


NEW ORGANISMS IN HEALTHCARE

WHEN TO PANIC, WHEN TO CARRY ON

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DISCLOSURE

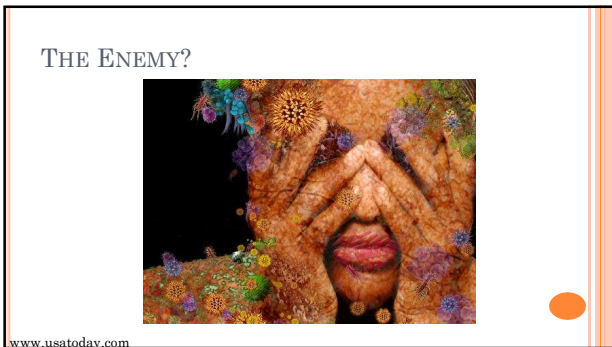
- Jim is employed by Diversey. His expenses to present this webinar (salary) are paid by this company. Diversey has had no input into this presentation from a commercial interest.



OBJECTIVES

- Discuss the frequency of new organisms in the healthcare world
- Describe the difficulty (or ease) of killing new organisms with disinfectants
- Explain how to use the Chain of Transmission when answering questions





The main buckets of microorganisms

Bacteria	Gram Positive Gram Negative	<i>Staphylococcus</i> <i>E. coli</i>
Spores	Resistant form of bacteria	<i>Clostridioides difficile</i> , <i>Bacillus anthracis</i>
Viruses	Envelope or Non-envelope	Influenza, Rhinovirus, HIV, HBV, Norovirus
Fungi	Multicellular	<i>Trichophyton</i> , <i>Aspergillus</i>

- WHO HAS BEEN THE ENEMY?
- Bacteria
 - *Staphylococcus aureus*
 - MRSA
 - *E. coli*, *Klebsiella pneumoniae*
 - ESBL, CRE
 - Enterococcus
 - VRE
 - Clostridium/Clostridioides sp.
 - CDI, Gas gangrene

WHO HAS BEEN THE ENEMY?

- Enveloped Viruses (Easy to Kill)
 - HIV, Hepatitis B&C, Influenza, parainfluenza
- Non-Enveloped Viruses (Not Easy to Kill)
 - Norovirus, Rhinovirus, Hepatitis A
 - Large non-enveloped are easier
 - Rotavirus, Adenovirus



WHO HAS BEEN THE ENEMY?

- Fungi
 - Candida
 - *albicans*, *glabrata*
 - Aspergillus, Tinea sp. (Athlete's Foot), Cladosporium



WHO WAS/IS THE NEW ENEMY?

- | | |
|---------------------|------------------------------------|
| ○ SARS-CoV-1 | ○ Zika |
| ○ pH1N1 Influenza A | ○ <i>Elizabethkingia anopheles</i> |
| ○ MERS-CoV | ○ <i>Candida auris</i> |
| ○ Ebola | ○ Hepatitis A |

SARS-CoV-2



SARS-CoV-2

- Causes **C**oronavirus **D**isease 2019 (COVID-19)
- Human to human spread
 - Appears Contact/Droplet
- Updates daily
 - ProMed (<https://promedmail.org/>)
 - <https://www.worldometers.info/coronavirus/#countries>



COVID 19

- Global pandemic declared by WHO March 11, 2020
- Basically in every country of the world
 - Varying success in controlling
- US just passed 4 million cases; 145,000 deaths (3.6% mortality rate)
 - This AM: 4.975 mil, ~161,600 deaths (3.25%)



PANIC [PAN-IK]

- noun
- 1. a sudden overwhelming fear, with or without cause, that produces hysterical or irrational behavior, and that often spreads quickly through a group of persons or animals.
www.dictionary.reference.com





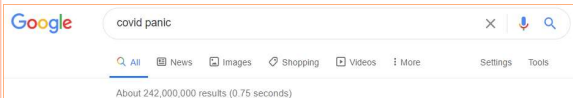
HISTORY OF PANIC

- “My heart is in anguish within me; the terrors of death have fallen on me. Fear and trembling have beset me; horror has overwhelmed me...”
 - Psalm 55:4-5



SARS-CoV-2

- Sporting events cancelled
- Communities quarantined
- Toilet paper hoarding (?)
- No samples at Costco?



SARS-CoV-2 CHANGES

- No Mask, wear mask
 - Evidence of asymptomatic and pre-symptomatic carriers
- Droplet vs Airborne spread
 - Stay tuned!



IS IT HYPE? FEAR-BOLA!

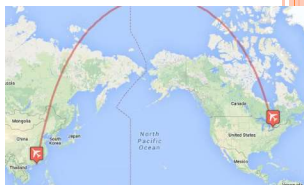
- It's a hyper-contagious disease that affects the brain, making sufferers fear a widespread Ebola outbreak in the United States.
- Fear-bola is an airborne disease that spreads through conversation, entering your brain through your ears.
- Fear-bola is so contagious that some victims have contracted it by simply seeing images and videos about Ebola.

Mel Robbins <https://www.cnn.com/2014/10/15/opinion/robbins-ebola-fear>



NOT THAT LONG AGO - 2003

- Severe Acute Respiratory Syndrome (the original)
 - Guangdong Province China
 - Hong Kong
 - Toronto
- ProMed





Courtesy Kingston General Hospital Archive



Courtesy Kingston General Hospital Archive



LET'S GO BACK...WAY BACK...



Grade 10 and Rocking It!



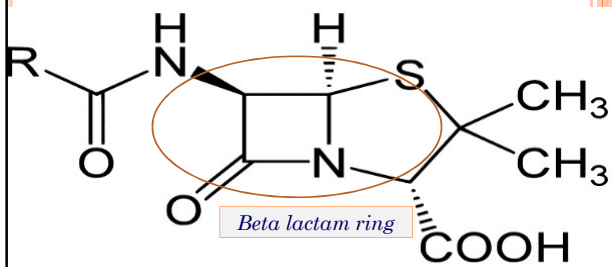
PENICILLIN RESISTANCE

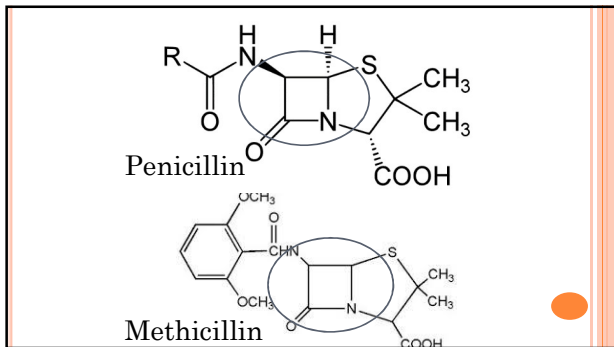
- *Staphylococcus aureus*
- Mortality before 1940 for bacteremia >80%
- Penicillin mass produced in 1938
- Resistance seen in 1942
 - By late 1960's, >80% resistant to penicillin

(Lowy 2003)



PENICILLIN MOLECULE





METHICILLIN RESISTANCE

- Semi-synthetic penicillin (along with Cloxacillin)
- Developed in 1961
- Resistance seen by 1962
- Spread was rapid through Europe

METHICILLIN RESISTANCE

- First reported case in US was 1968 (NIAID)
- First outbreak in Canada was reported in 1981

(Simor 1997)

MRSA BRITISH COLUMBIA

- First case – Canadian returning from India
 - Clinical specimen
 - Found two floors up, one floor down
- End of the world as 'they' knew it!



MRSA NELSON, BC

- Probably mid 90's
- Much the same!



HUMAN IMMUNODEFICIENCY VIRUS (HIV)

- 1981 reports of Karposi's sarcoma and *Pneumocystis carinii* in men who had sex with men (MSM)

(MMWR 1981 June, July)




HIV PANIC

- LGBTQ Community
- Children at school (hemophiliacs)
- Healthcare workers refusing to provide care
- First Responders wanting list of known HIV positive people



HIV OUTCOME

- Led to Universal Precautions, Body Substance Precautions and most recently:
 - Standard Precautions
 - Routine Practices and Additional Precautions (RPAP) 
- Safety needles



VRE

- First seen in 1986, reported in 1988 (Uttley 1988)
 - Cluster, probably related to the use of Vancomycin and Cefazidime as treatment of acute undiagnosed sepsis
- Spread went worldwide
- Fear of transfer of resistance to Group A Streptococci



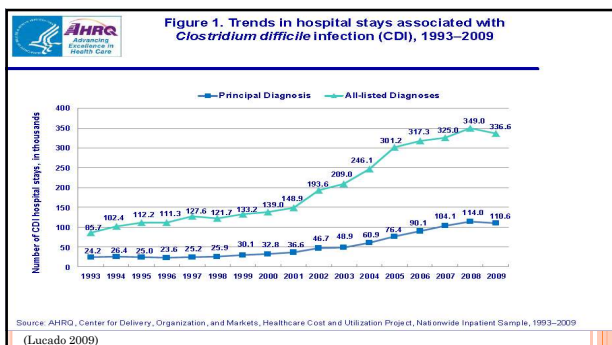
CLOSTRIDIODES DIFFICILE

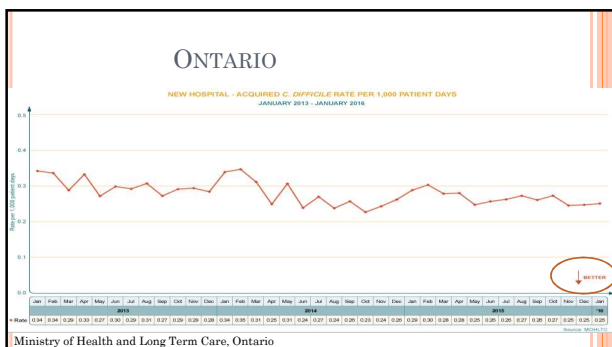
- First identified in culture in 1935
- First reported as cause of pseudomembranous colitis in 1974
- Has toxin mediated issues
- Spore allows long environmental survival (Bartlett 1994)
- Name Change 2016! (Lawson 2016)



Do you need a sporicide everywhere? – See Resources!

vaccinenewsdaily.com





The screenshot shows the Texas Department of State Health Services website. The header includes the Texas logo and the text 'TEXAS Health and Human Services' and 'Texas Department of State Health Services'. A navigation bar contains links for HOME, COVID-19, ABOUT DSHS, NEWS, I AM A..., MOST POPULAR, and RESOURCES. The main content area is titled 'Clostridium difficile Resources' and includes a breadcrumb trail: 'Home > Infectious Disease Control > Clostridium difficile Resources'. Below the title are links for 'AR/MDROs Home', 'C_diff Home', and 'Reporting'. A sidebar on the left lists 'Infectious Diseases A-C', 'D-G', 'H-L', and 'M-N' with expandable arrows. At the bottom, there is a link to 'Clostridium difficile Collaborations FY 16' and a URL: https://www.dshs.state.tx.us/IDCU/health/antibiotic_resistance/Clostridium_difficile_Resources.aspx.

GRAM NEGATIVE RESISTANCE

- Extended spectrum beta lactamase (ESBL)
 - Breaks down the beta lactam ring
 - Emerges and changes as our antibiotics change (third and fourth generation Cephalosporins) (Bradford 2001)

GRAM NEGATIVE RESISTANCE

- Carbapenemase
 - Enzyme attacks carbapenem antibiotics: meropenem, imipenem, ertapenem
 - CPE: Carbapenemase Producing Enterobacteriaceae
 - CRE: Carbapenem Resistant Enterobacteriaceae
 - May not be an enzyme mechanism!
 - CP-CRE: Carbapenemase Producing - Carbapenem resistant Enterobacteriaceae
 - Plasmid spread possible
 - CPO: Carbapenemase Producing Organism

CANDIDA AURIS (SCHWARTZ 2018)

- Has spread rapidly around the globe
- Can cause invasive disease with high mortality rates
- Frequently resistant to one or more classes of antifungals
- Difficult to identify in some clinical microbiology laboratories.
- Prolonged colonization of patients' skin and contamination of surrounding environments
- Nosocomial outbreaks in hospitals and long-term care facilities

(Schwartz 2018)



CANDIDA AURIS

- Suspect in
 - patients with invasive candidiasis and recent hospitalization in global regions where *C. auris* is prevalent
 - patients who fail to respond to empiric antifungal therapy and from whom unidentified or unusual *Candida* species have been isolated.
- Presentation available at:
 - <http://solutionsdesignedforhealthcare.com/ce>



CANDIDA AURIS INFECTION CONTROL

- Standard and Contact
- Good hand hygiene
- Clean and disinfect (label claim for *C. auris* or sporicidal agent)
- Inter-facility communication
- Screening if a case is detected
- Surveillance

<https://www.cdc.gov/fungal/candida-auris/health-professionals.html>



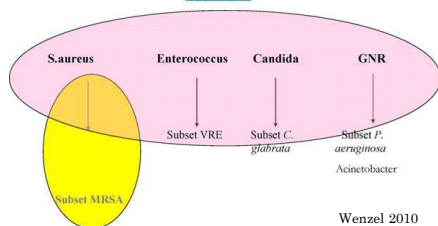
So?

- There are always going to be new organisms
- Look at horizontal Infection Prevention and Control, not vertical



HORIZONTAL VS VERTICAL INFECTION CONTROL

Controlling Healthcare Associated
BSI: Vertical vs Horizontal
Approach



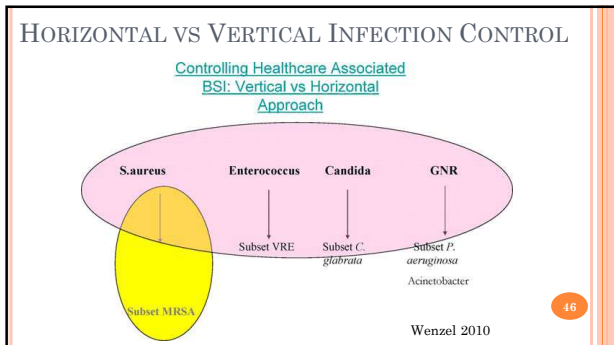
Wenzel 2010

44

VERTICAL

- Focus on a single pathogen or anatomic site
- Pathogen specific
 - MRSA
 - VRE
 - ESBL
 - CRE
 - Acinetobacter
 - Candida

45



- ### HORIZONTAL
- Reduce rates of all infections for all pathogens
 - Hand hygiene program
 - Decolonization therapies (Chlorhexidine bathing)
 - Board to ward (Nat Audit Office 2009)
 - Antibiotic Stewardship Programs
 - Standardized cleaning and disinfection
- 47


- ### VERTICAL ISSUES
- Can cause confusion
 - Contact / Enhanced Contact / Contact Plus
 - Contact, Airborne with a mask
 - Contact/Droplet/Airborne
 - Alcohol based hand rub or soap and water?
- 48

HOW TO HANDLE QUESTIONS

◦ _(ツ)_/

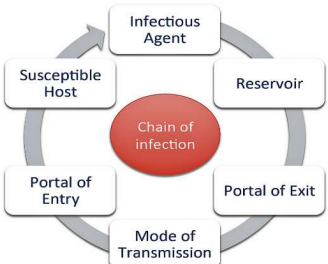


The slide features two images: on the left, a man in a white lab coat shrugging his shoulders with a questioning expression; on the right, a black and white photograph of a baby with a hand to their ear, looking thoughtful.



A photograph of a man with glasses and a light blue shirt. A large, semi-transparent Superman logo is overlaid on his chest.

Chain of Transmission

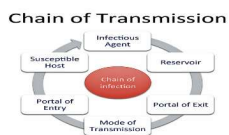


The diagram illustrates the chain of infection. At the center is a red circle labeled "Chain of infection". Surrounding it are six white boxes connected by a circular arrow: "Infectious Agent" (top), "Reservoir" (top-right), "Portal of Exit" (right), "Mode of Transmission" (bottom), "Portal of Entry" (left), and "Susceptible Host" (top-left).

http://diseasedetectives.wikia.com/wiki/Chain_of_Transmission

RESERVOIR

- The organism/area where the infectious agents reside
- Humans
 - SARS-CoV-2 Respiratory Tract
- Animals
- Food Chain
- Environment



RESERVOIR – BREAKING THE LINK

- **Hand Hygiene** – remove the organism before it is placed near or on another person or surface, or infect ourselves
- **Disinfection** – kill the organism on the surface
- **Pre-operative skin prep** – remove and kill organisms
- **Engineering** – Redesign sinks



PORTAL OF EXIT – SARS-COV-2

- Cough
- Sneeze
- Talk (loud) or singing
- Aerosol-generating procedures
 - Can vary by jurisdiction



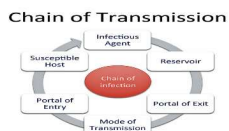
BREAKING THE PORTAL OF EXIT

- Masks
 - Home made
 - Surgical
- Covering coughs, sneezes



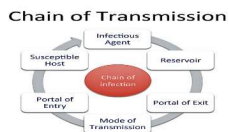
MODE OF TRANSMISSION

- Method by which the pathogen gets from the reservoir to the new host



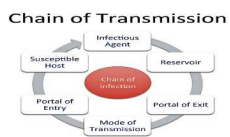
MODE OF TRANSMISSION - CONTACT

- **Direct**
 - Contact between infectious agent and susceptible host
- **Indirect**
 - Contact of a fomite (surface) then contact of susceptible host
- **Mode**
 - Equipment
 - Hands
 - Sex (not COVID!)



MODE OF TRANSMISSION – PERCUTANEOUS

- Needlestick



MODE OF TRANSMISSION

◦ Droplet

- Particle size >5um
- Cough
- Sneeze

Airborne

- Particle size <5um
- Cough
- Singing



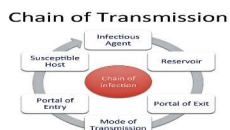
MODE OF TRANSMISSION

◦ Common Vehicle

- Food
- Water
- Medication vial

◦ Vector-Borne

- Mosquitos
- Flies
- Lice
- Ticks



MOT- BREAKING THE LINK

- Direct/Indirect
 - Hand Hygiene
 - Environmental disinfection
 - Personal Protective Equipment (PPE)
 - Isolation of infected patients
 - Not in contact with others when ill/contagious



MOT – BREAKING THE LINK

- Droplet/Airborne
 - Face protection (mask, respirator(?), goggles, shield)
 - Airflow (Airborne Infection Isolation Room - AIIR)



PORTAL OF ENTRY

- Eyes, nose, mouth (T-Zone)



BREAKING THE PORTAL OF ENTRY

- Masks and eye protection



SUSCEPTIBLE HOST

- SARS-CoV-2
 - Elderly
 - Obese
 - High blood pressure
 - Lung issues
 - Metabolic issues (diabetes)
 - Heart Issues
 - Multi-system Inflammatory Syndrome
 - Children



CHAIN OF TRANSMISSION

- Helps explain the risk
- Helps calm some of the panic



WHAT BROKE THE CHAIN?

- **Disinfectants**
 - Variety of kill ability
 - Low Level to High Level
 - Sporicidal
 - EPA Emerging Viral Pathogen Document
- **Label Claim**
 - Surrogate/marker organisms
 - Can't have 'em all!

https://www.epa.gov/sites/production/files/2016-09/documents/emerging_viral_pathogen_program_guidance_final_8_19_16_001_0.pdf

WHAT BROKE THE CHAIN?

- Hand hygiene
- Personal Protective Equipment

The main buckets of microorganisms

Bacteria	Gram Positive Gram Negative	<i>Staphylococcus</i> <i>E. coli</i>
Spores	Resistant form of bacteria	<i>Clostridioides difficile</i> , <i>Bacillus anthracis</i>
Viruses	Envelope or Non-envelope	Influenza, Rhinovirus, HIV, HBV, Norovirus
Fungi	Multicellular	<i>Trichophyton</i> , <i>Aspergillus</i>

EFFECT OF DISINFECTANTS ON MICROORGANISMS

Organism	Type	Examples
Bacterial Spores	Spore	<i>Bacillus anthracis</i> , <i>Clostridioides difficile</i>
Mycobacteria	Bacteria	<i>M. tuberculosis</i>
Small non-enveloped virus	Virus	Poliovirus, Norovirus, Rhinovirus, Hep A
Fungal spores	Fungus	Aspergillus, Penicillium, Trichophyton
Gram negative bacteria	Bacteria	<i>E. coli</i> , Klebsiella including CRE , Pseudomonas, Acinetobacter
Fungi (Vegetative)	Fungus	Candida
Large Virus (non-enveloped)	Virus	Adenovirus, Rotavirus
Gram positive bacteria	Bacteria	Staphylococcus including MRSA , Enterococcus including VRE
Virus (enveloped)	Virus	HIV, HBV, HCV, Influenza, Coronavirus

*Resistant
*Sensitive

Adapted from Rutala et al. ICHE 2014;35(7):862

RESISTANT ORGANISMS

- Antibiotic resistance does NOT confer disinfectant resistance!
 - *E. coli* is *E. coli* whether it can produce a beta lactamase or a carbapenemase
- Antibiotics are more “Lock and Key”
- Disinfectants are more “Dynamite” or “Sledgehammer”

●

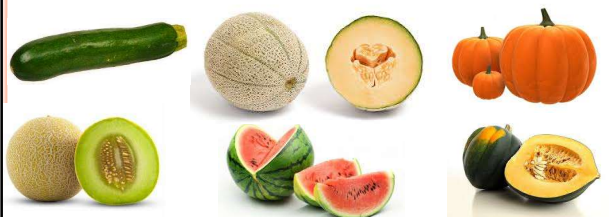
(Weber 2006, Rutala 1997)

ANTIBIOTICS – LOCK AND KEY

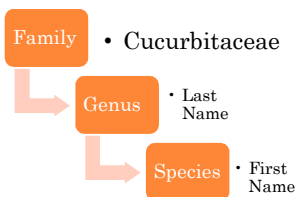
ANTIBIOTIC RESISTANCE – LOCK AND KEY



ANALOGY FOR DISINFECTANTS


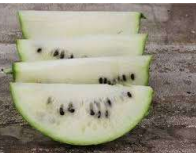



THE FAMILY TREE





GENETIC MUTATIONS

		
Watermelon coli	Watermelon ESBL	Watermelon CRE

●



COMMUNICATION

- Difficult during panic
 - Facility Outbreaks
 - New Organisms
 - Pandemic Problems



HOW TO COMMUNICATE

- Get the facts
 - Reliable sources
 - CDC, WHO, PHAC, APIC, ProMed
- Aim for Grade 6-8 (newspaper) level of language
 - Avoid jargon unless necessary



SARS

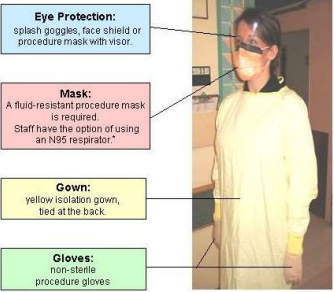








○ WHO



Eye Protection:
splash goggles, face shield or procedure mask with visor.

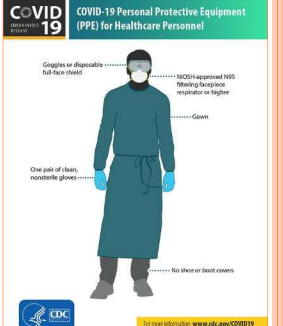
Mask:
A fluid-resistant procedure mask is required. Staff have the option of using an N95 respirator.*

Gown:
yellow isolation gown, tied at the back.

Gloves:
non-sterile procedure gloves

*Refer to N95 Respiratory Protection Policy to determine when the N95 is mandatory. October 2019

○ CDC



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

Goggles or disposable full face shield

N95-approved N95 filtering facepiece respirator or higher

Gown

One pair of clean, non-sterile gloves

No shoe or boot covers

For more information, visit www.cdc.gov/COVID19

PUBLIC HEALTH AGENCY OF CANADA (PHAC)

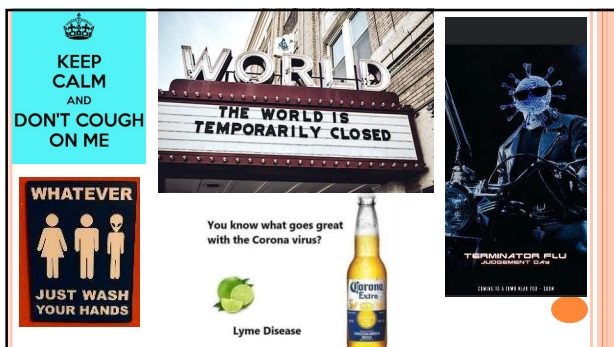
○ ...contact and droplet precautions should be used:

- Gloves and a gown should be worn upon entering the patient's room;
- Facial protection (mask and eye protection, or face shield, or mask with visor attachment) should be used when within two metres of the patient;
- A fit-tested N95 respirator (including eye protection) should be used by all HCWs in the patient's room when AGMPs are being performed on a person under investigation for COVID-19.

HOW TO COMMUNICATE

- Get the facts out there
 - Newsletters
 - Bulletins
 - Huddles or Town Hall Meetings

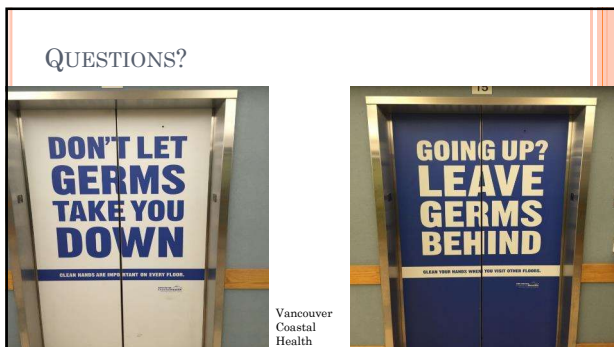




SUMMARY

- There are always going to be new problems – DON'T PANIC
- Keep in mind Chain of Transmission and horizontal infection control
 - Doing activities that protect patients from all organisms
 - Appropriate use of disinfectants including point of care
 - Patient hand hygiene





REFERENCES

- Bartlett J. *Clostridium difficile*: History of its role as an enteric pathogen and the current state of knowledge about the organism. Clin Infect Dis 1994;18(Suppl 4):S265-72
- Bradford PA. Extended-spectrum –beta lactamases in the 21st century: characterization, epidemiology, and detection of this important resistance threat. Clin Micro Rev 2001;14(4):933-951
- Lawson PA, et al. Reclassification of *Clostridium difficile* as *Clostridioides difficile* (Hall and O’Toole 1935) Prévot 1938. Anaerobe 2016;40:95-9
- Lucado J, et al. *Clostridium difficile* infections (CDI) in hospital stays, 2009. HCUP Statistical Brief #124. January 2012. Agency for Healthcare Research and Quality, Rockville, MD. <http://www.hcup-us.ahrq.gov/reports/statbriefs/sb124.pdf>

REFERENCES

- Lowy FD. Antimicrobial resistance: the example of *Staphylococcus aureus*. J Clin Invest 2003;111:1265-73
- Ministry of Health and Long Term Care (Ontario). http://www.hqontario.ca/public-reporting/patient-safety?_ga=1.214855314.462030773.1452205540 Accessed March 5, 2016
- MMWR Weekly Pneumocystis Pneumonia- Los Angeles. 1981;June 5, 30(21): 1-3
- MMWR Weekly. Kaposi’s sarcoma and Pneumocystis pneumonia among homosexual men- New York City and California 1981;July 4,30 (4):305-308

REFERENCES

- o Rutala WA, et al. Susceptibility of antibiotic-susceptible and antibiotic-resistant hospital bacteria to disinfectants. ICHE 1997;18(6):417-21
- o Schwartz IS, et al. Something wicked this way comes: What health care providers need to know about *Candida auris*. Can Commun Dis Rep 2018;44(11):271-6. <https://doi.org/10.14745/ccdr.v44i11a01>
- o Simor A, et al. The Canadian Nosocomial Infection Surveillance Program: Results of the first 18 months of surveillance for methicillin-resistant *Staphylococcus aureus* in Canadian hospitals. Can Comm Dis Rep. 1997;23:41-5
- o Weber DJ, et al. Use of germicides in the home and the healthcare setting: is there a relationship between germicide use and antibiotic resistance? ICHE 2006;27(10):1107-19

REFERENCES

- o Wenzel RP, et al. Infection control: the case for horizontal rather than vertical interventional programs. Int J Infect Dis 2010;14(suppl 4):S3-S5
- o www.gotquestions.org/Bible-panic-attacks.html#ixzz3TTAjrMQK Assessed February 29, 2020
- o Uttley A, et al. Vancomycin resistant enterococci. Lancet 1988;1(8575-6):57-8.

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