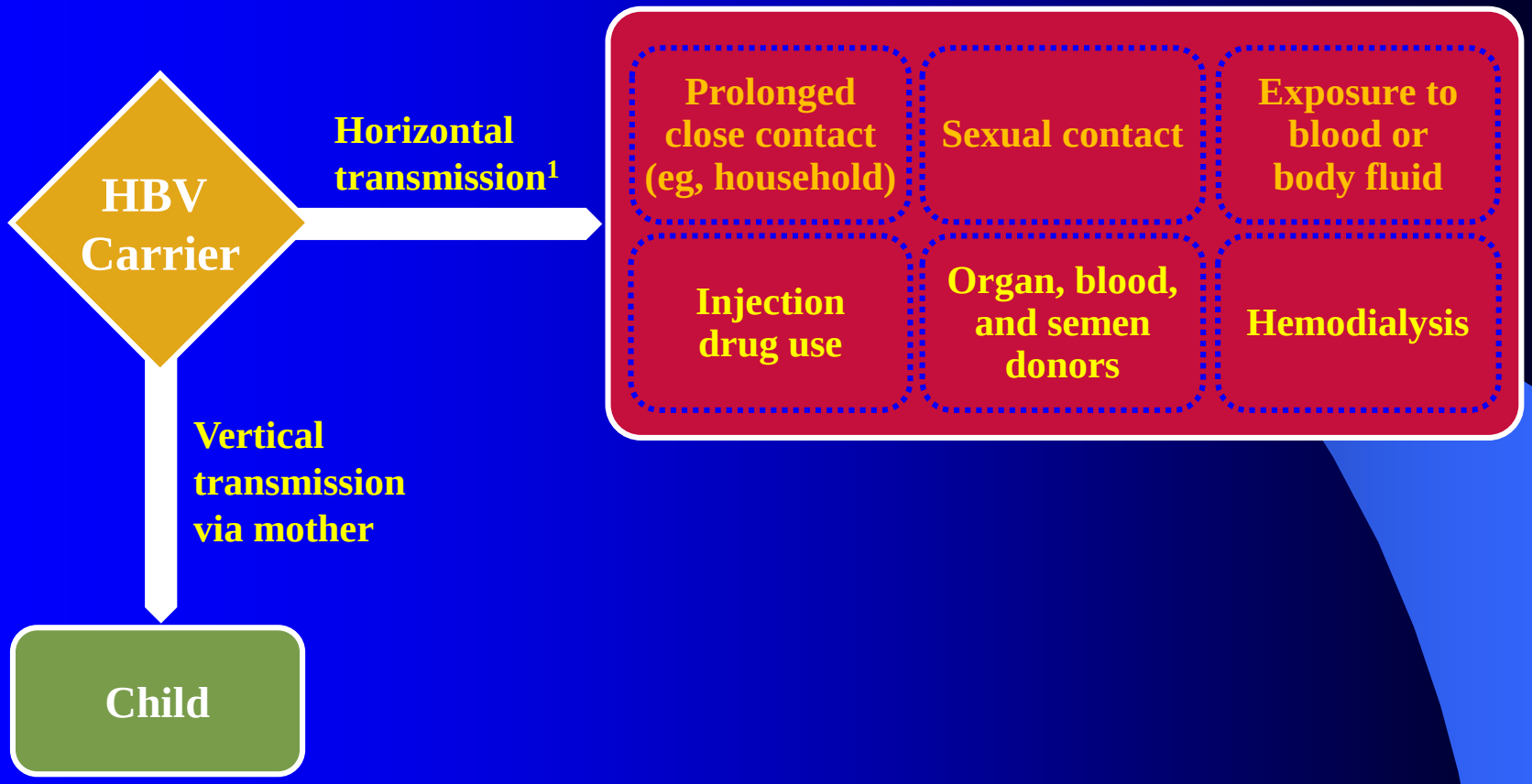


Figure adapted from Toronto Centre for Liver Disease. Hepatitis B. www.torontoliver.ca/hepatitis-b/.

cccDNA=covalently closed circular DNA.

1. Busch K, Thimme R. *Med Microbiol Immunol.* 2015;204:5-10; 2. Margeridon-Thermet S, Shafer RW. *Viruses.* 2010;2:2696-2739.

Routes of HBV Transmission



HBeAg–hepatitis B e antigen.

1. CDC. *Morb Mortal Wkly Rep*. 2008;57:1-20. 2. Buchanan C, Tran TT. *Clin Liver Dis.* 2010;14:495-504.

Progression and Complications of CHB

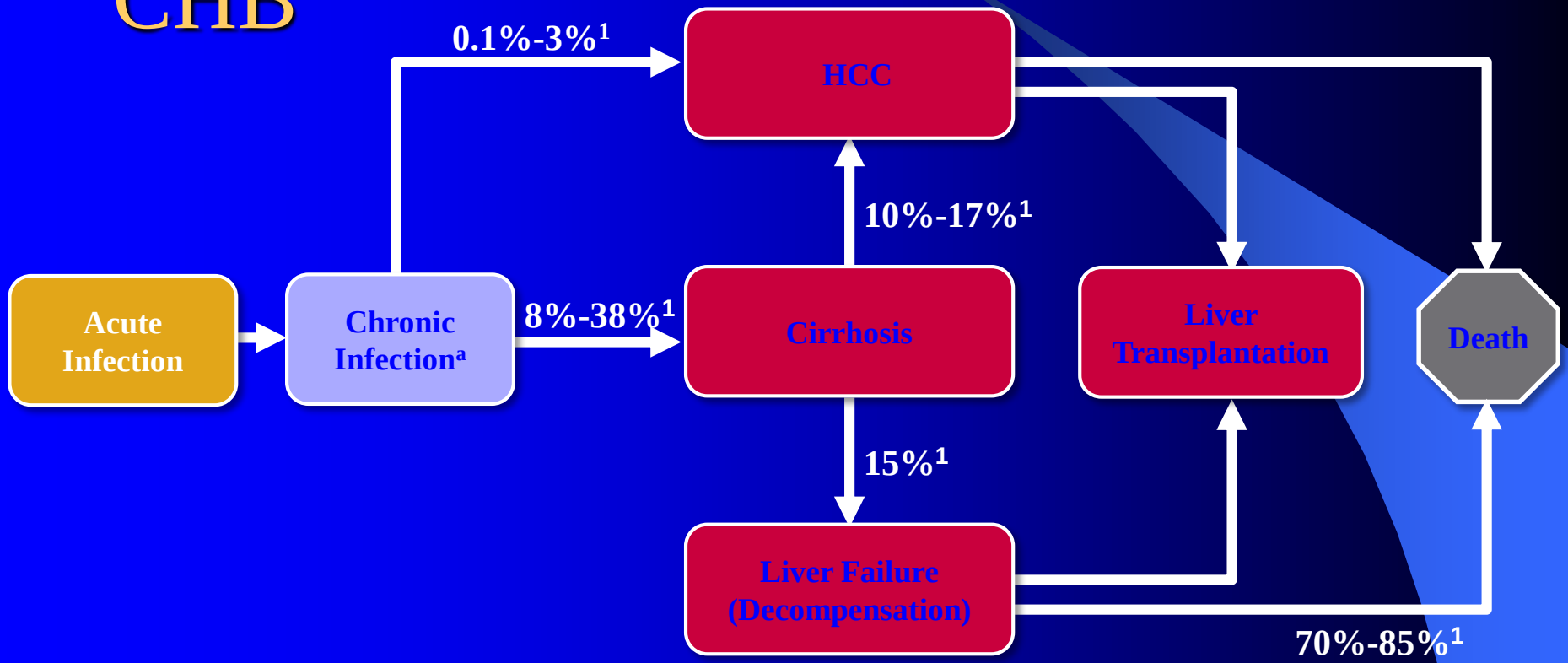


Figure adapted from Fattovich G, et al. In: Marcellin P, (ed.) *Management of Patients With Viral Hepatitis*. Paris: APMAHV; 2004.

[a]Chronic infection is defined as the persistence of positive test results for hepatitis B surface antigen or HBV DNA for at least 6 months.[2]

Percentages are 5-year cumulative incidence rates.

HCC=hepatocellular carcinoma.

1. Fattovich G, et al. *J Hepatol*. 2008;48:335-352; 2. CDC. *Morb Mortal Wkly Rep*. 2008;57:1-20.

HBV Screening Tests

Screening tests for virologic markers of HBV infection include HBsAg, anti-HBs, and anti-HBc[1,2]

HBsAg	Anti-HBs	Anti-HBc[a]	Interpretation	Recommended Follow-up
+	–	+	Acute or chronic infection[b]	**Contact patient for evaluation and further testing**
–	+	+	Patient has immunity from previous infection	**Follow up as appropriate**[c,d]
–	+	–	Patient has immunity from vaccination	**No further action required**
–	–	–	Patient is at-risk for HBV infection	**Vaccinate**

[a]Anti-HBc refers to total anti-HBc.[2]

[b]Patients are chronically infected if HBsAg+ for ≥6 months.[3]

[c]Patients who are anti-HBc positive should be monitored closely during and after the administration of cytotoxic chemotherapy for signs of HBV reactivation.[3]

[d]Patients with cirrhosis may need to be monitored for hepatocellular carcinoma per the AASLD guidelines.[4]

1. Ke[illegible]a EB, et al. *Gastroenterol Hepatol.* 2008;6:1315-1341; 2. CDC. Interpretation of Hepatitis B Serologic Test Results. http://www.cdc.gov/hepatitis/HBV/testingchronic.htm. Updated December 11, 2013. Accessed March 25. 2015; 3. CDC. *Morb Mortal Wkly Rep.* 2008;57:1-20; 4. Bruix J, Sherman M. *Hepatology.* 2011;53. http://www.aasld.org/sites/default/files/ guideline_documents/HCCUpdate2010.pdf. Accessed March 25, 2015.

Blood Borne Pathogens…

- HBV
  - virus that causes hepatitis B
  - incubation period 45 to 180 days
  - person is infectious if test for antigen (HBsAG) is positive
  - unvaccinated persons are susceptible
    - vaccination is recommended for persons with occupational exposure

Blood Borne Pathogens…

- HBV
  - risk of transmission
    - needlestick: 22-31%
      if source is HBeAG +
    - needlestick: 1-6%
      if source is HBeAG -
    - direct or indirect contact with non-intact skin or mucous membranes is an important source of occupational exposure

HBV Vaccination

Populations recommended for HBV vaccination by the CDC[1]

- All newborns[a]
- All unvaccinated children and adolescents through 18 years of age
- All unvaccinated adults at risk for infection and those requesting protection from HBV infection

- Primary vaccination consists of 3 intramuscular doses given at 0, 1, and 6 months[2]
- A full 3-dose vaccine series is associated with immunity in >90% of healthy adults[2]

[a]Infants born to HBsAg-positive mothers should also receive hepatitis B immune globulin ≤12 hours of birth.[3]

1. CDC. Vaccination and Immunizations: Hepatitis B In-Short. http://www.cdc.gov/vaccines/hcp/vis/vis-statements/hep-b.html. February 2, 2012. Accessed March 25, 2015;
2. CDC. *Morb Mortal Wkly Rep*. 2006;55:1-33; 3. CDC. *Morb Mortal Wkly Rep*. 2005;54:1-33.

Blood Borne Pathogens…

- **HCV**
  - **incubation period 6 to 9 weeks**
  - **risk of transmission**
    - **needlestick: 1.8%**
    - **No vaccine** to prevent HCV.

Infection	Transmission in general	Risk of transmission evaluation		Risk classification of biological agents*	Main risk	Vaccine available	Post-exposure prophylaxis (PEP)
Influenza	Droplet spread; direct droplet transmission or droplet to contact transmission of respiratory secretions of infected patients	Moderate	Moderate	2	Close contact with patient (Within 3 feet from coughing/ sneezing)	Yes	Antivirals normally not recommended
Measles	Airborne; direct airborne transmission or airborne to contact transmission of respiratory secretions of infected person	High	High	2	Inhaling or contact with the patient's respiratory secretions	Yes	Immune globulin
Meningococcal infection	Droplet spread; direct droplet transmission or droplet to contact transmission of respiratory secretions of infected patients		Rare	2	Close contact; face to face	Yes (tetravalent A, C, W135, and Y)	Antibiotic after close contact
Mumps	Droplet spread; direct droplet transmission or droplet to contact transmission of respiratory secretions of infected patients	Moderate	Moderate	2	Close contact with patient (Within 3 feet from coughing/ sneezing)	Yes	
Rubella	Droplet contact or direct contact with respiratory secretions; airborne	Moderate	Moderate	2		Yes	

Risk Reduction

- Provide vaccinations:
  - Hepatitis B
  - Influenza
  - Mumps/Measles/Rubella/Varicella/Pertussis
  - Poliovirus
  - Tetanus, Diphtheria (as a routine adult vaccination)
  - Tubercolosis(TB)
  - **COVID-19**

Bloodborne Pathogen Standard

- Exposure Control Plan
- Exposure Determination
- Engineering and Work Practice Controls
- Personal Protective Equipment(PPE)
- Housekeeping

Bloodborne Pathogen Standard (cont.)

- Regulated Waste
- Training
- Hepatitis B Vaccination and Post-Exposure Evaluation and Follow-up
- **Covid-19 Vaccination**
- Communication of Hazards to Employees (signs and labels)
- Record Keeping

ENGINEERING CONTROL EXAMPLES

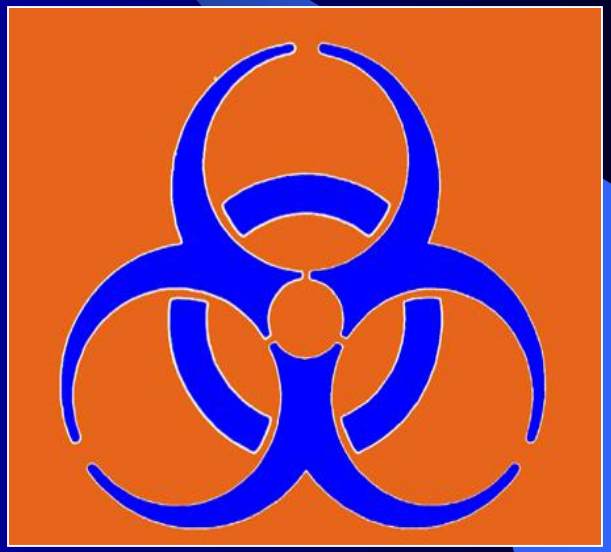
- Sharps disposal containers must be provided and used.
- Sharps disposal containers must be leakproof, puncture resistant, able to be closed, and labeled or color-coded.

LABELS

The standard requires that warning labels be attached to:

- Containers of regulated waste;
- Refrigerators and freezers containing blood…;
- Other containers used to store, transport, or ship blood or OPIM;
- Contaminated equipment prior to shipping.

Red bags or containers may be substituted for labels.

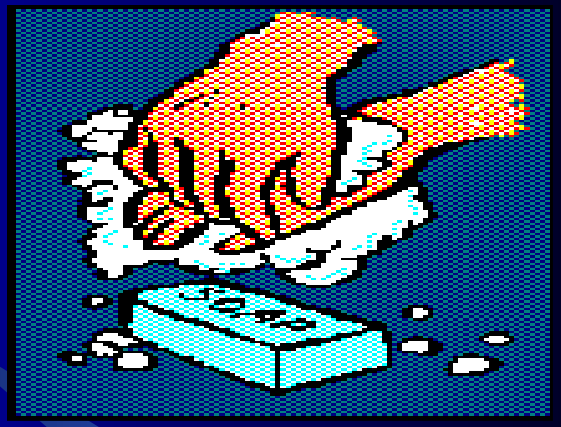


BIOHAZARD

Use Safe Clean-up Practices:

- Wear appropriate gloves and other required PPE
- Never pick up broken glass or similar items with hands
- Put glass, etc. in “puncture resistant”

Handwashing



- One of the most important work practice controls!
- Handwashing facilities should be readily accessible and adequately stocked or utilize a waterless hand disinfection system

Personal Protective Equipment (PPE)

Personal protective equipment is specialized clothing or equipment worn or used by you for protection against a hazard.

Provides a barrier between you and the hazard.

PPE (cont.)

Examples of PPE:

Latex gloves
Non-Latex gloves
Lab coats

N-95 Respirators
Isolation Masks

CPR masks
Face shields
Surgical Mask

REMOVE ALL PPE IN AREA OF USE !!!!

PPE (cont.)

Latex, Synthetic Latex or nitrile gloves are probably the most important protective apparel that can be worn to protect yourself from bloodborne pathogens

PPE (cont.)

Anytime there is a risk of splashing of contaminated fluids, and/or other eye protection should be used to protect your eyes

PPE (cont.)

Waterproof clothing such as lab coats or aprons may be worn to protect your clothing and to keep blood or other contaminated fluids from soaking through to your skin.

PPE (cont.)

Face shields may be worn in addition to goggles to provide additional face protection. A face shield will protect against splashes to the nose and mouth

Proper Glove Removal

1. Before removing disposable gloves, gather any contaminated materials and dispose of in red biohazard bag.
2. Strip off one glove from the wrist, turning it inside out so the “clean” side is on the outside.

Proper Glove Removal

3. Place the glove in the other hand and strip off the glove on that hand, turning it inside out.

Infectious Waste Management

- Infectious waste (blood-soaked towels, clothing, applicable sharps, etc.) must be managed
- Infectious Waste Management Program. This means that:
- Infectious wastes are stored separately from regular waste
- Infectious wastes must be placed in containers that are leak proof, closable, puncture resistant and labeled with the universal biohazard label
- Infectious wastes are transported by a licensed transporter to an approved infectious waste treatment and disposal facility

Hazard Communication LABELS!!!

Recordkeeping

Medical Records – including dates of Hepatitis B vaccinations and related information as well as medical evaluations and reports. These records must be maintained for the duration of employment plus 30 years and must be kept confidential.

Training Records – including the dates of training and the name(s)/title(s) of the individual's) who provided the training. These records must be maintained for three years. A copy of these records must also be maintained by Safety and Health.

Recommendations

- Isolation Procedures
  - Airborne
  - Contact
  - Droplet
- To be used in addition to Standard Precautions

COVID-19 transmission

- Generally, SARS CoV-2 is spread by larger respiratory particles of liquid referred to as droplets.
- These larger droplet particles tend to fall on adjacent surfaces (e.g. floor, tabletop) relatively quickly and do not travel long distances.
- Travelling over long distances on air currents is generally not a significant factor in the spread of this infection.

Personal Protective Equipment(PPE)

- N95 Mask
- Fluid resistant long-sleeved or isolation gown
- Eye protection - safety glasses or face shield
- Disposable nonsterile gloves when in contact with the patient (hand hygiene before donning and after removing gloves)

Advice for health workers, staff, healthcare and student

- Symptoms of COVID-19 include fever (≥37.50C), cough, sore/scratchy throat and shortness of breath. Other reported symptoms of COVID-19 include loss of smell, loss of taste, runny nose, muscle pain, joint pain, diarrhoea, nausea/vomiting and loss of appetite.

- The HW, healthcare student or volunteer must also follow the home isolation guidance for people suspected to have COVID-19. There are a number of COVID-19 Testing Clinics throughout NSW. General Practitioners and Emergency Departments can also perform COVID-19 testing

Facility Preparedness for COVID-19

- ❑ Staff needed (and suitability) to be trained in high level PPE for COVID-19
- ❑ Emergency Department trained and up to date with PPE competency and combined precautions
- ❑ Intensive Care/Critical Care Department trained and up to date with PPE competency and combined precautions
- ❑ Pandemic plan in place - reviewed and updated

Exposure Control: Protect Yourself

- Read the Exposure Control Plan – a copy is available to you
- Use engineering and work practice controls
- Use personal protective equipment
- Know what to do in case of an exposure

Infection prevention & control principles

- Environmental Cleaning
- Waste Management
- Hand Hygiene
- Respiratory hygiene
- PPE

Thank You for Attention