EMS Subspecialty Certification Review Course

Communicable Diseases

2025

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ABEM EMS Core Content

1.3.9	**Communicable Diseases**
1.3.9.1	General
1.3.9.1.1	Knowledge of prehospital personal protective equipment (PPE)
1.3.9.1.2	Isolation of persons with suspected infectious agents (e.g., severe acute respiratory syndrome [SARS])
1.3.9.2	Multi-Drug Resistant Organisms (MDROs)
1.3.9.2.1	Protection in the field (e.g., PPE, decontamination of ambulances)
1.3.9.3	Category A bioterrorism agents
1.3.9.3.1	Hemorrhagic fevers
1.3.9.3.2	Smallpox
1.3.9.3.3	Plague
1.3.9.4	Emerging infections
1.3.9.4.1	Pandemic viral illnesses
1.3.9.4.2	SARS
1.3.9.5	Quarantine

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Learning Objectives

Upon the completion of this program participants will be able to:

- Discuss general knowledge of communicable diseases relevant to EMS practice
- Describe elements of prehospital protective equipment (PPE)
- Explore concepts of protection in the field (decontamination and PPE)
- Review critical emerging and concerning communicable diseases most relevant to prehospital care

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Introduction

- EMS and first responders at increased risk for communicable and infectious diseases
- The type, extent, and severity of diseases are typically not initially known

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Introduction

- **Infectious disease**: results from the invasion of a host by disease producing organisms (bacteria, virus, fungi, parasites)
- **Communicable (contagious) disease**: one that can be transmitted from one source to another
- Not all infectious diseases are communicable

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Introduction

- **Mode of transmission:** mechanism by which an agent is transferred to the host
  - Contact transmission (direct, indirect, droplet)
  - Airborne
  - Vector-borne
  - Common vehicle (food, equipment)

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Droplet vs Airborne

- **Droplet:** mask
  - Type of contact transmission
  - Large droplets from the respiratory tract -> deposited on host mucous membranes, or settle into immediate environment and later be transmitted by indirect contact
  - Meningitis, RSV, influenza
- **Airborne:** N95
  - Spread through the air, dispersed by air currents
  - Infectious agents are contained in very small droplets that can remain suspended in the air
  - Measles, varicella, TB

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Pandemic Viral Illness

Cause	influenza
Morbidity	High
Mortality	High
Contagious	Yes
Weaponization Potential	No
Vaccine	Yes
Treatment	Yes

Organ Systems	Primary Target
Airway	X
Breathing	X
Cardiovascular	X
Disability (nervous)	
Elimination (hepatic & renal)	

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Influenza

- Influenza strains
  - A, more severe disease, main cause of pandemics
  - B, milder disease, mainly children
  - C, rarely causes human illness, no epidemics
- Droplet & indirect transmission
  - Coughing, sneezing, or contact with respiratory secretions on surfaces
  - Transmissible 1 day before symptom onset to 5-10 days after symptoms begin (kids infectious longer)

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Influenza

- Incubation: 1-4 days
- Clinical Presentation
  - Fever, sore throat, nonproductive cough, myalgias, headache, chills

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Influenza Management

- EMS providers should be immunized annually
  - Effective protection when the vaccination strain is similar to the circulating strain
- Antivirals are available
  - Not a replacement for vaccination
  - Varying degrees of evidence about efficacy…

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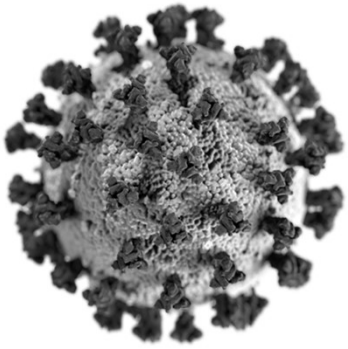

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Coronaviruses

SARS (2003)
Middle East respiratory syndrome (MERS) (2012)
SARS-CoV2 (2020)

Cause	Coronavirus
Morbidity	High
Mortality	High
Contagious	High
Weaponization Potential	
Vaccine	
Treatment	

Organ Systems	**Primary Target**
Airway	X
Breathing	X
Cardiovascular	
Disability (nervous)	
Elimination (hepatic & renal)	

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SARS

- Transmission
  - Virus is found in respiratory secretions, urine, and feces
  - Mostly droplet
- Incubation
  - 3-10 days, average of 4-5
  - Asymptomatic transmission
- Clinical Presentation
  - High fever, diarrhea, vomiting, cough occurs later in illness

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SARS Management

- Immediately notify local public health authority
- Must use all routine practices and additional precautions, PPE
- Limit or avoid procedures of increased risk: N95
  - Nebulized or aerosolized medications
  - Intubation or advanced airway management
  - Deep suctioning

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Multi Drug Resistant Organisms

- Methicillin-resistant *Staphylococcus aureus* (MRSA)
- Vancomycin-resistant enterococci (VRE)
- *Clostridium difficile*
  - Soap and water, not hand sanitizer!

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Biological Terrorism

- Intentional release or threatened release of viruses, bacteria, fungi, or toxins from living organisms to produce disease or death in humans, animals, or plants

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CDC Bioterrorism Agent Categories

Category A

High-priority agents include organisms that pose a risk to national security because they:

- can be easily disseminated or transmitted from person to person;
- result in high mortality rates and have the potential for major public health impact;
- might cause public panic and social disruption; and
- require special action for public health preparedness.

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Bioterrorism – Category A

- Smallpox
- Plague
- Viral Hemorrhagic Fever

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Smallpox

Cause	Variola virus
Morbidity	High
Mortality	High
Contagious	Yes
Weaponization Potential	High
Vaccine	Yes
Treatment	No (IND)

Organ Systems	Primary Target
Airway	X
Breathing	X
Cardiovascular	X
Disability (nervous)	
Elimination (hepatic & renal)	

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LAST CASE OF SMALLPOX NATURALLY: 1977

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LAST CASES OF SMALLPOX**

** Two laboratory acquired cases occurred in UK in 1978

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Smallpox Transmission

- Humans only natural host
- Transmission:
  - Inhalation from airborne particles or fine particle aerosols from the airways of an infected person
  - Physical contact with an infected person
  - Contaminated articles through skin inoculation

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Smallpox Clinical Features

- Incubation (10-14 days)
  - Asymptomatic, not contagious
- Prodrome (2-4 days)
  - Acute onset of fever, malaise, headache, backache, vomiting, occasional delirium
  - Transient erythematous or petechial rash
- Enanthem
  - Mucous membrane lesions appear 24 hrs before rash
  - Begins face, hands, forearms
  - Spread to lower extremities then trunk over ~ 7 days
  - Synchronous progression: macules --> vesicles --> pustules --> scabs
  - Lesions on palms /soles

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Smallpox Clinical Case

- **An illness with acute onset of fever ≥ 101° F followed by a rash** characterized by *firm, deep-seated vesicles or pustules in the same stage of development* **without other apparent cause.**
- **If smallpox is diagnosed, it will almost certainly be from terrorism.**

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Macules -> vesicles -> pustules -> scabs

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Pustular lesions on palms

Flattened lesions on soles

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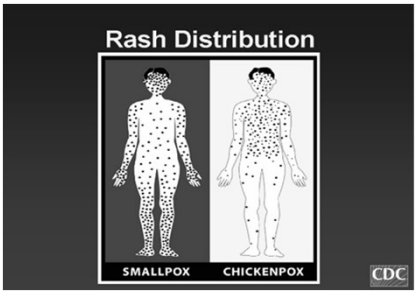

Centrifugal Centripetal

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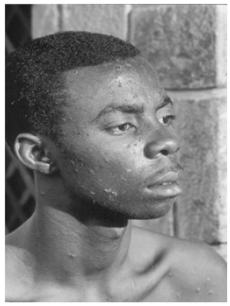
SMALLPOX

Same Stage!



CHICKENPOX

Different stages!

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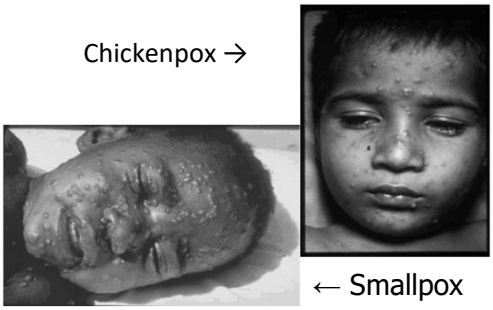
Chickenpox →



← Smallpox

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Smallpox Management

- Isolate patient
  - Respiratory isolation
    - Negative pressure if available, otherwise closed room
    - N95 mask or better for HCW
    - Patient should wear surgical mask
  - Contact isolation
    - Gown, gloves, eye protection
- Identify and isolate any ill contacts
- Report immediately to local health department
- Notify receiving institution of potentially infectious transfer
- Identify and record possible exposed contacts

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Smallpox Management

- Supportive care
- Vaccine can prevent/lessen the severity of disease if given within 2-3 days of the initial exposure
- No proven/effective antiviral therapy (there are ones effective against variola)

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Plague

Cause	*Yersina pestis*
Morbidity	High
Mortality	High
Contagious	Yes
Weaponization Potential	High
Vaccine	None
Treatment	Yes

Organ Systems	Primary Target
Airway	X
Breathing	X
Cardiovascular	X
Disability (nervous)	X
Elimination (hepatic & renal)	X

In the US about 13 cases/year

Generally during the summer

Often in the southwestern US

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Plague

- Natural vector – rodent flea
  - Mammalian hosts
    - ***Rats, squirrels, chipmunks, rabbits and carnivores***
- Human epidemics can occur due to
  - increased rodent epizootic transmission
  - via exposure to other humans with the pneumonic form
  - secondary to an intentional release of plague as an aerosol
- Any aerosol release would result in the pneumonic form

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Reported cases of human plague--United States, 1970-2012

1 dot placed in county of exposure for each plague case

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Plague Clinical Features

- Incubation: 1-6 days
- Non-specific initial symptoms: fever, chills, sore throat, malaise, headache

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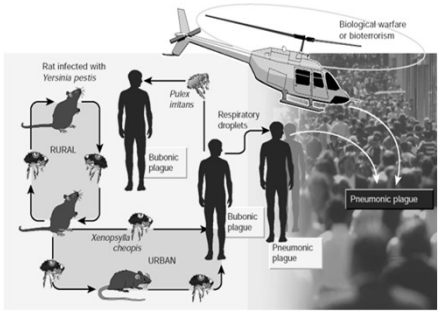

NATURE|VOL 413 | 4 OCTOBER 2001 |www.nature.com

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Plague Clinical Features

- **Bubonic**
  - **Most common type**
  - **Humans infected by flea bites or handling infected/dead animals via a break in the skin**
  - **60% mortality if untreated**
- Primary or secondary septicemic
  - 100% mortality untreated
- Pneumonic
  - From aerosol or septicemic spread to lungs
  - Person-to-person transmission by respiratory droplet
  - 100% mortality untreated

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Plague Management

- Pneumonic
  - Strict isolation
  - Airborne precautions until 48h after start of ABX
  - Close contacts -> prophylactic ABX and 7 days surveillance

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Hemorrhagic Fever

Cause	arenavirus, filovirus, bunyavirus, flavivirus
Morbidity	High
Mortality	High
Contagious	Yes
Weaponization Potential	High
Vaccine	None
Treatment	None

Ex of a filovirus = Ebola

Organ Systems	Primary Target
Airway	X
Breathing	X
Cardiovascular	X
Disability (nervous)	X
Elimination (hepatic & renal)	X

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Viral Hemorrhagic Fever

- Transmission
  - Direct human contact w infected animals (rodents) or bitten by mosquito/tick vector
  - Some person-to-person transmission, mainly during the later stages of the illness
    - Close contact w infected person
    - Indirectly via contaminated objects/infected body fluids
- Incubation (2 days – 3 weeks)
  - Asymptomatic, not contagious

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Viral Hemorrhagic Fever Clinical Features

- Non-specific initial symptoms: fever, headache, muscle aches, severe fatigue, N/V/D, abd pain
- 5 days after onset of symptoms: truncal maculopapular rash develops
- Bleeding begins
- Progression to shock, coma, SZ, kidney failure in severe cases

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Viral Hemorrhagic Fever Management

- Supportive care
- Rubavurub may be effective against some
- Investigational antivirals
- Convalescent plasma therapy (neutralizing antibody) may be effective for Argentine HF

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CDC Bioterrorism Agent Categories

Category B

Second highest priority agents include those that:

- are moderately easy to disseminate;
- result in moderate morbidity rates and low mortality rates; and
- require specific enhancements of CDC's diagnostic capacity and enhanced disease surveillance.

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Category B Agents

- Brucellosis (*Brucella* species)
- Epsilon toxin of *Clostridium perfringens*
- Food safety threats (e.g., *Salmonella* species, *Escherichia coli* O157:H7, *Shigella*)
- Glanders (*Burkholderia mallei*)
- Melioidosis (*Burkholderia pseudomallei*)
- Psittacosis (*Chlamydia psittaci*)
- Q fever (*Coxiella burnetii*)
- Ricin toxin from *Ricinus communis* (castor beans)
- Staphylococcal enterotoxin B
- Typhus fever (*Rickettsia prowazekii*)
- Viral encephalitis (alphaviruses [e.g., Venezuelan equine encephalitis, eastern equine encephalitis, western equine encephalitis])
- Water safety threats (e.g., *Vibrio cholerae*, *Cryptosporidium parvum*)

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Category C

- Third highest priority agents include emerging pathogens that could be engineered for mass dissemination in the future because of availability; ease of production and dissemination; and potential for high morbidity and mortality rates and major health impact.
- Emerging infectious diseases such as Nipah virus and hantavirus

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Isolation and Quarantine

Isolation and quarantine are public health practices used to stop or limit the spread of disease.

- **Isolation** is used to ***separate ill persons*** who have a communicable disease from those who are healthy.
- **Quarantine** is used to ***separate and restrict the movement of well persons*** who may have been exposed to a communicable disease to see if they become ill.

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Decontamination & Disinfection

Decontamination

- The **removal of microorganisms** to leave an item safe **for further handling**.

Disinfection

- The **inactivation of disease-producing microorganisms** with the exception of bacterial spores. Hospital-grade disinfectants are used on inanimate objects.

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Decontamination & Disinfection

High level disinfection

- The level of disinfection **required when processing semi-critical items. High level disinfection processes** destroy vegetative bacteria, mycobacteria, fungi and enveloped (lipid) and non-enveloped (non-lipid) viruses but not necessarily bacterial spores.

Low level disinfection

- The **level of disinfection required when processing non-critical items and some environmental surfaces**. Low level disinfectants kill most vegetative bacteria, some fungi, and enveloped viruses. Low level disinfectants do not kill mycobacteria or bacterial spores.

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Take Home Points

- EMS is at the intersection of health care, public health, and public safety
- Communicable and infectious diseases, PPE, and biological agents are critical knowledge domains for EMS physicians

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