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.

APIC 2021 STRATEGIC PARTNER PLUS

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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 Enemy?

www.usatoday.com

The main buckets of microorganisms

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

Who Has Been The Enemy?

- Bacteria
  - *Staphylococcus aureus*
    - MRSA
  - *E. coli, Klebsiella pneumoniae*
    - ESBL, CRE
  - Enterococcus
    - VRE
  - Clostridium/Clostridioides sp.
    - Gas gangrene, CDI

Who Has Been The Enemy?

- Enveloped Viruses (Easy to Kill)
  - HIV, Hepatitis B&C, Influenza, Parainfluenza, RSV
- 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
- pH1N1 Influenza A
- MERS-CoV
- Ebola
- Zika
- *Elizabethkingia anopheles*
- *Candida auris*
- Hepatitis A

SARS-CoV-2

SARS-CoV-2

- Causes Coronavirus Disease 2019 (COVID-19)
- Human to human spread
  - Appears Contact/Droplet
  - New terminology re: 'by the air'
- Updates daily
  - ProMed (https://promedmail.org/)
  - https://www.worldometers.info/coronavirus/

COVID 19

- Global pandemic declared by WHO March 11, 2020
- Basically in every country of the world
  - Varying success in controlling
  - Mar 25, 2021: 30.7 mil, ~559,000 deaths (1.82%)
    - NM: 190,275 cases, 3,909 deaths (2.1%)
  - Apr 28, 2021: 32.9 mil, ~587,000 deaths (1.78%)
    - NM: 196,997 cases, 4,039 deaths (2.05%)

PANIC [PAN-IK]

- noun

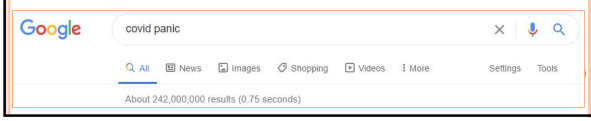
1. a sudden overwhelming fear, with or without cause, that produces hysterical or irrational behavior, and that often spreads quickly through a group of persons or animals.
   www.dictionary.reference.com

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 – the outset!

- 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
- Double mask…
- 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…

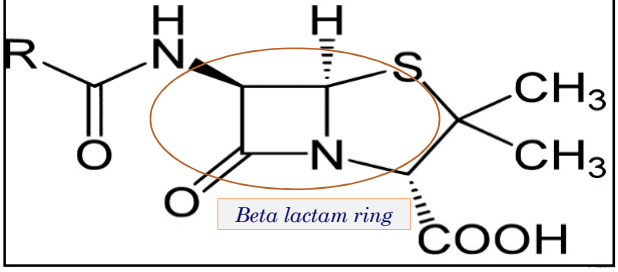
Grade 10 and Rocking It!

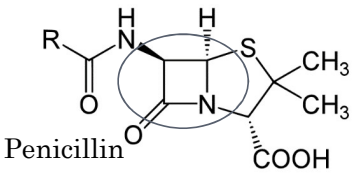
Penicillin Resistance

- *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

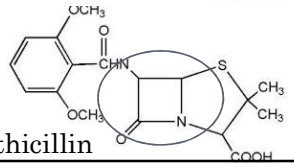
(Lowy 2003)

Penicillin molecule





Penicillin



Methicillin

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 Ceftazidime as treatment of acute undiagnosed sepsis
- Spread went worldwide
- Fear of transfer of resistance to Group A Streptococci

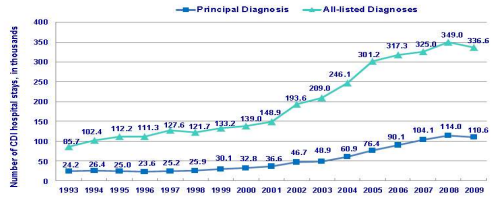
Clostridiodes difficile

- 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)

vaccinenewsdaily.com

Do you need a sporicide everywhere? – See Resources!

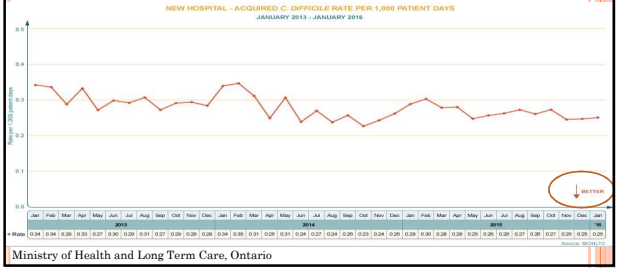
Figure 1. Trends in hospital stays associated with *Clostridium difficile* infection (CDI), 1993–2009



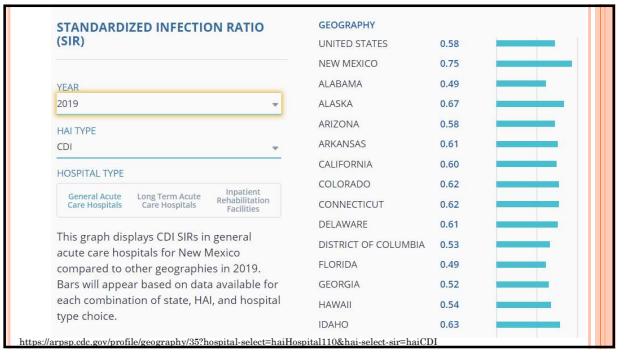
Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1993–2009

(Lucado 2009)

Ontario



Ministry of Health and Long Term Care, Ontario



https://arpsp.cdc.gov/profile/geography/35?hospital-select=haiHospital110&hai-select-sir=haiCDI

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
  - CRE: Carbapenem Resistant Enterobacteriaceae
    - May not be an enzyme mechanism!
  - CPE: Carbapenemase Producing Enterobacteriaceae
  - CP-CRE: Carbapenemase Producing - Carbapenem resistant Enterobacteriaceae
    - Plasmid spread possible
  - CPO: Carbapenemase Producing Organism

CANDIDA AURIS (SCHWARTZ 2018)

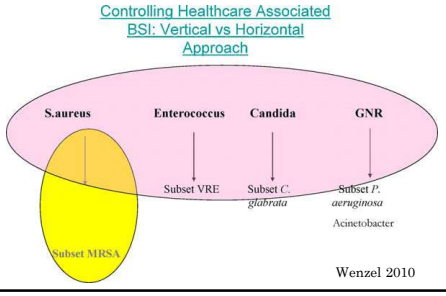
- Has spread rapidly around the globe
- Can cause invasive disease with high mortality rates
- Frequently resistant to one or more classes of antifungals
- Difficult to identify in some clinical microbiology laboratories.
- Prolonged colonization of patients' skin and contamination of surrounding environments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

(Schwartz 2018) (Prestel MMWR 2020)

SO?

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

HORIZONTAL VS VERTICAL INFECTION CONTROL



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Wenzel 2010

VERTICAL

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

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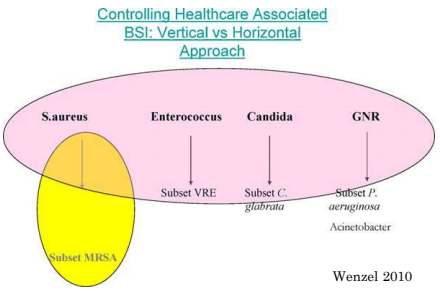
HORIZONTAL VS VERTICAL INFECTION CONTROL



Wenzel 2010

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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

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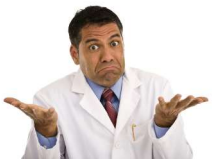
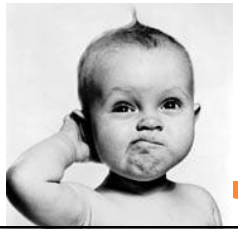
Vertical Issues

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

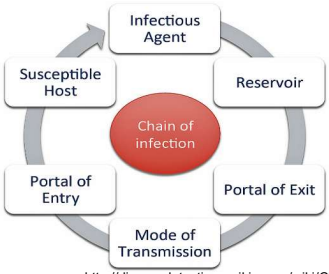
How to Handle Questions

- ¯_(ツ)_/¯





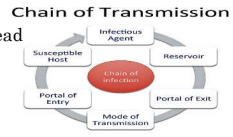
Chain of Transmission



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

Reservoir

- The organism/area where the infectious agents reside
- Humans
  - SARS-CoV-2 Respiratory Tract
- Animals
  - Possible for cats to get, not spread
- 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

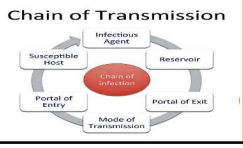
- Cough
- Sneeze
- Talk (loud) or singing
- Aerosol-generating procedures
  - Can vary by jurisdiction/specialty

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!)

Chain of Transmission

Mode of Transmission – Percutaneous

- Needlestick

Chain of Transmission

Mode of Transmission

- **Droplet**
  - Particle size >5um
  - Cough
  - Sneeze
- **Airborne**
  - Particle size <5um
  - Cough
  - Singing
- **Of the Air**
  - Size not important

Mode of Transmission

- **Common Vehicle**
  - Food
  - Water
  - Medication vial
- **Vector-Borne**
  - Mosquitos
  - Flies
  - Lice
  - Ticks

Chain of Transmission

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)
  - Air exchanges

Brown J, et al. A quantitative evaluation of aerosol generation during tracheal intubation and extubation. Anaesthesia 2020.
https://associationofanaesthetists-publications.onlinelibrary.wiley.com/doi/epdf/10.1111/anae.15292

Portal of Entry

- Eyes, nose, mouth (T-Zone)

Breaking the Portal of Entry

- Masks and eye protection

abc3340.com/

Guardian.com

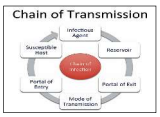
Medicom.com

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

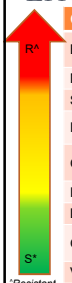
What Broke the Chain?

- Hand hygiene
- Personal Protective Equipment

The main buckets of microorganisms

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

Effect of Disinfectants on Microorganisms



*Resistant
^ Sensitive

Organism	Type	Examples
Bacterial Spores	Spore	*Bacillus anthracis, Clostridioides difficile*
Mycobacteria	Bacteria	*M. tuberculosis*
Small non-enveloped virus	Virus	Poliovirus, Norovirus, Rhinovirus, Hep A
Fungal spores	Fungus	Aspergillus, Penicillium, Trichophyton
Gram negative bacteria	Bacteria	*E. coli*, 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

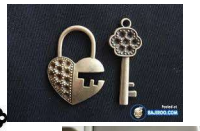
Adapted from Rutala et al. ICHE 2014;35(7):862

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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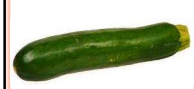
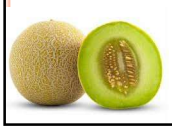
Analogy for Disinfectants

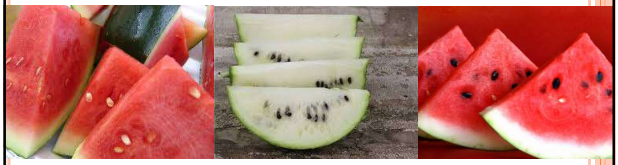


The Family Tree

- Family • Cucurbitaceae
- Genus • Last Name
- Species • First Name

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, Public Health Agency of Canada (PHAC), APIC, ProMed
- Aim for Grade 6-8 (newspaper) level of language
  - Avoid jargon unless necessary

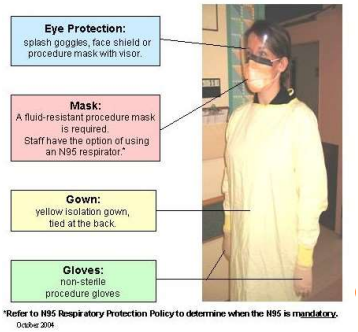
SARS

Ebola

- SARS-CoV-2 S. Korea

Please don't do this!

- WHO



- CDC

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

Look After Ourselves!

- Very stressful times
  - So much mis-information
- We all need to re-charge
  - Mindfulness
  - Family
  - Downtime

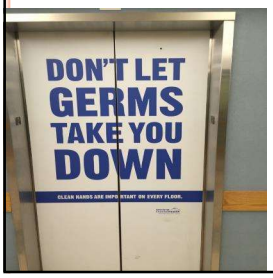
Summary

- 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

Summary

- Infection Preventionists need to be more involved in analyzing the data from this pandemic
  - To have evidence based recommendations for all healthcare settings

QUESTIONS?



Vancouver Coastal Health

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http://www.diverseydigital.com/natools/videoHub/index.php