

CIC Study Group

Week 3



HAI Prevention Program

Agenda

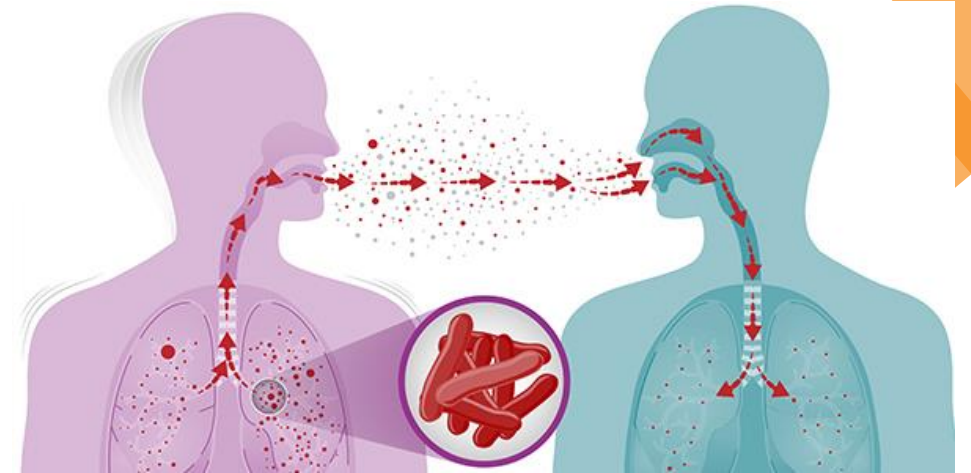
- Chapter 97 Tuberculosis and Other Mycobacteria
- Chapter 72 *Clostridium difficile* (*Clostridioides difficile* and Pseudomembranous Colitis
- Chapter 74 Coronavirus Disease 2019 (COVID-19)
- Chapter 84 Influenza
- Group Member Spotlight
- Assignments for 12/6/24 – No session on 11/29/24

Chapter 97

Tuberculosis (TB)

Overview

- Airborne transmission (1 to 5 μm [microns]) for pulmonary and laryngeal TB.
- Upon infection, may have mild symptoms, but the initial infection usually goes unrecognized.
- **Not contagious unless active disease develops.**
- Infection may remain asymptomatic for several years (latent TB infection or **LTBI**) or progress to **active TB**.

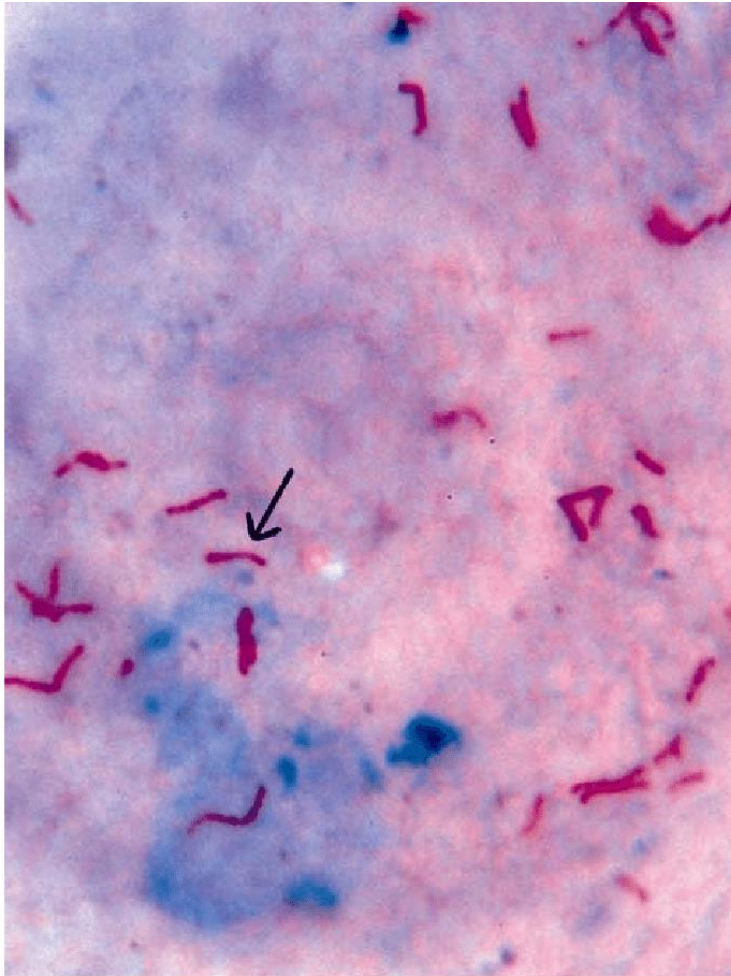


Overview, Continued.

High-risk individuals include:

- Close contact with pulmonary or laryngeal TB cases.
- Foreign-born persons (within 5 years of arrival to the United States).
- Residents and employees in crowded settings.
- Health care personnel (HCP).
- Some underserved/low-income populations Infants exposed to high-risk adults.

Overview, Cont.



Mycobacterium tuberculosis (MTB) complex (includes *M. tuberculosis*, *M. bovis*, *M. canetti*, *M. africanum*, *M. microti*, *M. caprae*, *M. pinnipedii*, and *M. mungi*).

MAC, *M. abscessus*

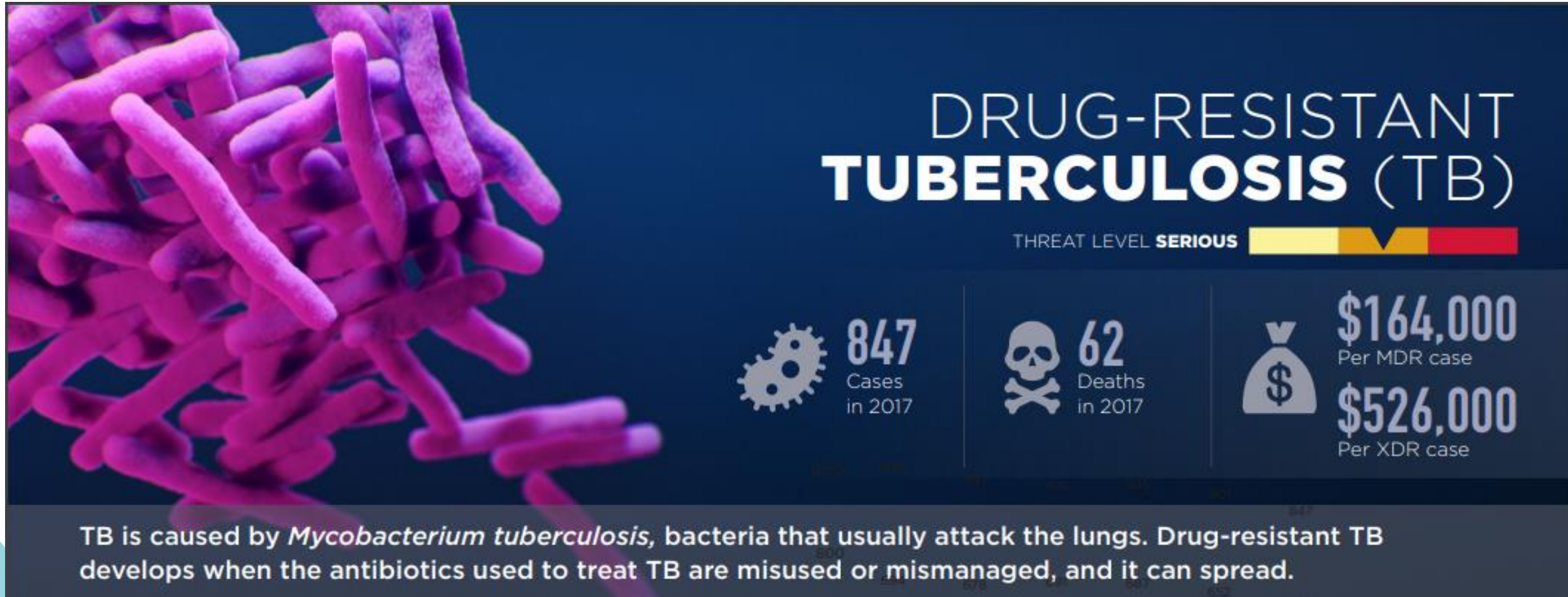
Aerobic, poorly staining gram-positive bacillus.

What kind of stain is this?

Acid-fast Differential

Microphotograph of TB bacillus, *Mycobacterium tuberculosis* on an oil-immersion smear slide stained with **Ziehl-Neelsen** or acid-fast staining of a clinical sample. Bacilli are long and rod-shaped; a bacillus is indicated by a black arrow; magnification, X 2250.
www.researchgate.net/figure/Microphotograph-of-TB-bacillus-Mycobacterium-tuberculosis-on-an-oil-immersion-smear_fig1_236166795

Drug-Resistant TB



Clinical Features

- Primary TB infection is usually asymptomatic, with a few patients developing fevers, cough or erythema nodosum.
- Post primary TB usually manifests with productive cough, fevers and night sweats.
- Patients with HIV may have atypical presentations due to dissemination during primary infection.
- Extrapulmonary TB may be associated with different symptoms based on the organ of involvement.



Image source www.ncbi.nlm.nih.gov/books/NBK470369/figure/article-21301.image.f1/

Patients With Suspected TB

- Chest x-ray.
- Sputum specimens should be collected for AFB staining and culture or other direct tests.
 - AFB staining and culture of sputum should be obtained **three times, at least 8 hours apart.**
- **Having three negative sputum smears is recommended in order to discontinue respiratory isolation.**



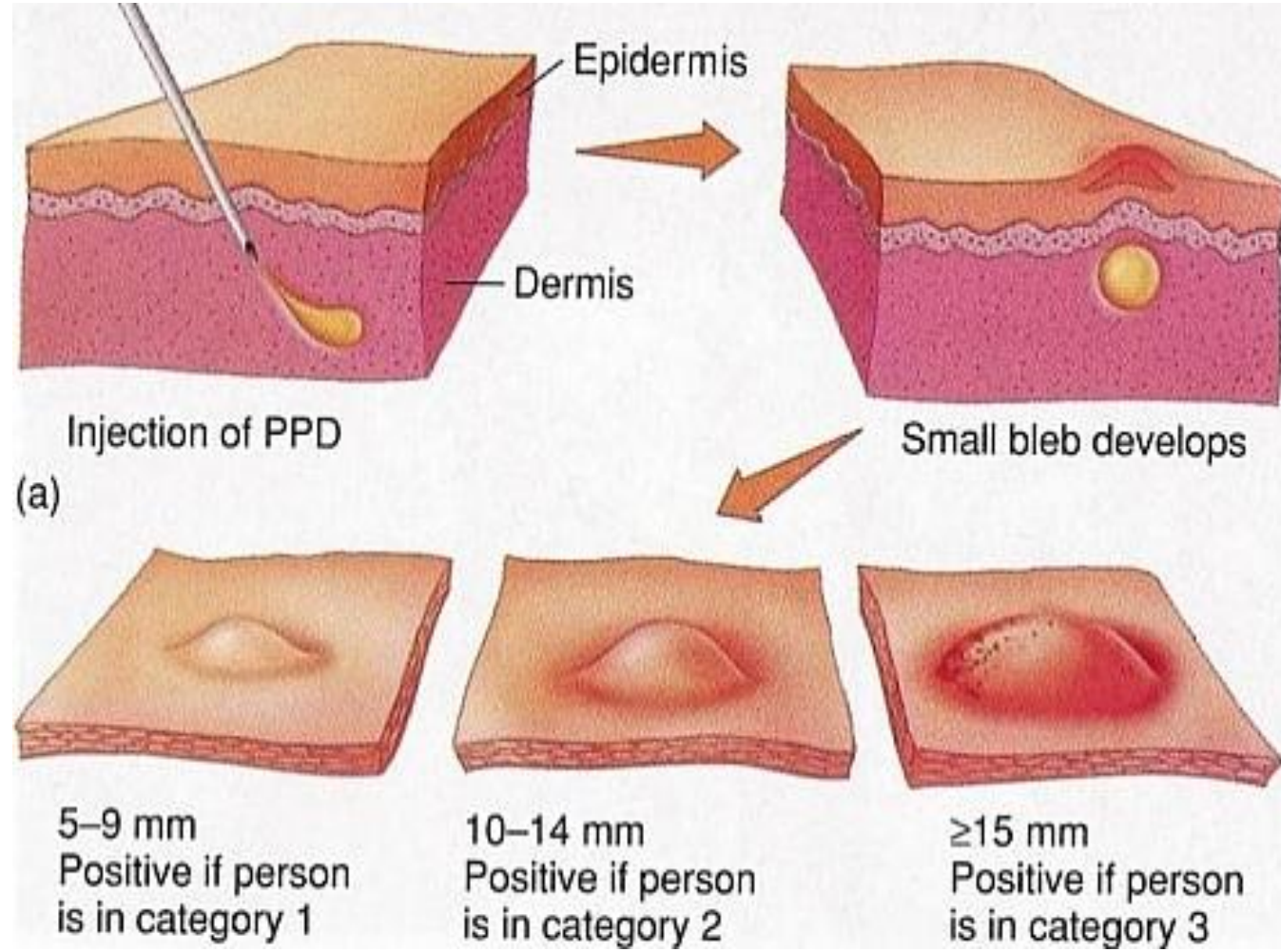
Chest x-ray showing dense homogenous opacity in right, middle and lower lobe of primary pulmonary TB.

clinmedjournals.org/articles/jfmdp/journal-of-family-medicine-and-disease-prevention-jfmdp-4-073.php?jid=jfmdp

Latent TB Infection (LTBI)

- Screening and treatment of LTBI is recommended for groups with high prevalence of LTBI and/or those at risk for TB exposure/disease.
- Two methods of screening are currently recommended:
 - **Tuberculin Skin Test (TST).**
 - **Interferon gamma release assays (IGRA).**
 - IGRAs may be preferred in patients with a history of bacillus Calmette–Guérin (BCG) therapy for bladder cancer or vaccination and in those unlikely to return for reading if TST is administered.

Positive Mantoux Tuberculin Test Reactions

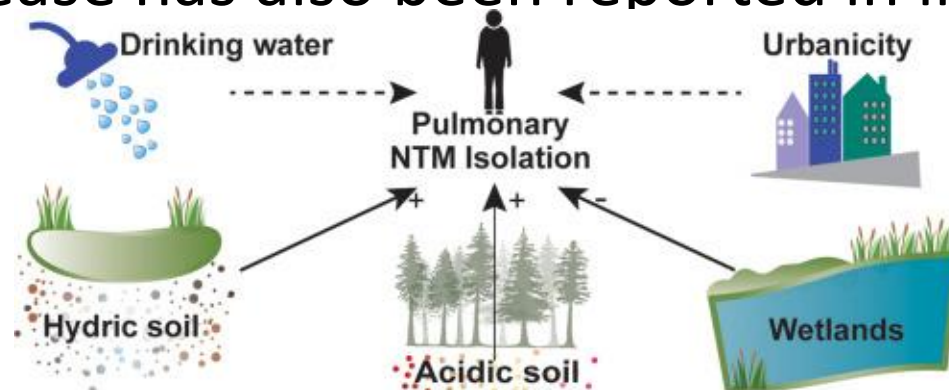


Positive Mantoux Tuberculin Test Reactions

- Category 1:
 - HIV-positive.
 - Recent contacts of TB case.
 - Fibrotic changes on CXR consistent with old TB.
 - Patients with organ transplants and other immunosuppressed patients (≥ 15 mg/day prednisone for 1 month).
- Category 2:
 - Recent arrivals (<5 years) from high-prevalence countries.
 - Injection drug users (HIV negative).
 - Residents and employees of high-risk congregate settings: health care facilities, prisons, shelters, etc.
 - Mycobacteriology lab personnel.
 - Persons with high-risk clinical conditions (e.g., chronic renal failure, silicosis, gastrectomy, malnutrition).
 - Medically underserved high-risk minorities.
 - Children <4 years of age or infants and children exposed to adults in high-risk categories.
- Category 3:
 - Person with no risk factors of TB.

Non-Tuberculosis Mycobacteria (NTM)

- Can be found in soil and water.
 - Infection usually occurs from environmental sources, though sources are difficult to characterize.
- No evidence of human-to-human NTM transmission.
- Asymptomatic infection is common.
- The most common site of isolation is the lungs, but skin and soft tissue infection, lymph node involvement and bloodstream infection have been reported.
- Disseminated disease has also been reported in immunosuppressed patients.



Source: www.sciencedirect.com/science/article/abs/pii/S0048969720380839

NTM Clinical Features

- Pulmonary disease:
 - Most common clinical manifestation.
- Disseminated disease:
 - Usually occurs in AIDS patients.
- Skin and soft tissue infection:
 - Puncture/trauma.
 - Swimming pools, fish tanks, water sources.
 - *M. leprae* (leprosy).
- Lymphadenitis:
 - Young children.
 - People with HIV.



theconversation.com/humans-gave-leprosy-to-armadillos-now-they-are-giving-it-back-to-us-99915

Pop Quiz!

What is the most common NTM in the United States?

- ☒ A. *M. avium complex* (MAC)
- B. *M. xenopi*
- C. *M. malmoense*
- D. *M. szulgai*

Chapter 72

Clostridioides difficile (*C. diff*) and Pseudomembranous colitis

Overview

- Formerly known as *Clostridium difficile*.
- Gram-positive, spore-forming, anaerobic bacillus.
- Produces two large toxins (A and B):
 - Toxin A (an enterotoxin and cytotoxin).
 - Toxin B (a cytotoxin).
- A third toxin, known as **binary toxin**, has been found in about 5% of *C. diff* isolates and in 100% of the BI/NAP1/027 epidemic strain.
- Causes diarrhea and colitis in susceptible patients.
- Pseudomembranous colitis seen in about half the patients with symptomatic CDI.



Image source:
www.cdc.gov/hai/organisms/cdiff/cdiff_infect.html

Pseudomembranous Colitis

- More severe form of CDI in which patients exhibit a colitis characterized by the presence of pseudomembranes on the colon surface.
- The colonic mucosa shows punctate-to-confluent yellow, white, or gray plaques that are readily visualized at endoscopy, but are observed in only about half of all patients with symptomatic CDI.

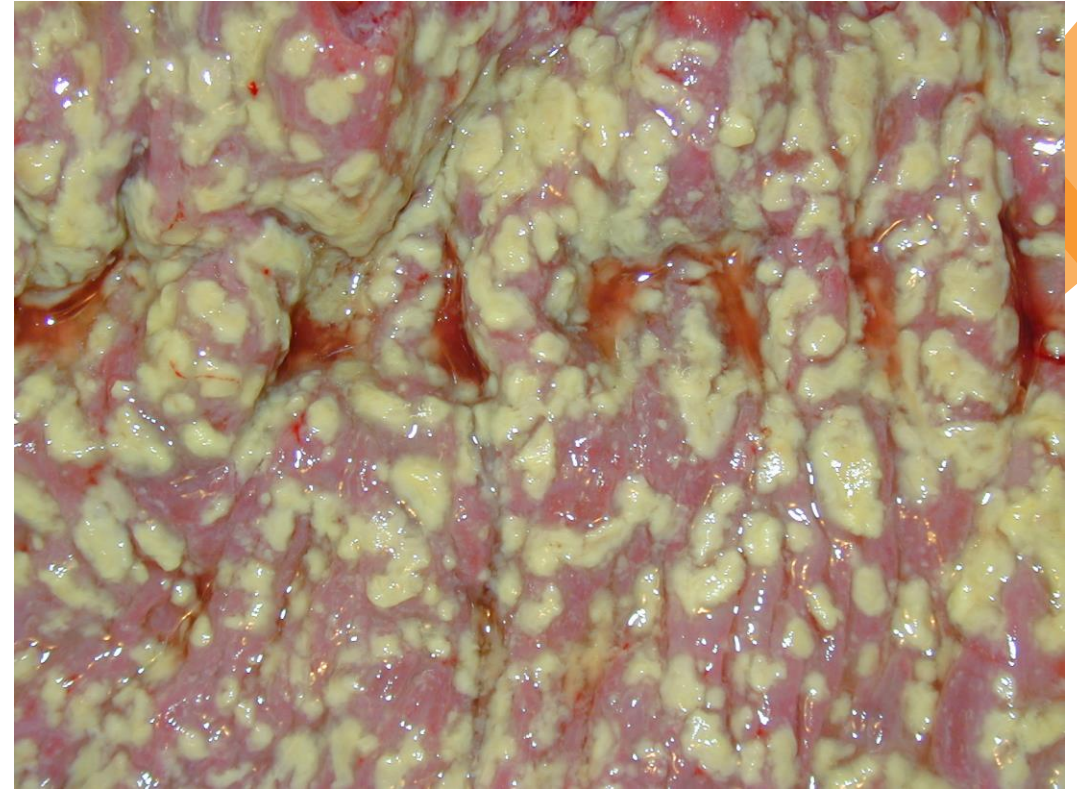


Image source:
wikipedia.org/wiki/Clostridioides_difficile_infection



WHAT YOU NEED TO KNOW

- While healthcare-associated *C. difficile* cases are decreasing, community-associated cases are not.
- Strategies to reduce *C. difficile* infections include improving antibiotic use, infection control, and healthcare facility cleaning and disinfection.
- *C. difficile* infections are more common and tend to be more severe in older patients.

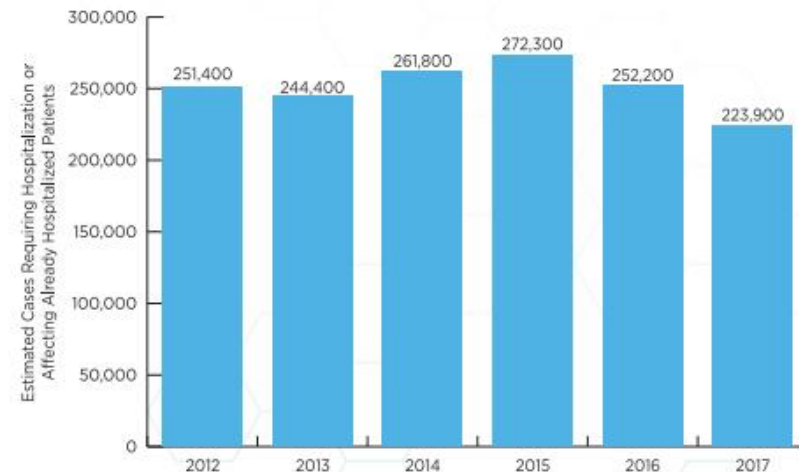
Previously *Clostridium difficile*. Also called *C. diff*. Cost includes hospital-onset cases only.



U.S. Department of
Health and Human Services
Centers for Disease
Control and Prevention

CASES OVER TIME

Continued appropriate infection control, antibiotic use, and diagnostic testing are important to maintain decreases in *C. difficile* cases.



Clinical Features

- Diarrhea:
 - Consistency.
 - Odor.
- Toxic Megacolon:
 - Patients who develop an ileus (temporary lack of the normal muscle contractions of the intestines) are at especially high risk of fulminant CDI and complications of *C. difficile*, particularly toxic megacolon and perforation of the colon.

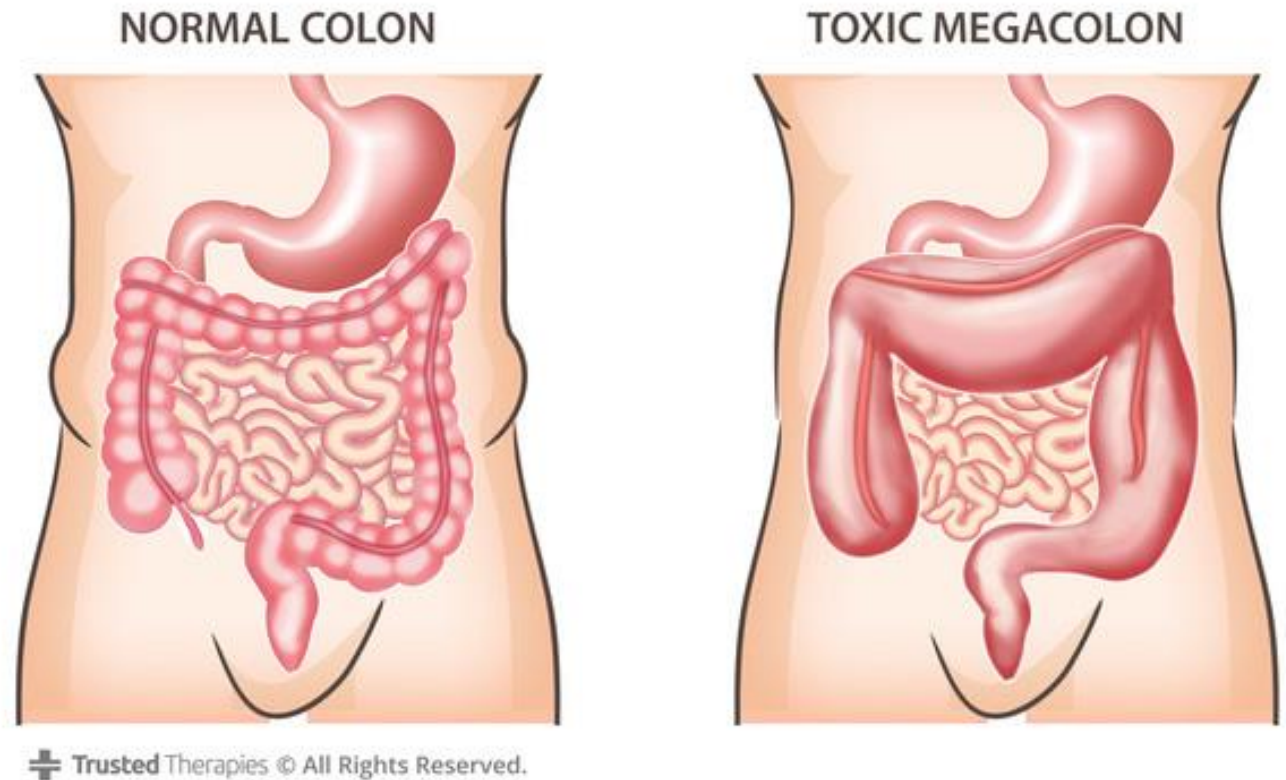
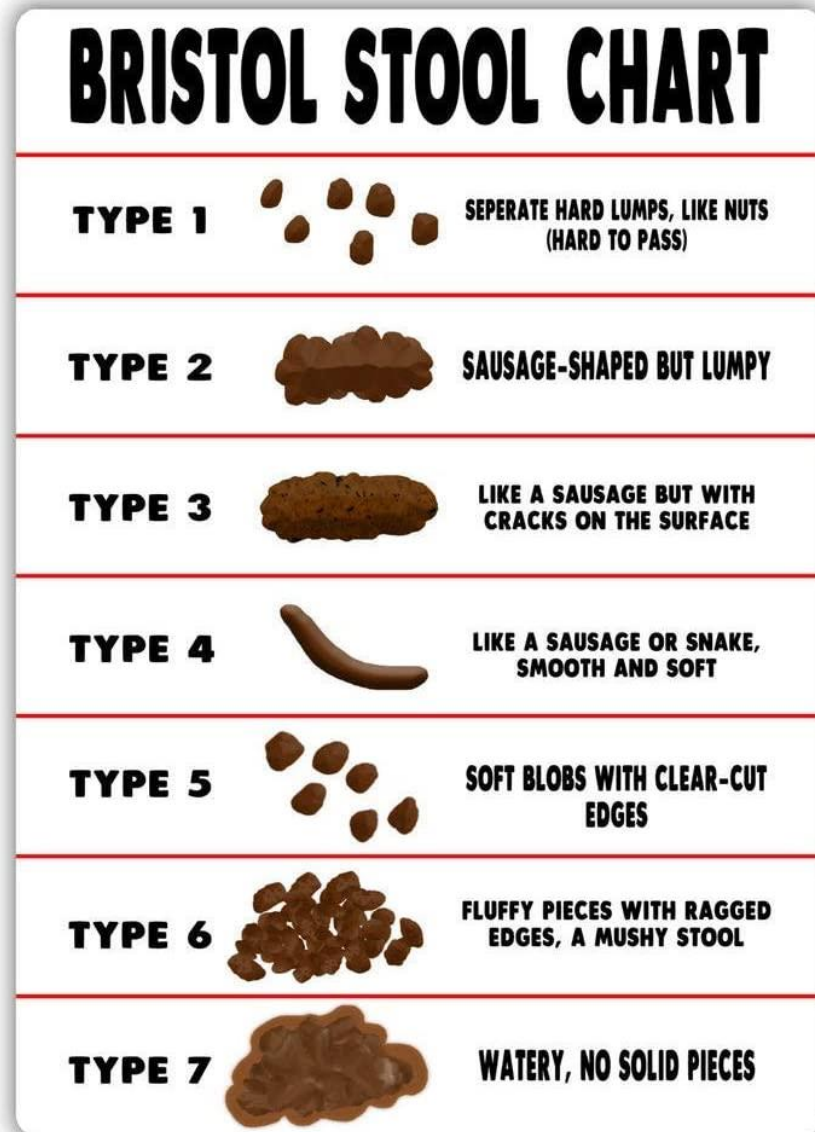


Image source: fromnewtoicu.com/blog/2016/12/28/toxic-megacolon-1

When should you test for CDI?



- Patient is symptomatic.
- Three or more **unformed or watery stools** in a 24-hour period (without other explanation).

Antibiotic Stewardship

Core Elements of Hospital Antibiotic Stewardship Programs



Hospital Leadership Commitment

Dedicate necessary human, financial, and information technology resources.



Accountability

Appoint a leader or co-leaders, such as a physician and pharmacist, responsible for program management and outcomes.



Pharmacy Expertise (previously "Drug Expertise"):

Appoint a pharmacist, ideally as the co-leader of the stewardship program, to help lead implementation efforts to improve antibiotic use.



Action

Implement interventions, such as prospective audit and feedback or preauthorization, to improve antibiotic use.



Tracking

Monitor antibiotic prescribing, impact of interventions, and other important outcomes, like *C. difficile* infections and resistance patterns.



Reporting

Regularly report information on antibiotic use and resistance to prescribers, pharmacists, nurses, and hospital leadership.



Education

Educate prescribers, pharmacists, nurses, and patients about adverse reactions from antibiotics, antibiotic resistance, and optimal prescribing.

Assess the appropriateness of prescribing antibiotics that pose the highest risk for CDI, especially **fluoroquinolones and 3rd and 4th generation cephalosporins.**

Fecal Microbiota Transplantation (FMT)

- Patients with recurrent CDI can develop prolonged chronic disease which can last for years.
- The concept behind FMT is that recurrent CDI persists because of the altered balance of normal colonic microbiota in the bowel due to prior receipt of antibiotics.
- FMT reestablishes the normal microbiota by infusion of healthy donor feces.



www.youtube.com/watch?v=Awn3haOpfcl

Prevention of CDI

- Isolate and initiate contact precautions.
- Confirm CDI in patients.
- Environmental cleaning and disinfection (EPA List K Agent).
- Develop infrastructure to support CDI prevention.
 - Auditing.
- Engage the facility antibiotic stewardship program.
- Consider use of supplemental interventions.
 - Limit the use of non-antibiotic patient medications (e.g., proton pump inhibitors, H2-receptor blockers) that are hypothesized to increase risk for CDI.

Infection Control

- Contact Precautions.
- Barrier precautions :
 - Gloving.
 - Isolation.
 - Cohorting.
 - Environmental cleaning and disinfection.
- Hand hygiene:
 - Per APIC text (2018): ABHR is ineffective against *C. diff* spores but are highly effective against other hospital pathogens and have high usage compliance rates.
 - Per CDC (2022), no single method of hand hygiene will eliminate all *C. diff* spores.
 - Using gloves to prevent hand contamination remains the cornerstone for preventing *C. diff* transmission via the hands of HCP.
 - In outbreak situations, consider using soap and water instead of ABHR for hand hygiene after removing gloves while caring for patients with CDI.

Infection Control, Cont.

- Consistent cleaning and disinfection is important as ***C. difficile* spores** contaminate the environment and patient equipment.
- Recommendation is to use a **1:10 dilution of sodium hypochlorite or other EPA-approved *C. difficile* sporicidal product** for disinfection.
 - EPA List K.

Hypochlorite drawbacks:

- Odor.
- Respiratory and skin irritation.
- Damage to surfaces.

Reserve this agent for areas of the hospital **where CDI rates are high.**

Concept Check

A patient was recently diagnosed with *C. difficile* infection of the colon. You are called to institute Contact Precautions and do all of the following EXCEPT:

- A. Gloves and gown required before entry
- B. The patient is limited in movement outside of the room except when absolutely medically necessary
- C. Move the patient to a single room
- ☒ D. The patient is moved to a negative pressure room to avoid airborne fomite exposure

Concept Check

What diagnostic test is the “gold standard” for CDI?

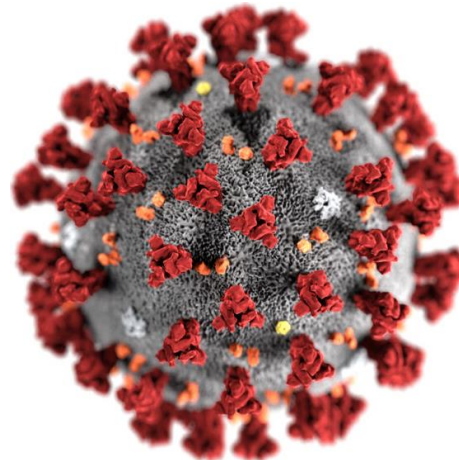
- A. Cell cytotoxicity assay
- ☒ B. Stool culture
- C. Enzyme immunoassay
- D. Latex test

Chapter 74

Coronavirus Disease 2019 (COVID-19)

Overview

- Discovered in Wuhan, China December 2019.
- Caused by SARS-CoV-2.
- Causes a respiratory infection that is transmitted via respiratory droplets and via indirect contact on environmental fomites or when the hands of HCP touch a patient's or their own mouth, nose or eyes (called contact transmission).
- Airborne transmission is thought possible.



Aerosol-Generating Procedures (AGP)

- Medical procedures potentially resulting in generation of high concentrations of infectious small-particle aerosols.
- Potentially put HCP and others at an increased risk for pathogen exposure and infection if there is inadequate availability of appropriate PPE or PPE donning and doffing errors.
- Examples include:
 - Endotracheal intubation.
 - Cardiopulmonary resuscitation.
 - Manual ventilation.
 - Positive pressure ventilation.



theconversation.com/when-covid-patients-are-intubated-in-icu-the-trauma-can-stay-with-them-long-after-this-breathing-emergency-167361

Diagnostic Testing and Serology

- **PCR (Gold standard due to increased sensitivity and specificity).**
- **Point of care (rapid test).**
- **Antibody test:**
 - May help identify individuals who had an undiagnosed and/or an asymptomatic COVID-19 infection.
 - Has not yet been determined how long antibodies for SARS-CoV-2 will remain in the body or whether antibodies offer protection from future infection.
 - Should not be used to make decisions about cohorting residents in congregate settings, such as LTCF, dormitories or correctional facilities, nor should these tests be used to make decisions about returning persons to the workforce until further studies can be done.

Infection Prevention and Control: PPE

COVID-19 Personal Protective Equipment (PPE) for Healthcare Personnel

Preferred PPE – Use N95 or Higher Respirator



Acceptable Alternative PPE – Use Facemask

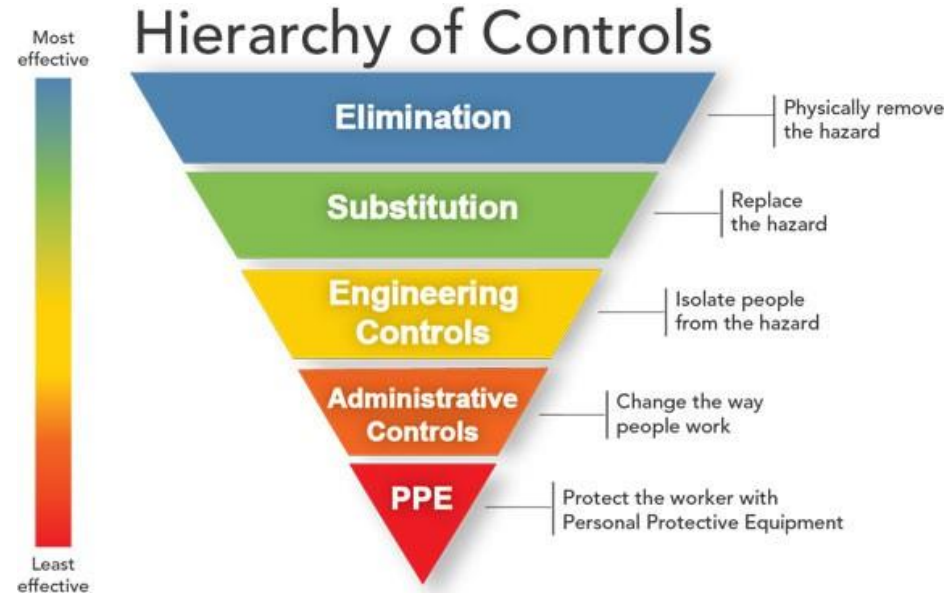


cdc.gov/COVID19

njacp.org/covid-njacp-resource-pages-for-ppe-hand-sanitizer-etc/

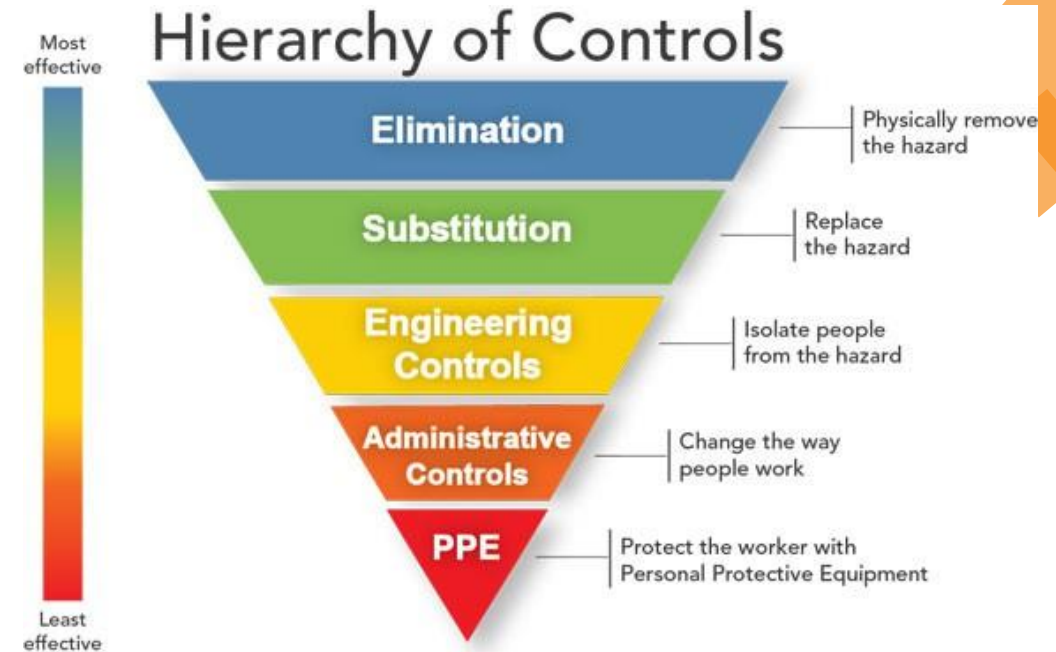
Infection Prevention and Control

- Source control vs. respiratory protection.
- Physical distancing (6 feet).
- Implementation of universal PPE dependent on the level of community transmission.
- IP should monitor and enforce IPC practices.



Infection Prevention and Control, Continued.

- **Elimination:**
 - Halt visitation, screening, physical distancing.
- **Substitution:**
 - Reusable equipment, use an EPA list N disinfectant.
- **Engineering Controls:**
 - Ventilation, HVAC, AIIR.
- **Administrative Controls:**
 - Standard and Transmission-Based Precautions, implementing screening tools, continuous education for HCP.
- **PPE:**
 - N95, eye protection, gowns, gloves.
 - Surgical masks for source control.



text.apic.org/toc/healthcare-associated-pathogens-and-diseases/coronavirus-disease-2019-covid-19

Concept Check

When can HCP utilize limited-reuse of N95 respirators to optimize PPE when caring for a COVID-19 patient?

- A. Conventional capacity
- B. Contingency capacity
- ☒ C. Crisis capacity
- D. All of the above

Concept Check

Disposable dishware and utensils are required for COVID-19 positive patients.

TRUE or FALSE?

Concept Check

There are no changes to current standards of practice for cleaning and disinfecting endoscopes if a patient is COVID-19 positive.

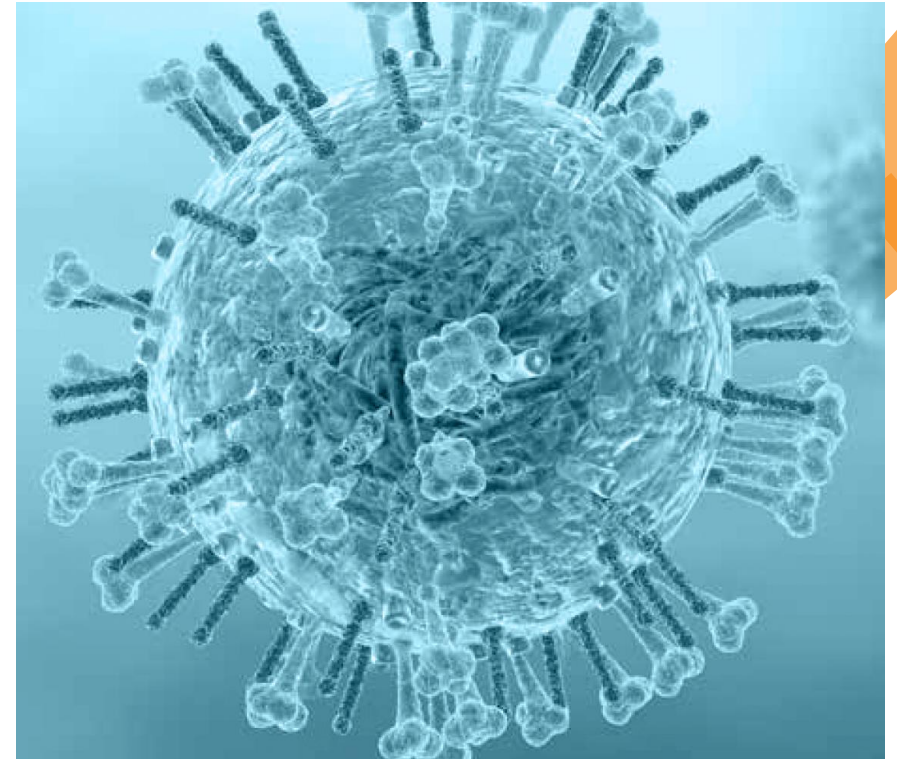
TRUE or FALSE?

Chapter 84

Influenza

Overview

- Respiratory disease transmitted via large droplets.
- Incubation period: 2 days (ranges from 1-4 days).
- Viral shedding for adults greatest within the first several days to week of illness and continues for about 1 week.
 - Shedding up to 10 days for **pediatric** patients and longer for **immunocompromised** patients.
- Symptoms: fever, cough, headache, sore throat, and muscle pain.
 - GI symptoms uncommon among adults but are more likely in pediatric patients.
- Virus can be detectable within 24 to 48 hours after infection and about 24 hours before symptom onset.



www.contagionlive.com/view/influenza-virus-primed-continual-emergence-pandemic-potential

Complications

- The patients at highest risk of developing complications and requiring hospitalization from influenza include:
 - Children younger than 2 years.
 - Patients 65 years or older.
 - Pregnant women.
 - Obese patients.
 - Patients with chronic underlying medical conditions.

The most significant medical condition associated with development of complications is asthma, but other pulmonary, cardiac, hematologic, metabolic, and neurologic conditions can also increase the risk for complications.

Complications, Cont.

- **Viral pneumonia:**

- High mortality in older adults with comorbidities.
- Younger patients can be at greater risk for pneumonia during influenza pandemics.
 - During 2009 H1N1 pandemic, the mean age for pneumonia at one center was as low as 32 years.

- **Bacterial coinfection:**

- **Bacterial pneumonia.**
- *Streptococcus pneumoniae* is the most common cause of bacterial coinfection—particularly for pneumonia—*followed by Haemophilus influenzae* and *Staphylococcus aureus*.

Diagnosis

- Molecular assays are the **gold standard** for influenza testing.
 - High sensitivity and specificity.
 - Includes:
 - Rapid molecular assays.
 - Reverse transcription polymerase chain reaction (RT-PCR).
 - Other nucleic acid amplification tests.
- Viral culture is less useful for clinical management because culture results are typically not known soon enough to guide care.
- For outpatient diagnosis, rapid influenza molecular assays are preferable to **rapid influenza diagnostic tests** (RIDTs) because the assays have higher sensitivity and specificity.

Diagnosis, Continued.

- If there is clinical suspicion of influenza infection in a hospitalized patient, then empiric treatment should be initiated.
- **Only culture and PCR are sensitive enough to rely on for ruling out influenza infection, and thus for removing suspected influenza patients from Droplet Precautions.**
- **More information:** www.cdc.gov/flu/professionals/diagnosis/clinical_guidance_rid.htm.

Treatment

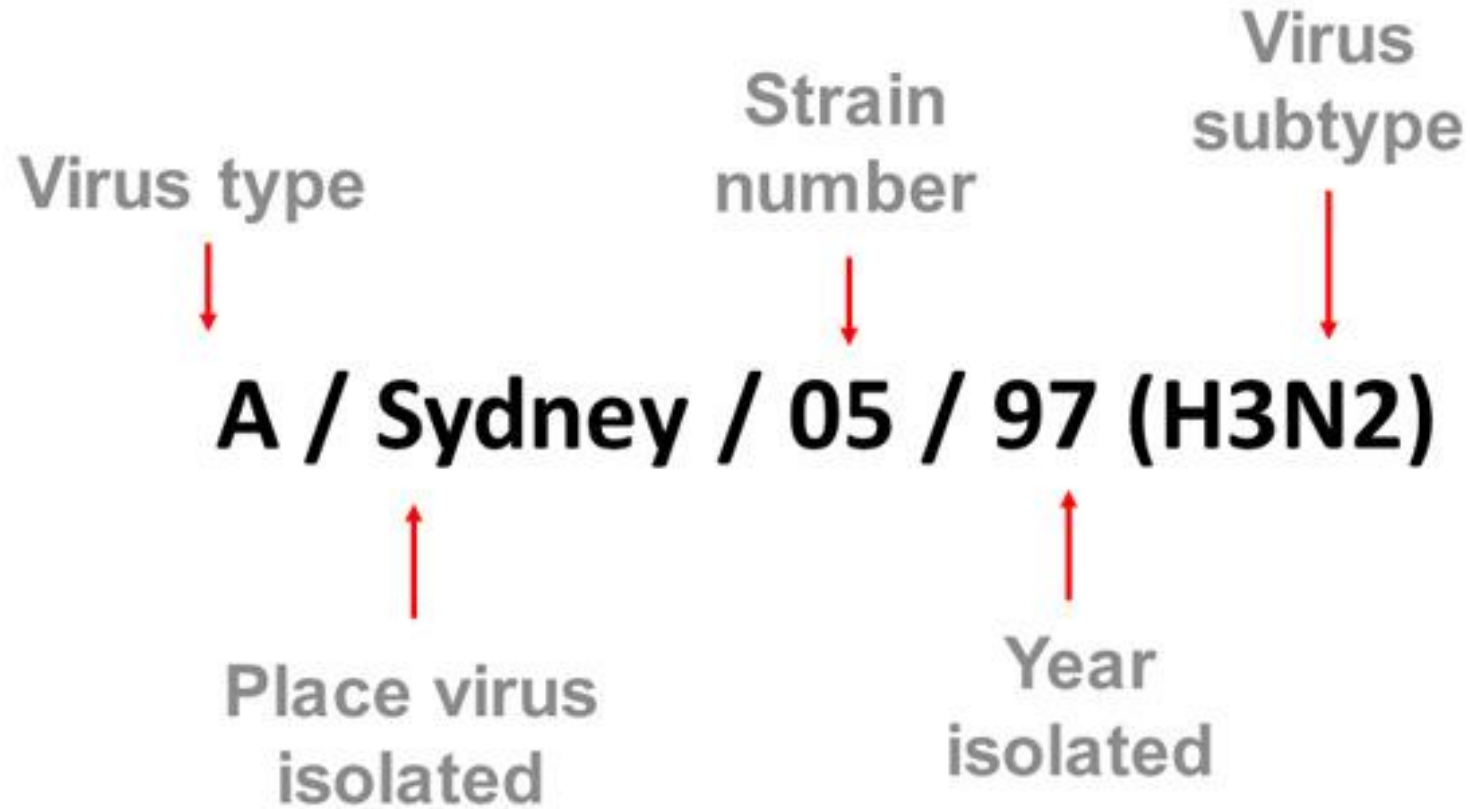
- Supportive measures for all.
- **Antiviral therapy initiated if:**
 - Hospitalized.
 - Severe, complicated, or progressive disease.
 - High risk for influenza complications:
 - Age younger than age 2 years or older than age 65 years.
 - Immunosuppressed.
 - Pregnant or postpartum (within 2 weeks after delivery).
 - Morbid obesity.
 - Chronic care facility or nursing home resident.
 - American Indians/Alaska Natives.
 - Younger than 19 years on chronic aspirin.
 - Chronic pulmonary, cardiovascular, renal, hepatic, hematological, or metabolic disorder.
 - Neurologic or neurodevelopmental condition.

Virus Characterization

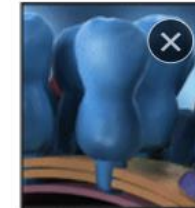
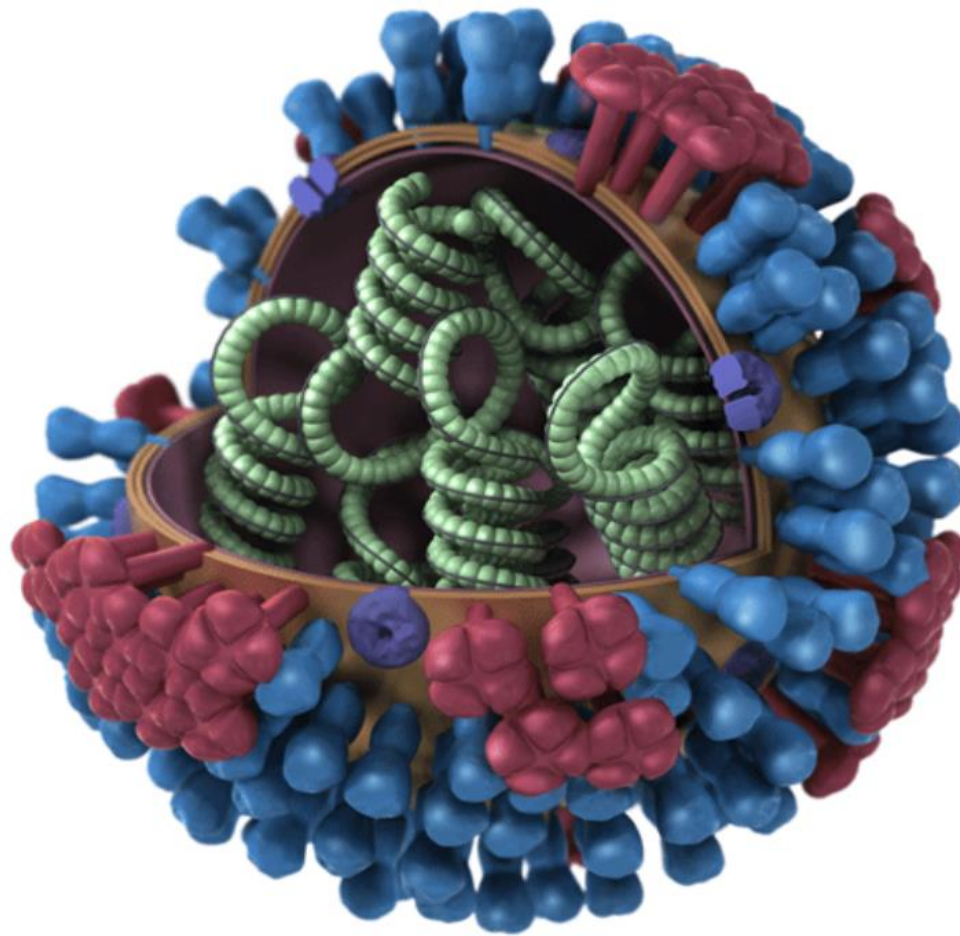
- **Influenza A** strains are the predominant cause of pandemics.
 - Primarily derived from viruses in birds and swine.
- **Influenza B** strains can also cause annual epidemic disease, but the clinical illnesses tend to be milder than illnesses caused by influenza A.
 - Thought to primarily infect children.
- **Influenza C** strains can be identified in up to 13% of influenza infections, but they either produce mild illness (usually a common cold) or are detected with another respiratory virus which makes it difficult to assess its clinical role.
 - **Have not been associated with large epidemics.**
- **Influenza D** viruses are most often found in cattle and swine.
 - Not known to sustainably infect or cause illness in humans.

Virus Characterization

Understanding the naming of flu viruses



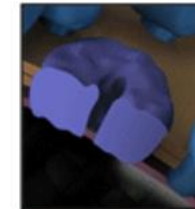
Influenza (Flu)



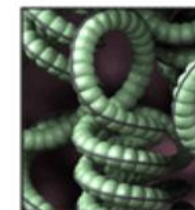
Hemagglutinin



Neuraminidase



M2 Ion Channel



RNP

This is a picture of an influenza (flu) A virus. Influenza A viruses are classified by subtypes based on the properties of their hemagglutinin (H or HA) and neuraminidase (N or NA) surface proteins. There are 18 different HA subtypes and 11 different NA subtypes. Subtypes are named by combining the H and N numbers – e.g., A(H1N1), A(H3N2).

Prevention and Control

Vaccination is the preferred method.

- All persons aged 6 months and older should receive routine annual influenza vaccine.
- Prioritize high risk individuals.
- All flu vaccines for the 2024-2025 season are trivalent vaccines, designed to protect against three different flu viruses, including two influenza A viruses and one influenza B viruses.
- Available flu vaccines include:
 - Standard dose flu shots.
 - Cell-based flu shot.
 - Recombinant flu shot.
 - Egg-based High dose flu shot.
 - Egg-based Adjuvanted flu Shot.
 - Egg-based Live attenuated flu nasal spray vaccine.
 - www.cdc.gov/flu/prevent/different-flu-vaccines.htm

Prevention and Control

- Standard precautions **always.**
- Hand Hygiene.
- PPE use.
- Respiratory hygiene/ cough etiquette.
- Aerosol Generating Procedures (AGPs): Implement airborne precautions.
- Symptom screening.
- Engineering controls (i.e., physical barriers).
- Environmental cleaning.

Concept Check

How long should patients with influenza infection be kept on Droplet Precautions in a private room after diagnosis?

- A. 7 days after diagnosis or 24 hours after the resolution of fever and respiratory symptoms, whichever is longer
- B. 5 days after diagnosis or 24 hours after the resolution of fever and respiratory symptoms, whichever is longer
- C. 10 days after diagnosis or 24 hours after the resolution of fever, whichever is longer
- D. 14 days after diagnosis or 24 hours after the resolution of respiratory symptoms, whichever is longer
- E. None of the above

Concept Check

An influenza-positive mother refuses to temporarily separate from her newborn after giving birth. The facility should consider taking all of the following steps to reduce the risk of virus transmission except:

- a) Use engineering controls such as a curtain between the mother and newborn.
- b) Keep the newborn more than 6 feet from the mother.
- c) Ensure a healthy caregiver cares for the newborn. If the mother must care for the newborn, the mother should don a mask and practice hand hygiene before each interaction.
- d) Encourage open visitation of the mother and newborn.

Additional Resources

- CDC: [TB](#)
- American Gastroenterological Association: [C. diff](#)
- Sketchy micro: [Coronavirus](#)
- Nucleus Medical Media: [Influenza](#)

Group Member Spotlight

Nicole Rowney, BSN, BS, RN, CMSRN, CIC

- Infection Prevention and Control Manager
- Mariners and Fishermen's Hospitals



Nicole Rowney, BSN, BS, RN, CMSRN, CIC

I have been technically studying for two years, but don't panic. I took the IPC job 2 1/2 years ago and felt that I had a lot to learn, so I immersed myself. My background is nursing, micro ,and biology. The FDOH runs a Virtual CIC study cohort every Friday from 3PM to 4PM. It is at an in between time and they have not announced when the 4th cohort will begin this year, This FDOH Virtual CIC study cohort every Friday from 3PM to 4PM has been a great help to me. I attended the 2nd and 3rd cohort classes. I printed every APIC chapter that they reviewed and all their correlating PP's. They have many questions throughout these sessions and I feel they are very valuable. I started, what I call cramming about 5 months prior, which consisted of spending 4 hours on Saturday and 4 hours on Sunday of dedicated flash card making and test taking, which I made from the CIC virtual study program I purchased from APIC. This is the one where you study at your own pace. If you have taken any nursing certification exams, then you know the test questions and rational are the most crucial to getting all the info that they really want you to know. Very basic statistical questions and many scenario questions. They weren't really hard, but 70% of the questions you really had to think and use your knowledge.

If you don't feel ready, reschedule and remember that you can always re-take the exam in 90days.

Week 4 Assignments

Friday December 6th, 2024

Action Items

Assigned chapter readings:

- Chapter 77 Enterobacteriaceae
- Chapter 86 *Legionella*
- Chapter 81 Diarrheal Diseases Viral, Bacterial and Parasitic
- Chapter 99 Viral Hepatitis

- Group member spotlight