Legionnaires’ Disease and IAQ During COVID-19

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Agenda

• Background
• Habitat
• Epidemiology/ Risk factors
• Mode of Transmission/ Attack Rate
• Clinical Presentation
• Treatment
• Prevention
Legionnaires’/ COVID-19

What we know is incomplete!
The current knowledge is evolving!
Path Through The Chaos
Types of Prevention

1. Primary prevention

2. Secondary prevention

3. Tertiary prevention
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Background
**Background**

*Legionella* bacteria

- Causes Legionellosis
  - Legionnaire’s disease (LD)
  - Pontiac Fever (PF)
- Gram-negative bacteria
- 60+ species, 70+ serogroups
- Water (surface, ground) and soil
- Commonly found in our water systems

*SARS CoV2/ COVID-19 virus*

- COVID-19 – Caused by SARS CoV2 virus
- SARS CoV2 is a Corona virus
- SARS CoV2 is an RNA virus
- Other Corona viruses
  - SARS 2003/ CFR15%
  - MERS 2012/ CFR 35%
  - Common cold (4: 229E, NL63, OC43, HKU1)
American Legion convention 1976
• Wuhan, China
Background

**Legionella bacteria**
- 221 pneumonia cases developed with multisystem involvement; 34 deaths in 1976
- Source unknown
- Terrorism?
- Press dubbed it “Board Street Pneumonia”
- Months of investigation – identified bacteria as the causative agent in 1977

**SARS CoV2/ COVID-19 virus**
- Outbreak – Cases of pneumonia with multisystem involvement in Wuhan, China in December 2019
- Source – wet market??
- Animal => human?
- Market - shut down/ disinfected
- Continued cases not related to the market
- Hospital staff became infected
- What Happened?
# Habitat

**Legionella bacteria**
- Waterborne
- Grows best in slime, sediment, or biofilms
- Grows inside single cell organisms e.g. amoebae, protozoa & slime mold
- Conditions: temperature, water stagnation, dead legs
- Legionellae can be isolated from natural waters

**SARS CoV2/ COVID-19 Virus**
- Enormous variety of animal coronaviruses
- Animal to animal transmission
- Corona virus often circulate among camels, cats, bats
- Can cause diarrhea in cows, pigs and URI in chickens
- Rapid mutations
Pathway Illustrating How *Legionella* / Waterborne Pathogens Are Introduced to and Flow through Water Systems
Is your water sterile?
Clean?
Habitat
Epidemiology
Epidemiology

**Legionella** bacteria
- 5.5x increase in reported cases from 2000-2017
- ~7,500 cases reported in 2017
- Significant underreporting is estimated
  - Estimated 70,000 cases per year (NASEM)
- ≤ 4% of cases are involved in Outbreaks
- Majority of cases are “sporadic”
- 10 to 35% mortality

**SARS CoV2/ COVID-19 Virus**
- China/ US Experience - Initial
  - 80% mild/ moderate to asymptomatic
  - 15% severe disease
  - 5% critical disease
  - 2 – 4% mortality
- World
  - 138.02 million cases
  - 2,971,130 deaths (2.2%)
- US
  - 31,420,418 cases
  - 564,388 deaths (1.8%)
Risk Factors

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Risk Factors

**Legionella bacteria**
- Smokers
- Elderly (Age 50 or older)
- Lung or kidney disease
- Diabetes
- Cancer
- Weakened immune system due to medications or disease

**SARS CoV2/ COVID-19 Virus**
- Obesity
- Elderly (Age 60 & older)
- Lung or kidney disease
- Diabetes
- Weakened Immune system
- Liver disease
- Heart disease
- Minorities?
Mode of Transmission

**Legionella bacteria**
- Waterborne sources
- Inhalation of aerosolized *Legionella* contaminated water droplets
- Aspiration or choking of drinking *Legionella* contaminated water
- Handling *Legionella* contaminated soil
- Surgical wounds treated with *Legionella* contaminated potable water
- No person to person Transmission

**SARS CoV2/ COVID-19 Virus**
- Contagious - Person to person
- Main mode – infectious aerosol droplets & micro-sprays from talking
- Direct – cough, sneeze, droplet inhalation
- Contact from touching or being touched by infected individuals
- Not building systems or waterborne
Attack Rate

**Legionella bacteria**
- Waterborne sources
  - AR – 5% Legionnaires’
  - AR – 95% Pontiac Fever

**SARS CoV2/ COVID-19 Virus**
- Human reservoir/ source
  - Incomplete knowledge
  - Diamond Princess >40%
  - SS G. Mortimer approx. 59%
  - Close contacts – 5%
    - Household – 10 – 40%
    - Meals – 7%
    - HCW w/ PPE’s – 3%
  - Casual/ grocery store – 0.6%
Clinical Presentation

**Legionnaires’**
- Develops 2-10/14 days after exposure to legionella bacteria with an avg. of 5-6 days
- Symptoms (extrapulmonary) include:
  - Headache, muscle pain, chills
  - Fever that may be 104 F (40 C) or higher
  - Cough, mucus and sometimes blood
  - Shortness of breath, chest pain
  - Gastrointestinal symptoms, such as nausea, vomiting and diarrhea
  - Confusion or other mental changes
  - Cardiovascular collapse and death

**COVID-19**
- Atypical & Critical Pneumonia
- Develops 2-14 days after exposure to SARS CoV2 with avg. of 5 days
- Multi-organ involvement
  - CNS/ neurological
  - Systemic
  - Skin
  - Kidneys
  - Respiratory
  - GI
  - Cardiovascular
  - Children - Multi-organic inflammatory
Clinical Treatment

**Legionella bacteria**
- Antibiotics – no documented antibiotic resistance
- Supportive care

**SARS CoV2/ COVID-19 Virus**
- Supportive care
- FDA EUA – Remdisivir/ Devices
- Promising
  - Dexmethasone (steroid)
  - Convalescing plasma
  - IL 6 Inhibitor
- Trials
  - Treatments – 326
  - Vaccines - 252
COVID-19 Treatments and Vaccines (combined)

Source: Milken Institute

- Antibodies
- Antivirals
- Cell-Based Therapies
- RNA Based Treatments
- Dormant/ Discontinued
- Scanning Compounds to Repurpose
- Devices
- Others
- Vaccines
Prevention

**Legionella bacteria**

- Source to tap approach
  - Public & Professional education
  - Best practices for public and premise water (and water system) management
  - Prompt notification of distribution disruptive events
  - Best practices for investigations
  - Research

**SARS CoV2/ COVID-19 Virus**

- Education
- Herd immunity
  - Vaccine
    - Effects of antivaxx
- NPI – prevent exposure
- Testing
- Contact tracing
- Prophylaxis/ Treatment
- Research
What Happens to the Indoor Environment During COVID-19 Pandemic?

What Happened to our Economy?
COVID-19 Pandemic

- Source to Tap Problems?
  - Water Utility
    - ST
    - LT
  - Facilities
    - Idled Buildings
    - Risk Assessment
    - Maintaining & Recommissioning
Legionnaires’ Disease Reporting During COVID-19 Pandemic
United States Legionnaires' Disease Cases
Year-End Totals

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<th>Year</th>
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<td>2020*</td>
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</tbody>
</table>

* Total cases for 2020 are preliminary
Legionnaires' Disease Cases Reported in 2020

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Q & A

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