Biohazards and Bloodborne Pathogens

March 2022

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Objectives

- A general explanation of the epidemiology and symptoms of bloodborne diseases
- An explanation of the modes of transmission of some bloodborne pathogens
- An explanation of the appropriate methods for recognizing tasks and other activities that may involve exposure to blood and other potentially infectious materials
- Information on the hepatitis B vaccine, including information on its efficacy, safety, method of administration, the benefits of being vaccinated

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Objectives

- An explanation of the use and limitations of methods that will prevent or reduce exposure including appropriate engineering controls, work practices, and personal protective equipment
- Information on the types, proper use, location, removal, handling, decontamination and disposal of personal protective equipment
- An explanation of the basis for selection of personal protective equipment
- Information on the appropriate actions to take and persons to contact in an emergency involving blood or other potentially infectious materials
- How potentially infections materials should be labeled

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Objectives

- What is not included to be compliant with OSHA 1910.1030 training
  - An explanation of the employer's exposure control plan and the means by which the employee can obtain a copy of the written plan
  - An explanation of the specific procedures to follow if an exposure incident occurs (general guidance provided)
  - Information on the post exposure evaluation and follow-up that the employer is required to provide for the employee following an exposure incident
  - Does not replaces individualized department plans

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Scene Safety, BSI!

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Bloodborne Pathogen Standard

- 29 CFR 1910.1030, Occupational Exposure to Bloodborne Pathogens
- Effective March 1992
- Scope
  - ALL occupational exposure to blood and other potentially infectious material (OPIM)

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Alphabet Soup

- OSHA
  - Occupational Health and Safety Organization
  - Protects the health of workers by ensuring a safe and healthy workplace for everyone
  - Sets and enforces standards
    - Bloodborne Pathogen (BBP) Standards protects employees at risk of exposure to blood or other potentially infectious material (OPIM)

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Alphabet Soup

- CDC
  - Monitors national disease data
  - Disseminates information to all health care providers
- NIOSH
  - National Institute for Occupational Safety and Health
  - Part of CDC
  - NIOSH works with OSHA
  - Research Arm, makes recommendations for prevention of workplace related illness and injury

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Employer Responsibilities – Written Exposure Control Plan

- Plan must be in writing and accessible 24/7
  - Employees need to be knowledgeable on location of written plan
  - Where is your plan kept and how do you get access?
- Department plan to be written including all elements required by OSHA BBP Standard 29 CFR 1910.1030
- Department plan needs to be tailored to your individual requirements

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Employer Responsibilities – Written Exposure Control Plan

- Content included in the plan
  - Identification of hazards in the workplace
  - Identification of which tasks could expose employees
  - Identification of which employees could have potential exposure based on tasks expected
  - Identification and provision of appropriate PPE
  - Training of employee in use & care of PPE's
  - Maintenance of PPE's and replacement of worn or damaged PPE

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Definition- Pathogen

- **An organism capable of causing a disease in a host**
- Bacteria
  - *Staphylococcus aureus*
  - *Borelia burgdorferi* (Lyme disease)
  - *Bacillus anthracis* (Anthrax)
- Viruses
  - SARS (COVID-19)
  - Ebola
  - Influenza
- Parasites
  - *Plasmodium spp. (Malaria)*
- Fungi
  - *Coccidiomycosis (San Joaquin Valley Fever)*

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Definitions

- *Bloodborne Pathogens* means pathogenic microorganisms that are present in human blood and can cause disease in humans.
- Other Potentially Infectious Material/Agents (OPIM)
  - CSF
  - Synovial Fluid
  - Amniotic Fluid
  - Any body fluid contaminated with blood or saliva in dental procedures
  - Body fluids in *emergency situations* that cannot be recognized –saliva, vomit, urine

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Infectious Disease Basics

- Host
  - The organism infected by a pathogen that is ill because of the infection
- Carrier
  - A host who is colonized with a pathogen and can spread the pathogen to susceptible hosts where the pathogen causes an infection (may not be symptomatic)
    - Ex: Typhoid Mary

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Infectious Disease Basics

- Reservoir
  - An organism in which a pathogen lives but does not cause illness and cannot spread the pathogen directly to a susceptible host
  - Ex: Prairie dogs and bubonic plague
- Vector
  - An organism that transmits a pathogen from a reservoir or infected host to another potentially susceptible host
  - Ex: *Aedes aegypti* mosquito (vector) and Zika Virus (pathogen)

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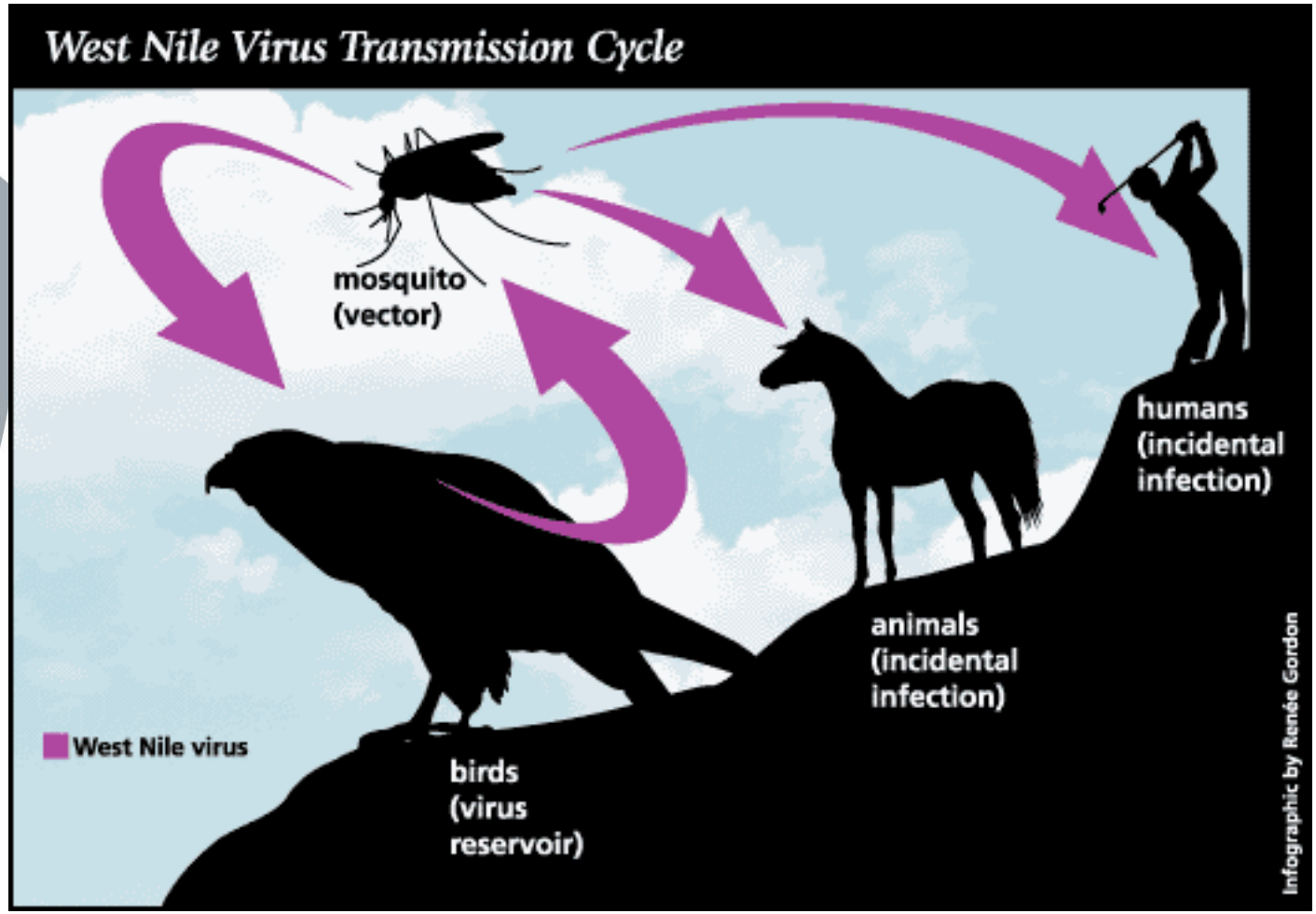
Infectious Disease Bascis



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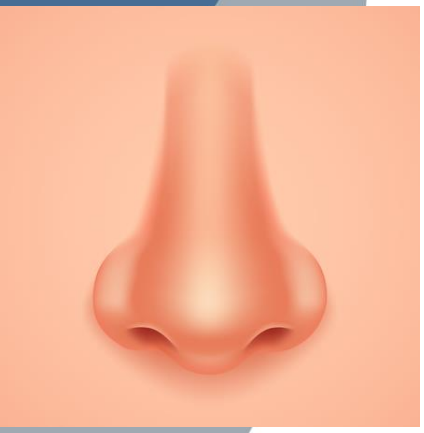
Infectious Disease Basics



- Infection
  - **Invasion** of host by pathogen(s), **multiplication** of the pathogen(s), and **reaction** of host tissues to the pathogen(s) and any toxins they produce
- Colonization
  - A pathogen capable of causing disease in a host lives on or in a host but does not cause disease in the host
  - Ex: MRSA colonization of nasal passages

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Infectious Disease Basics

- Four Modes of Disease Transmission
  - Direct
  - Indirect
  - Airborne
  - Vector

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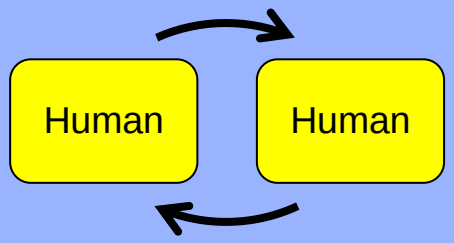
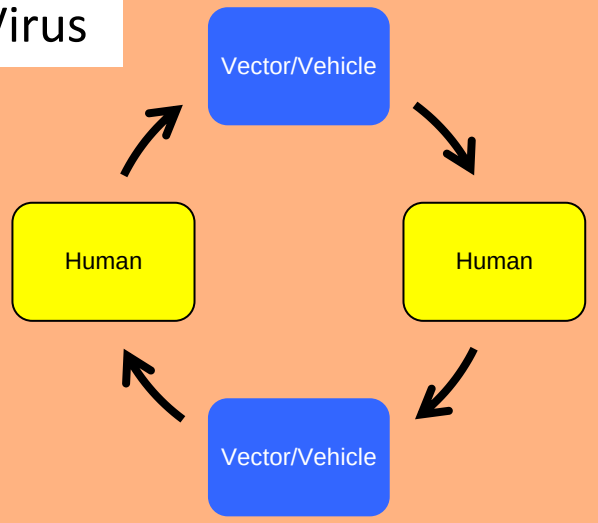
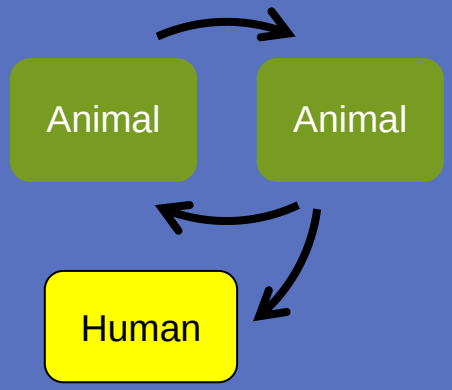
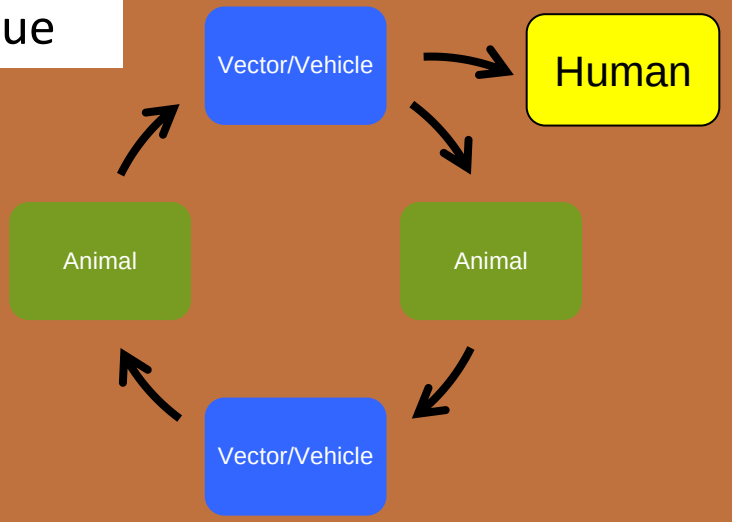
Modes of Transmission

	DIRECT	INDIRECT
ANTHROPONOSES	Measles 	Zika Virus 
ZOONOSIS	Rabies 	Plague 

Transmission- Indirect

- Fomite
  - Inanimate Object contaminated with a pathogen that can transmit the pathogen to a host
    - Cot Rails
    - ECG leads
    - Door handles
    - Radios
    - Steering wheel
    - Phone
    - Keyboard

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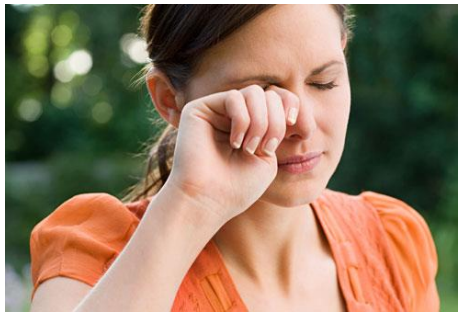
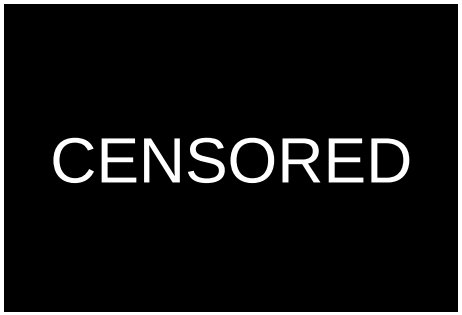
Human-to-Human Transmission

- Contact
  - Direct/Indirect
  - Mucous membrane or open skin contact with contaminated body fluids or surface

MUCOUS MEMBRANES



Nose, eyes, mouth



Genitals

OPEN SKIN

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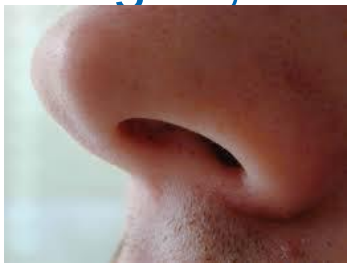
Human-to-Human Transmission

- Droplet
  - Mucous membrane contact with contaminated body fluids sprayed into air via coughing or sneezing
  - Large particles (>5u) that travel 1-3 feet, fall to surfaces quickly (may create a contact/fomite risk)
- Ex: Rhinovirus (Common cold), Neisseria meningitidis Meningitis, Plague



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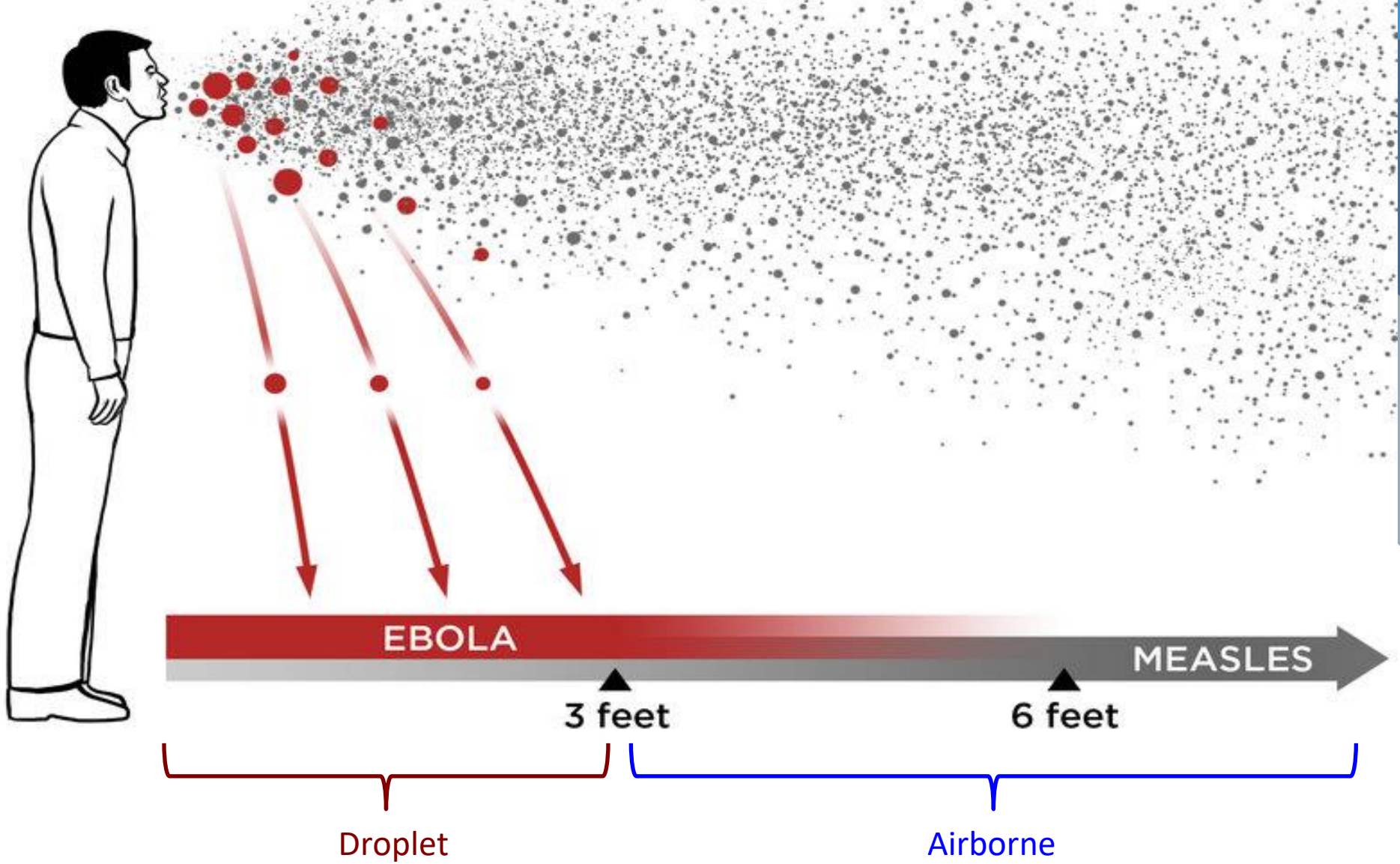

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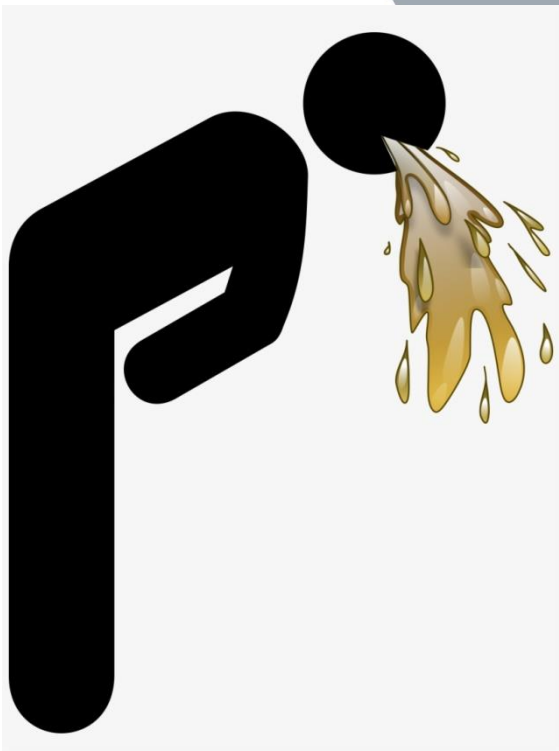
Human-to-Human Transmission

- Airborne
  - Inhalation of contaminated body fluids that are aerosolized and suspended in the air
  - Smaller particles travel many feet and may remain in the air for prolonged periods (<5 microns)

Ex: Measles, Tb, Chicken Pox, SARS-CoV-2

Human-to-Human Transmission

- Ingestion
  - Fecal-Oral
    - Ingestion of material contaminated with fecal material
    - May occur through ingestion or inhalation of pathogens that are aerosolized during vomiting
  - Ex. Norovirus (Cruise Ships)
  - Contact with and consumption of pathogens on a fomite
  - Ex: C. diff, Hepatitis A, Rotavirus
  - Hand Washing!



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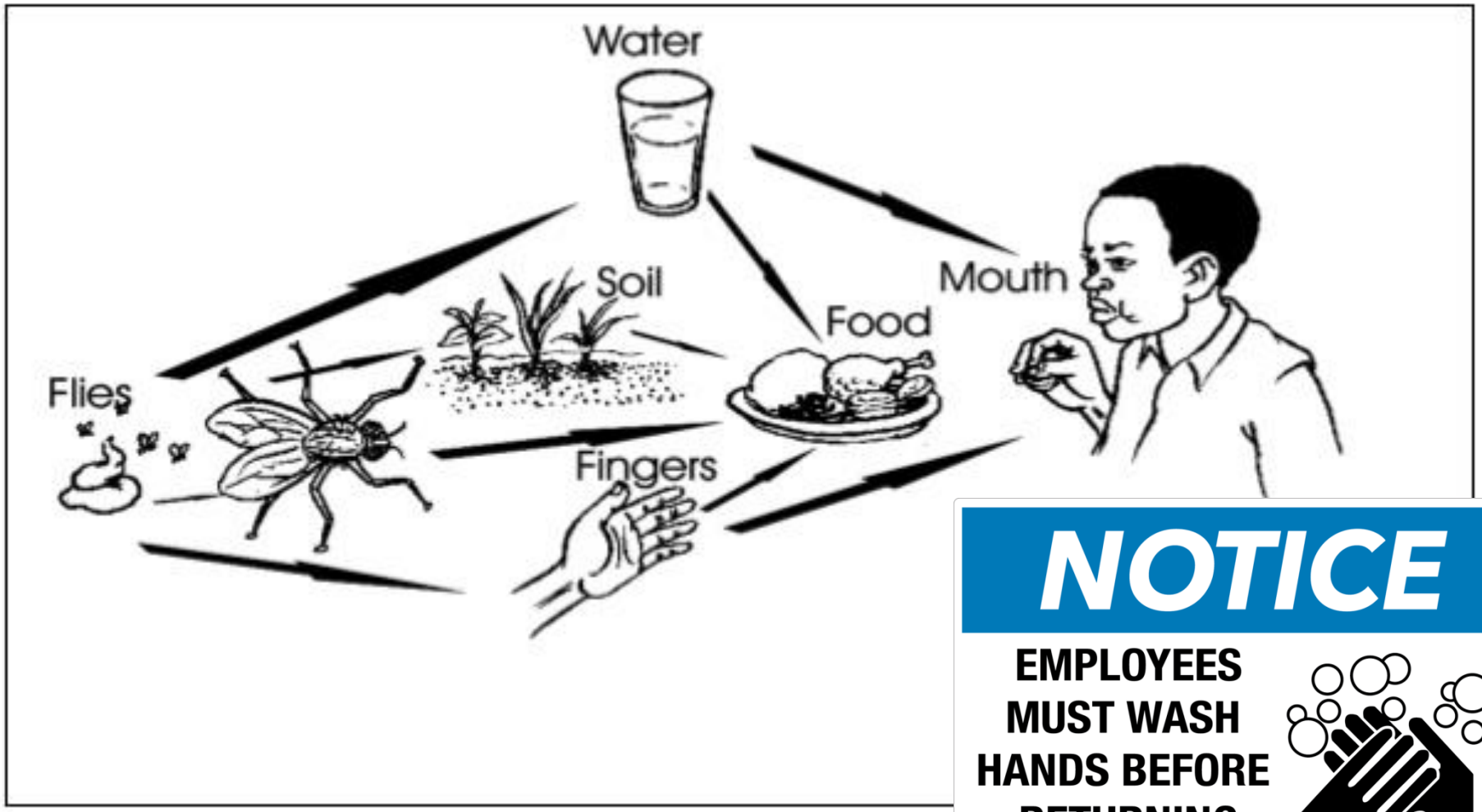
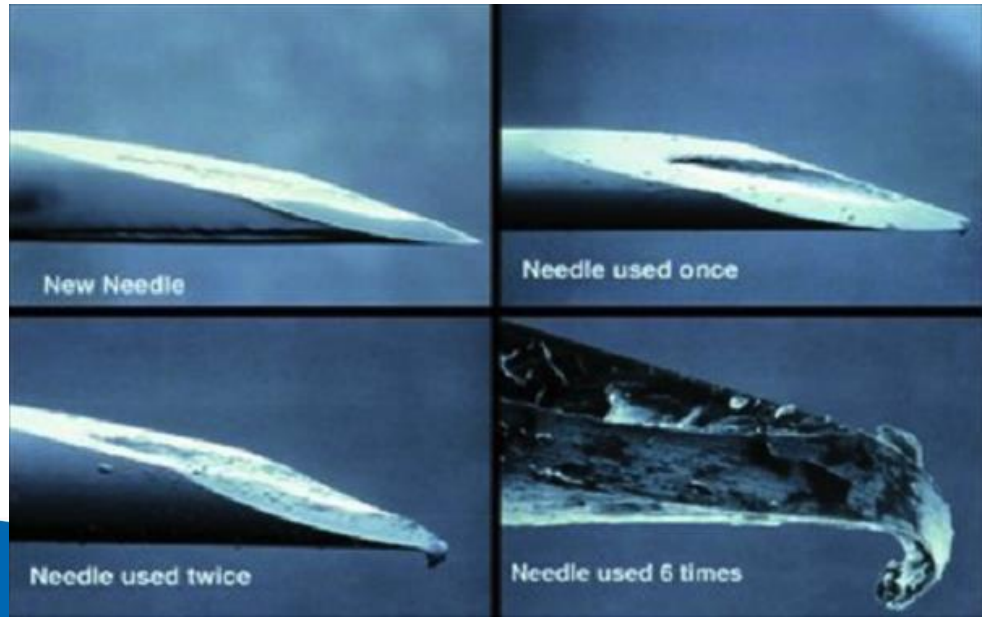
Fecal-oral Transmission route



(AMREF, 2007)

Human-to-Human Transmission

- Inoculation
  - Injection of contaminated body fluids or substances through the skin via penetrating injury such as a needle stick with a contaminated
  - Ex. HIV, Hepatitis B



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Standard Precautions

- The minimum infection prevention practices that apply to all patient care, regardless of suspected or confirmed infection status of the patient, in any setting where health care is delivered.
- Goals of Precautions
  - Apply PPE as needed to prevent exposure to body fluids based on expected disease transmission
  - Routine Hand Hygiene
    - Alcohol based hand cleaner should contain at least 60% alcohol
  - Cleaning/Decontamination

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Standard Precautions

- PPE
  - Gloves during patient contact for any potential exposure to infectious agent or bodily fluids
    - Gloves should be worn for all patient contacts
    - Gloves should be single use and not contain latex

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Standard Precautions

- PPE- Transmission Based
  - Goggles/face shield and surgical mask for any airway procedures (intubation, suctioning) or patient with active cough from apparent infectious source and to protect mucous membranes from splash/liquid exposure
  - Impermeable gown for any situation likely to generate splash/liquid exposures
  - Where are goggles/face shields/gowns located on you EMS Vehicle?

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Standard Precautions

- Patient Care Considerations
  - Provide Mask for Patients with Respiratory Complaints (all patients during pandemic setting)
    - *Masks should be placed on patients or over oxygen delivery devices as source control of respiratory borne illness*
  - Provide tissues to control secretions
- EMS Considerations
  - Clothes contaminated with blood or body fluids should be appropriately laundered or discarded

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Contact Precautions

- PPE
  - Standard +
    - Strict adherence to standard precautions based on situation
      - Mask, goggles/face shields,
    - Consider Donning/Doffing Checklist
    - Fluid Resistant gown that covers legs

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Contact Precautions

- Examples
  - MRSA, VRE, C. Difficle, Norovirus, RSV
  - EMS Considerations
    - Excessive Wound Drainage/ Skin/Soft tissue infections
    - Diarrheal Illness
- Goals of Precautions
  - Provide barrier to infectious agents that are **highly pathogenic**, **drug resistant**, **contagious** or **persistent** that can be easily be contracted or spread via fomites and surface contact

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Contact Precautions

- Patient Care Considerations
  - Source Control
    - Provide antiemetics
    - Emesis basins, towels impermeable sheet on stretcher
- EMS Consideration
  - Transport to private room
  - Uniform Consideration

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Droplet Precautions

- Examples
  - Meningitis, Pertussis, Rhinovirus, Influenza
- Goals of Precautions
  - Provide additional respiratory protection against inhalation of larger droplet during direct pt. care activities
- PPE
  - Contact +
  - Surgical Mask
  - Eye Protection

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Droplet Precautions

- Patient Care Considerations
  - Source Control
    - Provide surgical mask to pt.
    - Provide tissues and encourage pt. hand hygiene
    - Minimize airway interventions
      - Utili[illegible] filter

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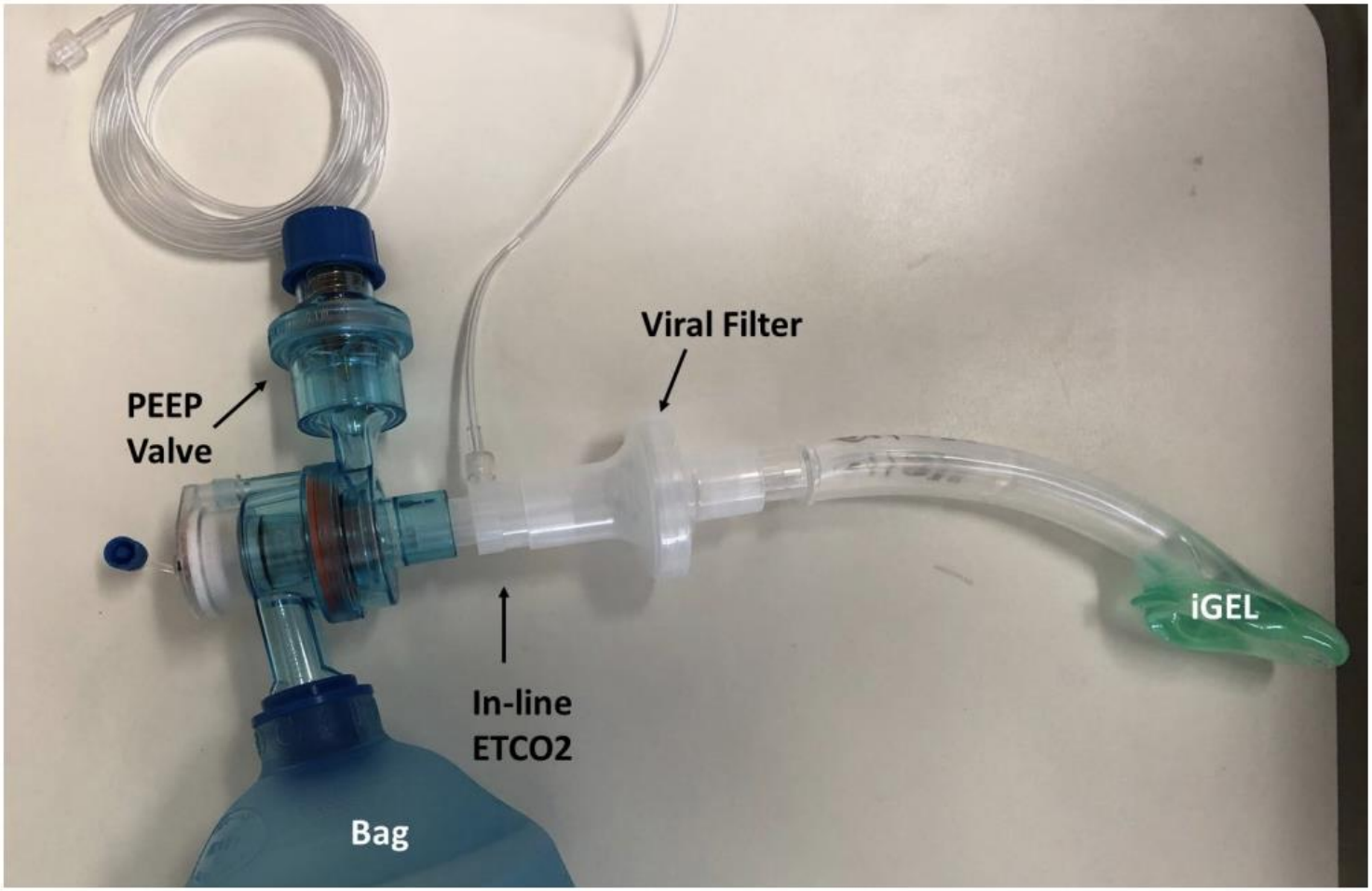
Filter Set Up



iGEL Setup

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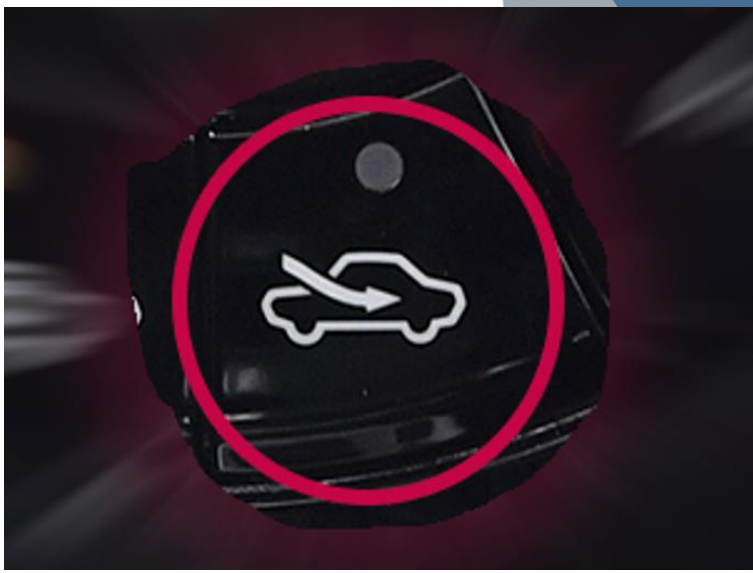
Droplet Precautions

- EMS Considerations
  - Exhaust fan on high
  - Isolate driver compartment
  - AC/Heat on non-recirculating, open windows
  - Transport to private room
  - **Treat unknown respiratory illness with Airborne precautions in setting of pandemic**



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Airborne Precautions

- Examples
  - Measles, TB, Chicken Pox, COVID-19
- Goals of Precautions
  - Provide respiratory protection against inhalation of infectious aerosols (agents that remain infectious over long distances when suspended in the air)
- PPE
  - Contact +
  - NIOSH- approved fit-tested N95 respirator/Powered Air Purifying Respirator (PAPR)
  - Add gown for body fluid exposures

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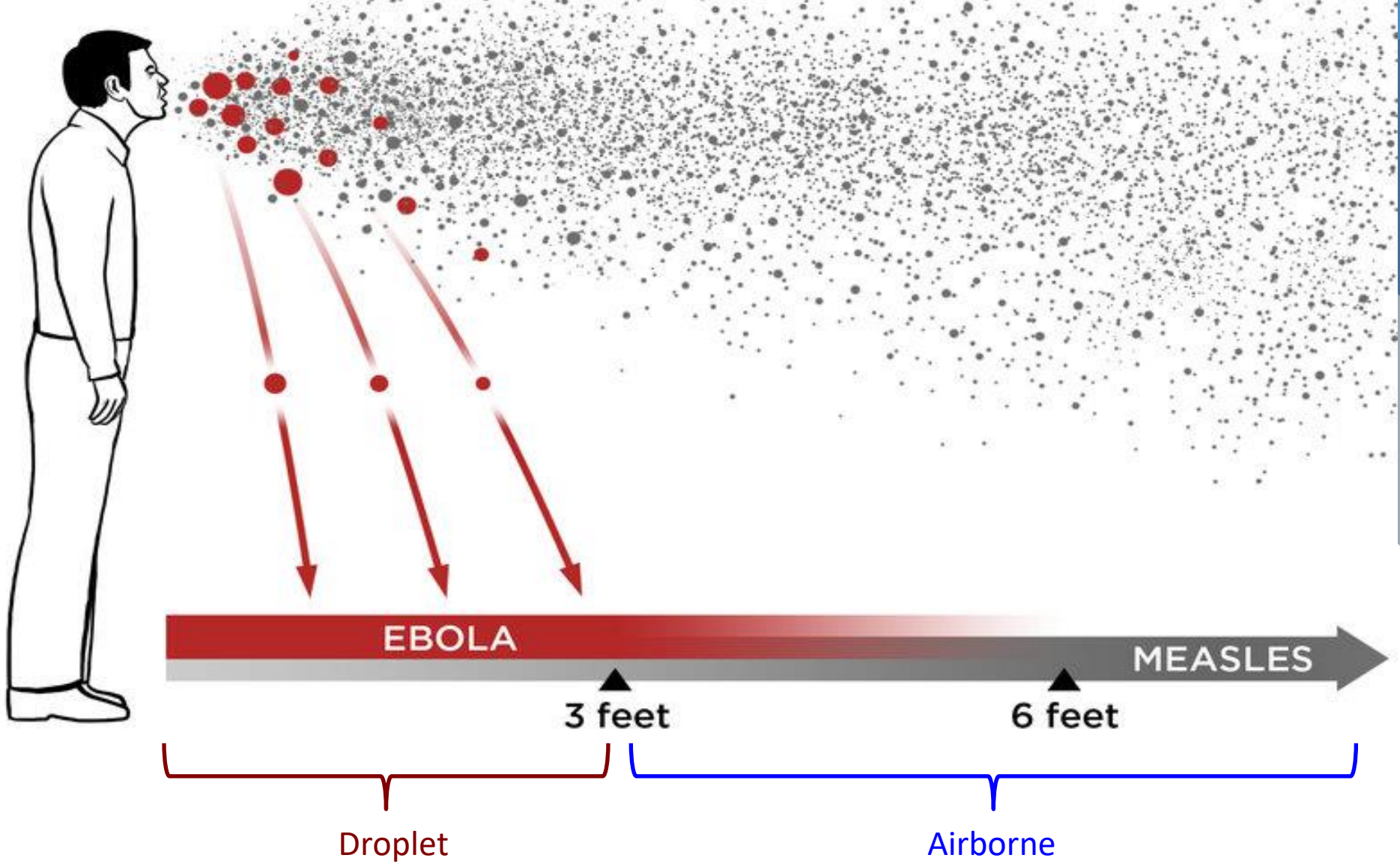

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Airborne Precautions

- EMS Considerations
  - Limit number of care givers
  - Don’t transport family.
  - Ambulance exhaust fan on high
  - Minimize Aerosol Generating Procedures
  - Isolate driver compartment if impossible driver wears N-95/PAPR
  - AC/Heat on non-recirculating
  - Transport to airborne isolation room
  - Early Notification

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Airborne Precautions

On-Scene Assessment

Ambulance Considerations

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Engineering Controls

- e.g., sharps disposal containers, self-sheathing needles that isolate or remove the bloodborne pathogens hazard from the workplace
- Sharps disposal should be in an approved puncture-proof "sharp-only" locked and secured bin.
- All sharps should not be re-capped.
- All sharps should not be bent or broken.

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Engineering Controls

- Employers must select and implement appropriate engineering controls to reduce or eliminate employee exposure.
- "Where engineering controls will reduce employee exposure either by removing, eliminating, or isolating the hazard, they must be used."
- Selection of engineering and work practice controls is dependent on the employer's exposure determination.

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Engineering Controls

- In health care workers 80% of exposures are due to sharps injuries!

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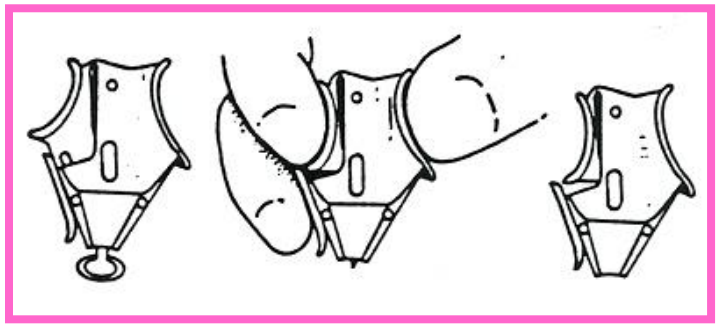
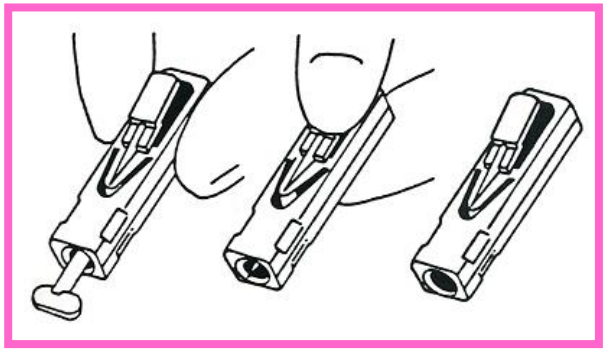
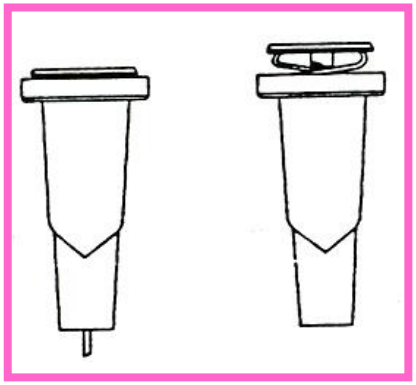
Engineering Controls



Before During After

Before During After





In use After use

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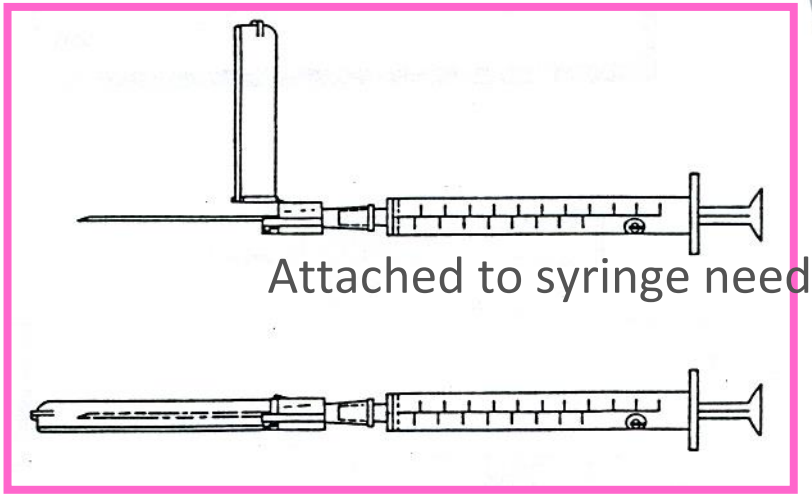
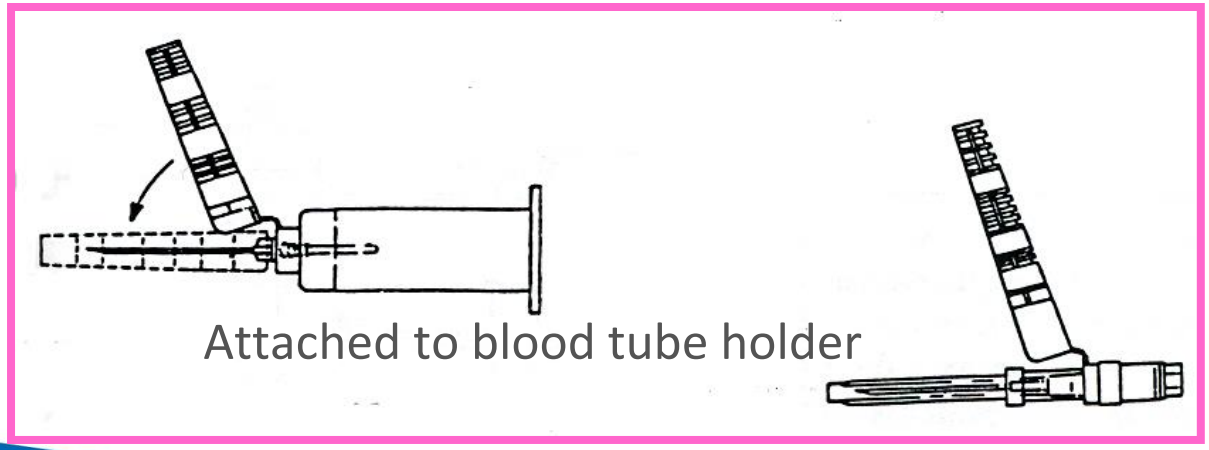
“Add-on” safety feature



Attached to syringe needle



Attached to blood tube holder

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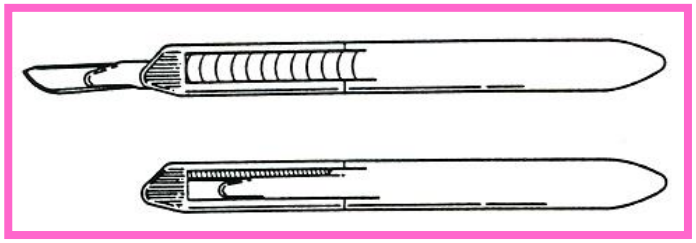
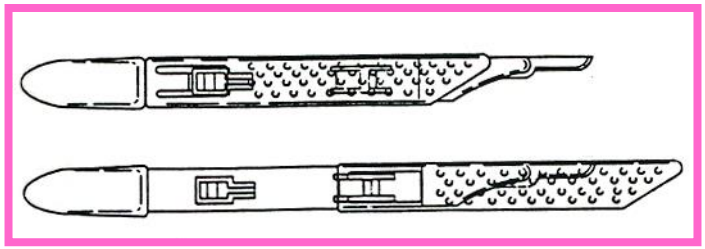
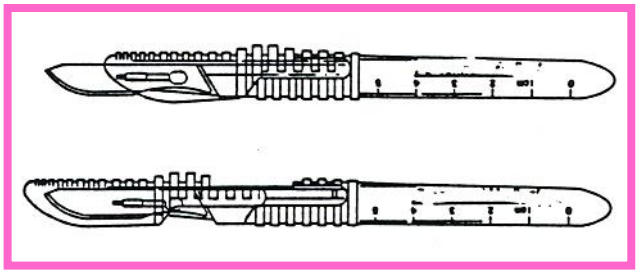
Disposable scalpels with safety features



Retracted position



Protracted position



Protracted position

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Environmental Design

Glove dispensers and hand sanitizer are mounted in plain sight and are easy to access

Other PPE is stored in a poorly accessible, out of sight location

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Donning PPE

This is undertaken outside the patient's room.

Pre-donning instructions

- ensure healthcare worker hydrated
- tie hair back
- remove jewellery
- check PPE in the correct size is available

Perform hand hygiene before putting on PPE

1 **Put on the long-sleeved fluid repellent disposable gown**

2 **Respirator**

Perform a fit check.

3 **Eye protection**

4 **Gloves**

Doffing PPE

PPE should be removed in an order that minimises the potential for cross contamination.

The order of removal of PPE is as follows:

1 **Gloves –**
the outsides of the gloves are contaminated

Clean hands with alcohol gel

2 **Gown –**
the front of the gown and sleeves will be contaminated

3 **Eye protection -**
the outside will be contaminated

4 **Respirator**
Clean hands with alcohol hand rub. Do not touch the front of the respirator as it will be contaminated

5 Wash hands with soap and water

Hazardous Material Labeling

- Warning label of fluorescent orange or orange red with contrasting letter and symbols (universal symbol)
- Must be used to identify presence of blood or other potentially infectious material
- Disposal
  - Packaging infectious waste in a manner that prevents release into the environment

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Specific Diseases- Ebola

- Filovirus
- Zoonotic-Bats, Mammals
- Ebola Enters the body through
  - Cutaneous
  - Inhalation- Aerosolized Droplets
  - Ingestion (Rare)
- Signs and Symptoms
  - Illness begins 2-21 days
  - Fever, HA, N/v/diarrhea, fatigue, bleeding
- PPE
  - Standard + contact +airborne (additional training)

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Specific Diseases- Enterovirus

- RNA Virus
- Found in the respiratory secretions (e.g., saliva, sputum, or nasal mucus) and stool of an infected person.
- Fever
- Rhinorrhea (Runny Nose)
- Cough
- Nausea/Vomiting/Diarrhea
- PPE
  - Standard + Contact + Droplet

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Specific Disease- Hepatitis

- Hepatitis Family
  - Fecal Oral, Body Fluid
  - Abdominal Pain, n/v/d, jaundice, fever
  - Acute and Chronic Illness
    - Liver failure
  - Vaccine Available for A, B
  - PPE
    - B-C =Standard Precautions
      - Hep B virus can survive for one week on surfaces
    - A= Contact Precautions

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Specific Disease- Hepatitis B

- Vaccination
  - Must be offered within 10 days of assignment to task involving an exposure risk and must be free
  - If employee declines, must sign declination form
  - Employee may, at any time, request the hepatitis B vaccine after initial declination
    - 3 injection series
    - Some don’t respond to vaccines

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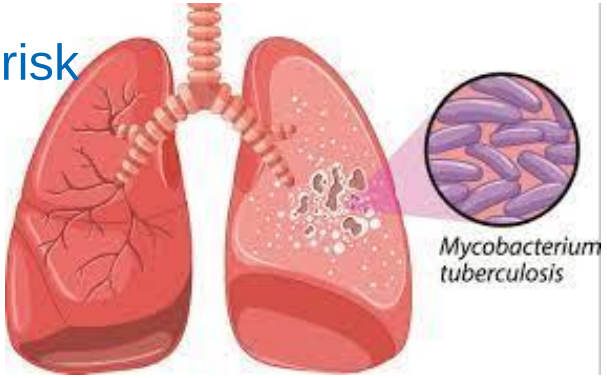
Specific Disease Tuberculosis

- Bacterial infection most commonly affecting the lungs
- Latent TB infection
  - Person is infected with the bacteria but is not ill; does spread disease
- TB disease
  - Person ill, can spread TB
  - Fever, Cough, Night Seats, Weight Loss
- Incubation 4 -12 weeks
- Transmission via airborne droplet
  - Prolonged exposure increases risk
- PPE
  - Airborne
  - Surgical Mask for Patient



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Specific Diseases-Chickenpox

- Varicella Zoster Virus
  - Singles
- Spread via Airborne Route (coughing/ sneezing)
- Spread via direct and indirect contact
  - Contagious until rash scabbed over
- PPE
  - Standard + Contact + Airborne
- Vaccination available

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Specific Diseases-Chickenpox

- Flu prodrome prior to rash
- Lesions in different stages (vs smallpox)

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Smallpox vs Chicken pox

(Smallpox rash)

(Chicken pox rash)

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Specific Disease- Meningitis

- Inflammation of covering of brain and spinal cord
  - Viral, Fungal, Bacterial, etc
  - Fever, Headache, Stiff Neck, N/v, irritability/mental status change
  - Difficult to differentiate in pre-hospital setting= treat all potential cases as bacterial
  - Transmitted via respiratory droplets
    - PPE Standard + Contact + Droplet
  - Antibiotic treatment and prophylaxis (bacterial)

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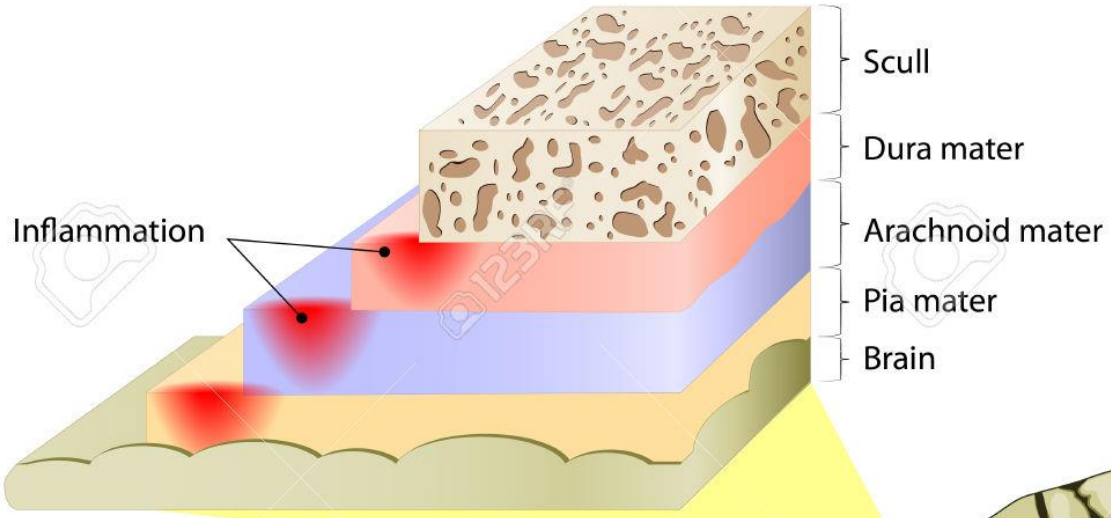
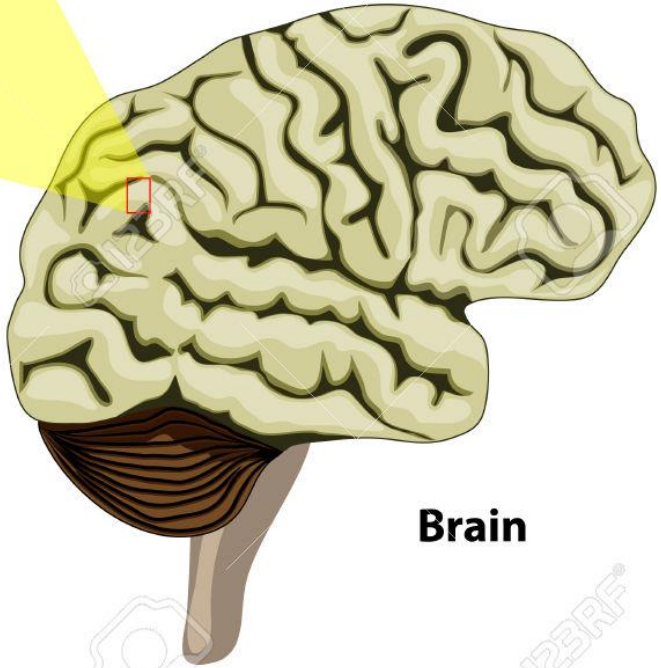
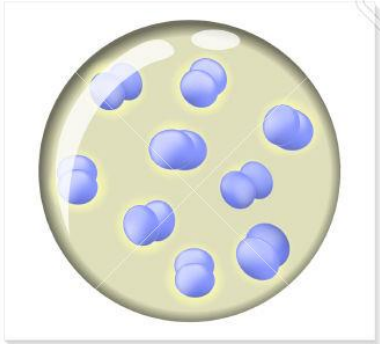
MENINGITIS



Meninges



Brain



Neisseria meningitidis

Signs of Meningeal Irritation

Opisthotonos.

Assessing for Kernig's sign.

Assessing for Brudzinski's sign.

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Specific Disease-Pertussis

- “Whooping Cough”
- Bacterial infection, highly contagious
- Spread via respiratory droplets
- PPE
  - Contact + Droplet
- Antibiotic treatment and prophylaxis
- Vaccine Available
  - Tdap
- Particularly dangerous for infants

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Specific Disease- MRSA

- MRSA – Methicillin-Resistant Staphylococcus Aureus
- Type of bacteria that is resistant to common antibiotics such as methicillin, oxacillin, penicillin and amoxicillin.
- More difficult to treat quickly than traditional skin and soft tissue infections.
- Occurs most frequently among persons in hospitals and healthcare facilities who have weakened immune systems.
    - Nasal Colonization

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Specific Disease- MRSA

- Skin and Soft Tissue Infections
- Pneumonia
- Blood Stream Infection
- Transmitted via direct and indirect contact
- PPE
  - Wounds- Contract Precautions
  - Pneumonia- Droplet Precautions
- Antibiotics
- Decontamination

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Specific Disease- C. Diff

- Clostridium Difficile – C Diff
- Spore Forming Bacteria
    - Spores can live on surfaced for up to 5 months!
    - EMS Decontamination Considerations
        - Use EPA registered disinfectant with sporicidal claim for environmental surface disinfecting after cleaning surface of gross material
        - Alcohol based hand sanitizer= not effective
            - Wash hands!
- Abdominal Pain, Diarrhea
- Transmitted via Fecal-Oral Route
- PPE
    - Contact Precautions

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Specific Disease- HIV/AIDS

- Virus that attacks the immune system
- AIDS (Acquired Immunodeficiency Syndrome) is late stage of HIV infection
- Transmitted by blood and body fluids
  - Semen
  - Rectal Fluids
  - Vaginal Fluids
  - Breast Milk

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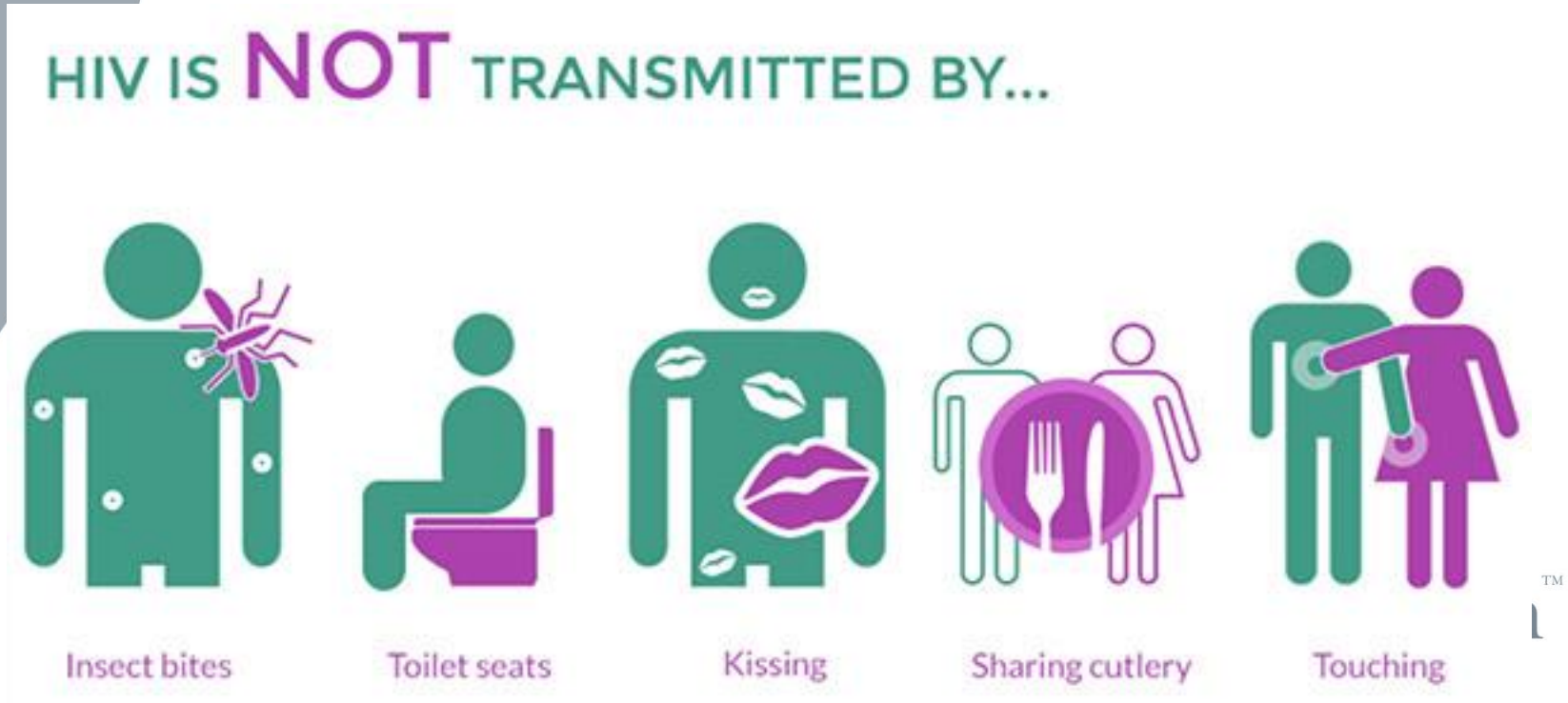
Specific Disease- HIV/AIDS

- HIV is ***not*** transmitted via
  - Saliva
  - Tears
  - Sweat
  - Airborne
  - Hugging, shaking hands etc.



Process of Contracting a Disease

- Window phase
  - Time from exposure to the disease until a person test positive for the disease
- Incubation period
  - Period of time between the exposure of a residing host to a communicable disease and the appearance of symptoms
- Seroconversion
  - Occurs when the test for the disease change from negative to a positive in an individual who has been in the window phase

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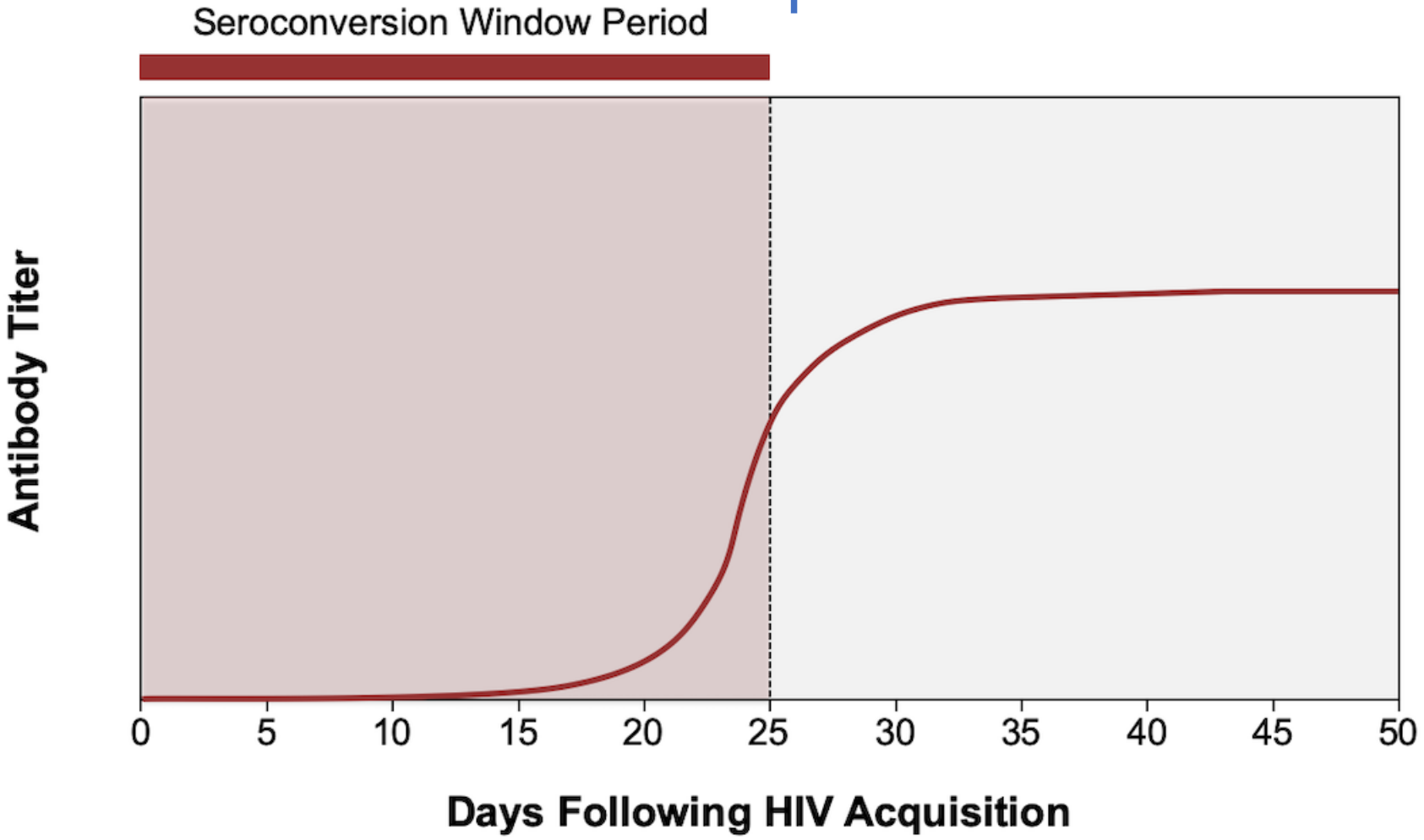
HIV Example



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Cleaning and Decontamination Basics

- Wear appropriate PPE for task
- Remove all blood and debris from surface to be cleaned
  - Products can’t clean the surface if they can’t be in contact with the surface
- Allow disinfectant to air dry
  - Read label directions to determine length of time to leave surface wet based on need for disinfection

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Cleaning and Decontamination Basics

- What product is effective at killing the pathogen?
- Follow product instructions!
  - Complete “wetting” or saturation of the surface
  - Adequate drying time
  - Proper mixing
    - *If some is good, more is NOT better*
    - Bleach + Ammonia = chloramine gas

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Cleaning and Decontamination Basics

- Bleach Products
  - Effective for C diff (and Ebola)
    - Caution - won't have diagnosis at time of transport
    - Assume C diff for any patient with diarrhea until proven otherwise
    - Can shed bacterium in stool if asymptomatic

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Factors that increase risk from Needle Stick

- Visible Contamination with Blood
- Hollow Bore Needle > Lancet
- Injection > Mucous Membrane > Nonintact skin

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Needle Stick/Body Fluid Exposure

- > 20 Blood Borne Pathogens
  - Hep B
  - Hep C
  - HIV

Bloodborne Pathogen	Prevalence*
Hepatitis B	**1 in 20**
Hepatitis C	**1 in 50**
HIV	**1 in 250**

***** *Prevalence in an average population, prevalence is higher for at risk populations*

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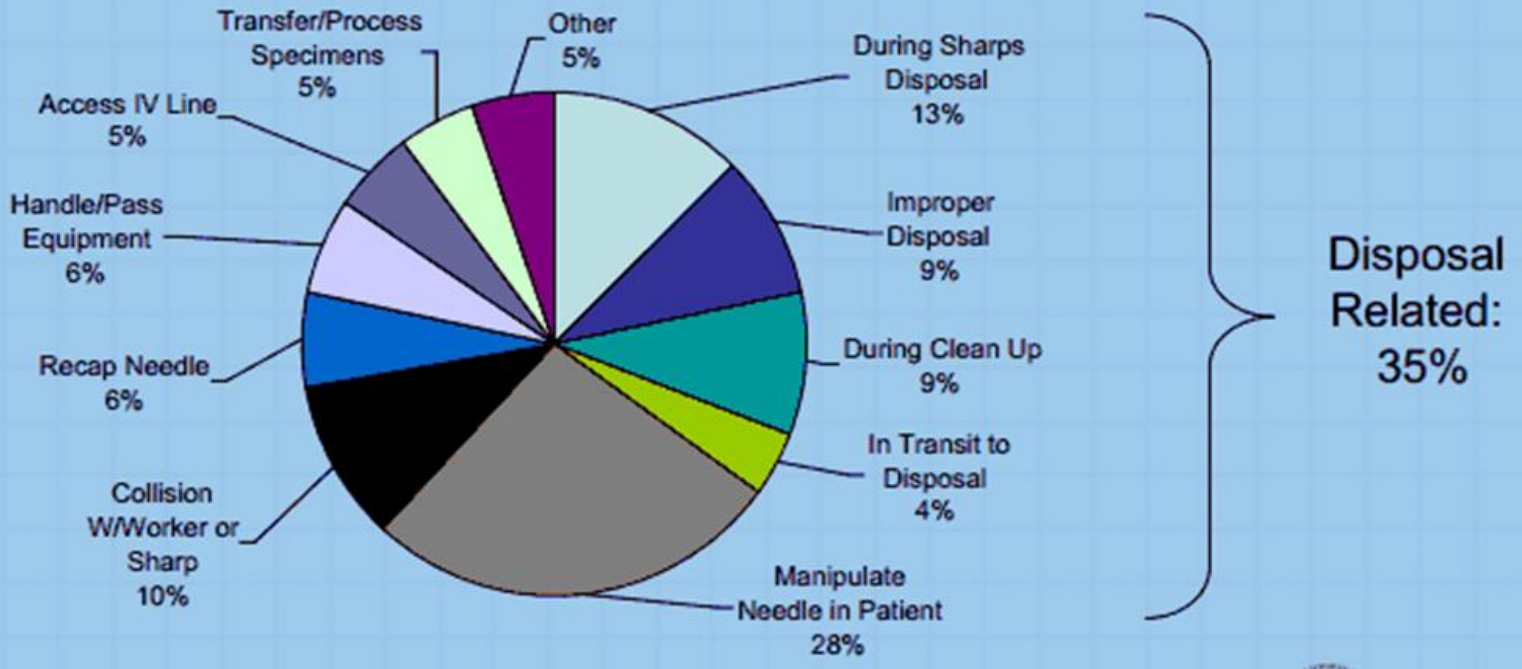
How Do Injuries Occur With Hollow-Bore Needles?

Circumstances Associated with Hollow-Bore Needle Injuries NaSH June 1995—December 2003 (n=10,239)



It takes a team to eliminate sharps injuries...

HIV

- Approximately 0.3% risk of seroconversion after needle stick
  - 1:300.
- Approximately 0.09% risk of seroconversion after exposure of mucous membrane or open skin.
  - 1:1000
- Post exposure antivirals available
  - Start within 72 hours

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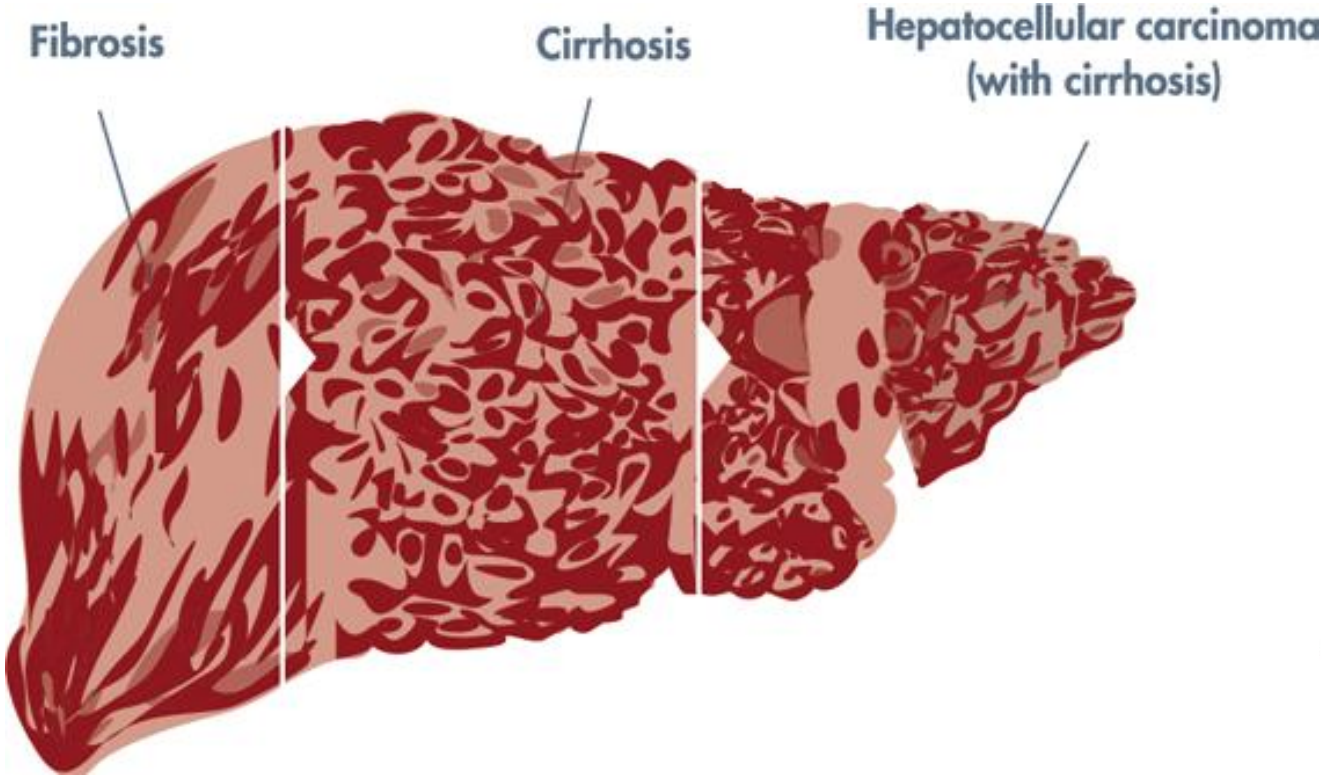
Hep C

- Approximately 1.8% risk of seroconversion from needle stick
- No Post exposure prophylaxis available (vaccine/immunoglobulin)



Hep B

- "Healthcare personnel who have received hepatitis B vaccine and developed immunity to the virus are at virtually no risk for infection"
  - Some patients are "nonresponders" to Hep B vaccine
- Up to 30% risk of seroconversion after needle stick
- Post exposure Hep B Immune Globulin and Heb B vaccination can prevent Hep B infection

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What Should I do if I am exposed?

- Wash needlesticks and cuts with soap and water
- Flush splashes to the nose, mouth, or skin with water
- Irrigate eyes with clean water, saline, or sterile irrigants

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What Should I do if I am exposed?

- Severity?
  - Hollow vs Straight Needle
  - Blood vs OPIM
  - Exposure Site
    - Mucous Membrane
    - Intact Skin
  - Source Patient Status?
- The risks of HBV and HCV transmission from non-bloody saliva are considered to be negligible.
  - The PEPline does not recommend routine HIV, HBV or HCV surveillance testing following exposure or possible exposure to non-bloody saliva.*

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What Should I do if I am exposed?

- Report exposure to agency supervisor
  - “Sharps Injury Log” kept by employer
- Report exposure to hospital receiving patient (ED)
  - Charge RN
  - ED staff will determine risk level of exposure and any additional actions needed
    - Source person and exposed EMS personal may have blood work obtained

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Post Exposure Hotline

- PEPline (the National Clinicians'
  - Postexposure Prophylaxis Hotline) is a 24- hour, 7-day-a-week consultation service for clinicians managing occupational exposures.
- PEPline can be contacted by phone at (888) 448-4911 (toll free) or http://pepline.ucsf.edu/pepline.

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You choose the PPE!

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Scenario #1

- You are the first on scene unit to an “industrial accident male with arm laceration, uncontrolled bleeding” Upon arrival you locate a 30 y/o male with cut himself on a grinder. The patient has a deep laceration to his arm. A bystander is holding pressure to the site of the laceration and there is blood intermittently spurting from the wound. What PPE would you choose?

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Scenario #1

- You are the first on scene unit to an “industrial accident male with arm laceration, uncontrolled bleeding” Upon arrival you locate a 30 y/o male with cut himself on a grinder. The patient has a deep laceration to his arm. A bystander is holding pressure to the site of the laceration and there is blood intermittently spurting from the wound.

- Standard + Contact
- Gloves
- Gown
- Mask
- Eye Protection

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Scenario #2

- You are called at 2 am to a local SNF for “Abnormal Labs” The patient has a hemoglobin of 4g/dl and denies complaints.

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Scenario #2

- You are called at 2 am to a local SNF for “Abnormal Labs” The patient has a hemoglobin of 4g/dl and denies complaints.
- Standard Precautions

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Scenario #3

- You are responding to an overdose with CPR in progress.

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Scenario #3

- You are responding to an overdose with CPR in progress.
- Standard + Droplet + Airborne (during pandemic)
- Potential for Airway Maneuvers

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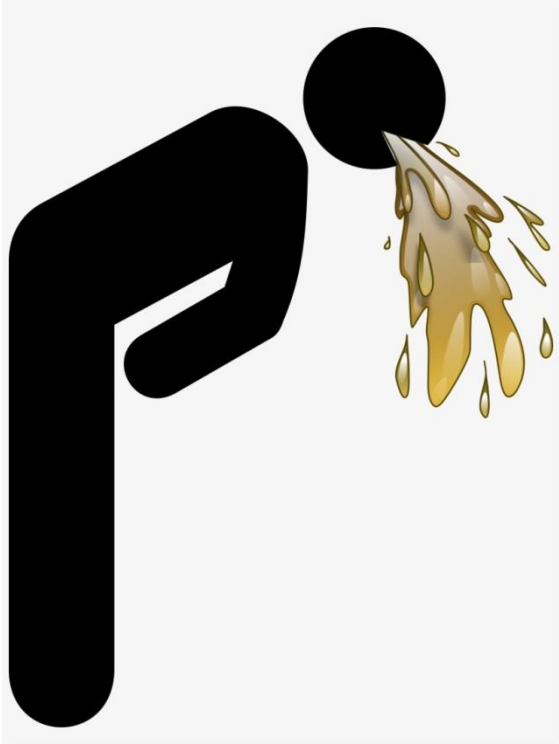
Scenario #4

- You are called to a “sick man” upon arrival you find a patients with copious emesis and diarrhea.



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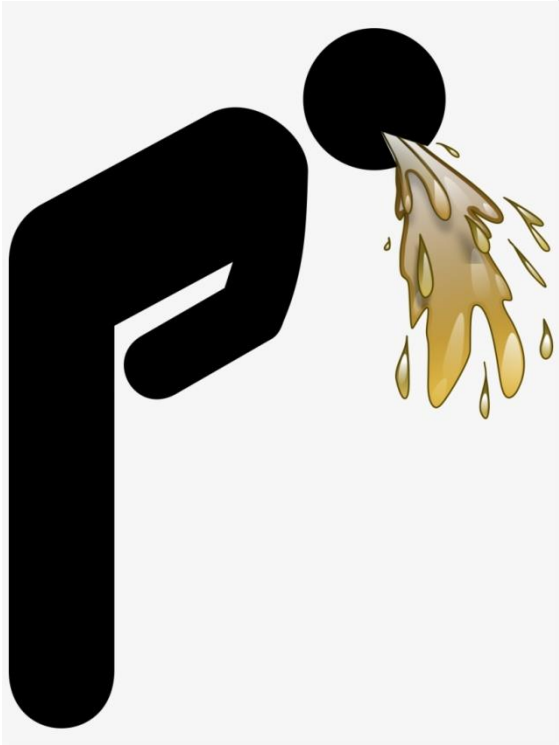
Scenario #4

- You are called to a “sick man” upon arrival you find a patients with copious emesis and diarrhea.
- Standard + Contact +/- Droplet
- Gloves, Gown, Mask, Eye protection
- Source control for patients
  - Chux
  - Antiemetic
  - Hand washing (C.Diff)



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