Biosafety and Infectious Disease Training Initiative (BIDTI)

A National Institute of Environmental Health Sciences (NIEHS) Worker Training Program (WTP)

5UH4 ES027055 (Ebola Biosafety and Infectious Disease Response)
How can you grieve without a funeral? As coronavirus restrictions become more strict, families make heartbreaking choices
The Human Coronavirus

Classical Human Coronaviruses

- 229E
- NL63
- OC43
- HKU1

229E

OC43

NL63

HKU1

229E

SARS

COVID-19

MERS

Novel Human Coronaviruses

- SARS
- COVID-19
- MERS
History of the Coronaviruses

Coronaviruses first described in 1960s as a cause of the ‘Common Cold’

“Novel” Coronaviruses:

2002- SARS outbreak in China
2003- SARS virus discovered
2004- SARS disappears
    Due to banned sale of civets?

2012- First MERS case in Kingdom of Saudi Arabia
2012- MERS virus discovered

2019- 2019-CoV outbreak begins
2020- Epidemic continues to escalate
COVID-19 US
As of March 9, 2020 at 1:00PM EST
Understanding an Infectious Disease

How Infectious is it?
How Contagious is it?
How Hazardous is it?
How is it spread?
How do we protect ourselves from it?
Pathogens of Concern
Infectious, Communicable, Highly Hazardous

HAZARDOUS
Anthrax
Botulism

INFECTION
Nipah
Tularemia
EBOLA
Norovirus
Rubella
Mumps
Brucella
Q-Fever

COMMUNICABLE
## Comparative Features of Coronavirus Disease

<table>
<thead>
<tr>
<th>Status</th>
<th>SARS</th>
<th>MERS</th>
<th>COVID-19</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No cases since 2004</td>
<td>Ongoing epidemic in Middle East</td>
<td>Escalating epidemic in China and beyond</td>
</tr>
<tr>
<td>Reservoir</td>
<td>Bats + Civet Cats</td>
<td>Bats + Camels</td>
<td>Bats + Pangolins?</td>
</tr>
<tr>
<td>ID&lt;sub&gt;50&lt;/sub&gt;</td>
<td>No Data</td>
<td>No Data</td>
<td>No Data</td>
</tr>
<tr>
<td>R&lt;sub&gt;0&lt;/sub&gt;</td>
<td>2.2-3.6</td>
<td>0.6-11.5</td>
<td>2.5-6.6 ??</td>
</tr>
<tr>
<td>Mortality</td>
<td>774/8098 (9.6%)</td>
<td>866/2519* (34.4%)</td>
<td>284,124/4,148,034 (6.85%)</td>
</tr>
<tr>
<td>Treatment</td>
<td>Supportive</td>
<td>Supportive</td>
<td>Supportive</td>
</tr>
<tr>
<td>Transmission</td>
<td>Droplets (Droplet nuclei?)</td>
<td>Droplets (Droplet nuclei?)</td>
<td>Droplets (Droplet nuclei?)</td>
</tr>
</tbody>
</table>

*as of Jan 20; **as of May 11, 20
What are the symptoms?

Additional symptoms have been identified as there have been more cases.
Transmission

COVID-19 is spread from person to person mainly through coughing, sneezing, and possibly talking, and breathing.

- **Droplet** - respiratory secretions from coughing or sneezing landing on mucosal surfaces (nose, mouth, and eyes)
- **Aerosol** - a solid particle or liquid droplet suspended in air
- **Contact** - Touching something with SARS-2 virus on it and then touching mouth, nose or eyes
- **Other possible routes**: Though fecal matter
Diseases that are Contagious before they are Symptomatic

Going Viral: What to Watch For
Viruses can be contagious during the incubation period, before symptoms start.

<table>
<thead>
<tr>
<th></th>
<th>COLD</th>
<th>FLU</th>
<th>NOROVIRUS</th>
<th>COVID-19*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incubation period</td>
<td>1-3</td>
<td>1-4</td>
<td>A few</td>
<td>2-14</td>
</tr>
<tr>
<td>Symptom onset</td>
<td>Gradual</td>
<td>Abrupt</td>
<td>Abrupt</td>
<td>Gradual</td>
</tr>
<tr>
<td>Typical illness duration</td>
<td>7-10</td>
<td>3-7</td>
<td>1-2</td>
<td>Undetermined</td>
</tr>
</tbody>
</table>

**SYMPTOMS**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>COLD</th>
<th>FLU</th>
<th>NOROVIRUS</th>
<th>COVID-19*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sore throat</td>
<td>Common</td>
<td>Sometimes</td>
<td>Rare</td>
<td>Undetermined</td>
</tr>
<tr>
<td>Sneezing</td>
<td>Common</td>
<td>Sometimes</td>
<td>Rare</td>
<td>Undetermined</td>
</tr>
<tr>
<td>Stuffy, runny nose</td>
<td>Common</td>
<td>Sometimes</td>
<td>Rare</td>
<td>Undetermined</td>
</tr>
<tr>
<td>Cough, chest discomfort</td>
<td>Sometimes</td>
<td>Common</td>
<td>Rare</td>
<td>Common</td>
</tr>
<tr>
<td>Fatigue, weakness</td>
<td>Sometimes</td>
<td>Common</td>
<td>Sometimes</td>
<td>Undetermined</td>
</tr>
<tr>
<td>Fever</td>
<td>Rare</td>
<td>Common</td>
<td>Sometimes</td>
<td>Common</td>
</tr>
<tr>
<td>Aches</td>
<td>Rare</td>
<td>Common</td>
<td>Sometimes</td>
<td>Undetermined</td>
</tr>
<tr>
<td>Chills</td>
<td>Rare</td>
<td>Common</td>
<td>Sometimes</td>
<td>Undetermined</td>
</tr>
<tr>
<td>Headache</td>
<td>Rare</td>
<td>Common</td>
<td>Sometimes</td>
<td>Undetermined</td>
</tr>
<tr>
<td>Shortness of breath</td>
<td>Rare</td>
<td>Rare</td>
<td>Rare</td>
<td>Common</td>
</tr>
<tr>
<td>Nausea</td>
<td>Rare</td>
<td>Rare</td>
<td>Common</td>
<td>Undetermined</td>
</tr>
<tr>
<td>Vomiting</td>
<td>Rare</td>
<td>Rare</td>
<td>Common</td>
<td>Undetermined</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>Rare</td>
<td>Rare</td>
<td>Common</td>
<td>Undetermined</td>
</tr>
<tr>
<td>Stomach pain</td>
<td>Rare</td>
<td>Rare</td>
<td>Common</td>
<td>Undetermined</td>
</tr>
</tbody>
</table>

*See below for emerging information on COVID-19 coronavirus symptoms. NOTE: Rare symptoms can occur in some cases with any of these diseases.

**SOURCES:** CDC, Merck Manual; University of Michigan

GRAPHIC BY ROBERT ROY BRITT
What We Don’t Know cont.

1. The true mortality rate
dead reporting lags behind case reporting
the proportion of mild and asymptomatic cases
is unknown
2. The secondary reservoir (Pangolins?)
3. The $R_0$
initial estimate is a crude approximation
reason for paucity of pediatric cases
4. The route of transmission (hence the optimal
PPE)
droplet vs droplet nuclei
What We Don’t Know cont.

5. Whether transmission can really occur before symptoms
   impacts quarantine strategy
6. Role of ‘Superspreaders’
7. Efficacy of various antiviral therapies
8. Many, many other factors relevant to the epidemic
Best Guess Epidemiology

• \( R_0 = 2.5 \); Doubling time 7-10 days
• Community attack rate = 30-40%
• Cases requiring hospitalization = 5%
• Cases requiring ICU care = 1-2%
• Cases requiring ventilatory support = 1%
• CFR = 0.5%

• Community epi wave 2 months
  US: 96 million cases
  US: 4.8 million admissions
  US: 1.9 million ICU
  US: 1 PPV
  US: 480,000 deaths

• PREPARE FOR DISEASE BURDEN ROUGHLY 10X SEVERE FLU SEASON
# Health Care Worker Protection

## Precautions

<table>
<thead>
<tr>
<th>Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Recognition (‘‘Identify, Isolate, Inform’’)</td>
</tr>
<tr>
<td>Standard Precautions</td>
</tr>
<tr>
<td>Movement of PUIs to private rooms upon identification</td>
</tr>
<tr>
<td>Placement of procedural masks on PUIs</td>
</tr>
<tr>
<td>Contact + Airborne Precautions</td>
</tr>
<tr>
<td>Single room (Ideally an airborne infection isolation rooms)</td>
</tr>
<tr>
<td>N-95 Respirator + Eye Protection (Goggles or Face Shield)</td>
</tr>
<tr>
<td>Gown</td>
</tr>
<tr>
<td>Gloves</td>
</tr>
<tr>
<td>Boots, Coveralls, Aprons are <strong>not</strong> needed for routine care</td>
</tr>
<tr>
<td>Travel Considerations</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td><strong>Global Health Advisory</strong> March 19, 2020</td>
</tr>
<tr>
<td><strong>COVID-19 Update</strong> March 19, 2020</td>
</tr>
<tr>
<td><strong>COVID-19 Update</strong> March 19, 2020</td>
</tr>
</tbody>
</table>
Airport Screening in the US

11 Air Gateways:

JFK, ORD, SFO, SEA, HNL, LAX, ATL, IAD, EWR, DFW, DTW
Community Spread is Occurring throughout the United States
Prevention

• Social distancing
• Avoiding unnecessary air travel
  • Do not travel when sick
• Staying home when sick
  • Seek medical care right away, telehealth options
• Frequently disinfecting surfaces using EPA-registered products
• Hand hygiene and covering coughs/sneezes
• Avoid touching the transmission zone (eyes, nose, mouth)
• PPE, as available
Treatment

• Oxygenation as needed
• Ventilation as needed
• Monitored fluid administration
• Nutrition
• Antibiotics in event of bacterial superinfection
• Therapeutic trials:
  • Remdesivir
  • Lopinavir/Ritonavir
Current Testing

As of May 5, 2020

PCR tests
• Tells if someone current has disease
• Most widely available
• Pretty Reliable
• Still supply chain issues

Antibody tests or Serology tests
• Tells if someone has antibodies or they previously had disease. Practical value if the possession of antibodies makes them immune to re-infection, which we don’t know at this time.
• More and More available
• Currently Very Unreliable
• Still supply chain issues

Antigen test
• The value of an antigen is that it is easier and quicker than the PCR. But it tells me if they currently have the virus, not if they previously did.
• Currently Very Unreliable

Estimated porous surfaces (i.e. cardboard) 24 hours, non-porous surfaces (i.e. plastic, stainless steel) up to 72 hours under certain temperature and humidity conditions.
American Chemistry Council and Center for Biocide Chemistries

COVID-19 Fighting Products

[Link to PDF](https://www.americanchemistry.com/Novel-Coronavirus-Fighting-Products-List.pdf)

<table>
<thead>
<tr>
<th>Commercially Available Product Name</th>
<th>Company/Distributor</th>
<th>EPA REG No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accel Tb</td>
<td>Virox Technologies, Inc.</td>
<td>74559-1</td>
</tr>
<tr>
<td>Advantage</td>
<td>Wechem, Inc.</td>
<td>1839-83-34370</td>
</tr>
<tr>
<td>AERO TB FRESH</td>
<td>AERO CHEMICAL CO</td>
<td>1839-83-13103</td>
</tr>
<tr>
<td>Af Ultra Acid Free Total Bathroom Cleaner</td>
<td>Ultra Chem</td>
<td>1839-83-57839</td>
</tr>
<tr>
<td>All Purpose Virex</td>
<td>Diversey, Inc.</td>
<td>1839-83-70627</td>
</tr>
<tr>
<td>Aviation RTU Cleaner</td>
<td>Zep</td>
<td>6836-152-1270</td>
</tr>
<tr>
<td>Avistat-D RTU Spray Disinfectant Cleaner</td>
<td>National Chemical Laboratories, Inc.</td>
<td>1839-83-2296</td>
</tr>
<tr>
<td>Bioesque Solutions Botanical Disinfectant Solution 12/1 qt</td>
<td>Bioesque Solutions/Natureal, LLC</td>
<td>87742-1-92595</td>
</tr>
<tr>
<td>Bioesque Solutions Botanical Disinfectant Solution 4/1 gal</td>
<td>Bioesque Solutions/Natureal, LLC</td>
<td>87742-1-92595</td>
</tr>
<tr>
<td>Bioesque Solutions Botanical Disinfectant Solution 5 gal</td>
<td>Bioesque Solutions/Natureal, LLC</td>
<td>87742-1-92595</td>
</tr>
<tr>
<td>Bioesque Solutions Botanical Disinfectant Solution 55 gal</td>
<td>Bioesque Solutions/Natureal, LLC</td>
<td>87742-1-92595</td>
</tr>
<tr>
<td>BioSentry 904 Disinfectant</td>
<td>Hacco, Inc.</td>
<td>6836-78-61282</td>
</tr>
<tr>
<td>BLEACH DISINFECTANT CLEANER</td>
<td>Ecolab Inc</td>
<td>1677-235</td>
</tr>
<tr>
<td>Bright Solutions Lemon Zip Disinfectant RTU</td>
<td>Bright Solutions</td>
<td>1839-83-75473</td>
</tr>
<tr>
<td>Bright Solutions RTU Bathroom Cleaner Non-Acid Bowl and Restroom Disinfectant</td>
<td>Bright Solutions</td>
<td>1839-83-75473</td>
</tr>
<tr>
<td>BS &amp; H</td>
<td>NATIONAL AMERICAN SALES CORP.</td>
<td>1839-83-50718</td>
</tr>
</tbody>
</table>
Other Items

- **Waste Handling**: Handle in normal waste streams (medical, MSW)
  - No national capacity to treat as Cat B
  - Talk to SLTT about requirements

- **Risk Communication**: Transparency, dispelling misinformation, quelling public panic
For Mortuary Workers

1) How long does the virus lives in human remains, once death had occurred?


Interim Guidance for Collection and Submission of Postmortem Specimens from Deceased Persons Under Investigation (PUI) for COVID-19, February 2020

CDC has updated its guidance on what specimens to collect when testing for COVID-19. The latest guidance is available online at Evaluating and Testing Persons for Coronavirus Disease 2019 (COVID-19).
The following factors should be considered when determining if an autopsy will be performed for a deceased PUI: medicolegal jurisdiction, facility environmental controls, availability of recommended personal protective equipment (PPE), and family and cultural wishes.

If an autopsy is performed, collection of the following postmortem specimens is recommended:

- Postmortem clinical specimens for testing for SARS-CoV-2, the virus that causes COVID-19:
  - Upper respiratory tract swabs: Nasopharyngeal Swab AND Oropharyngeal Swab (NP swab and OP swab)
  - Lower respiratory tract swab: Lung swab from each lung
- Separate clinical specimens for testing of other respiratory pathogens and other postmortem testing as indicated
- Formalin-fixed autopsy tissues from lung, upper airway, and other major organs

If an autopsy is NOT performed, collection of the following postmortem specimens is recommended:

- Postmortem clinical specimens for testing for SARS-CoV-2, the virus that causes COVID-19, to include only upper respiratory tract swabs: Nasopharyngeal Swab AND Oropharyngeal Swab (NP swab and OP swab)
- Separate NP swab and OP swab specimens for testing of other respiratory pathogens

Detailed guidance for postmortem specimen collection can be found in the section: [Collection of Postmortem Clinical and Pathologic Specimens](https://www.cdc.gov/coronavirus/2019-nCoV/lab/guidelines-clinical-specimens.html).

In addition to postmortem specimens, submission of any remaining clinical specimens (e.g., NP swab, OP swab, sputum, serum, stool) that may have been collected prior to death is recommended. Please refer to [Interim Guidelines for Collecting, Handling, and Testing Clinical Specimens from Persons Under Investigation (PUIs) for Coronavirus Disease 2019 (COVID-19)](https://www.cdc.gov/coronavirus/2019-nCoV/lab/guidelines-clinical-specimens.html) for more information.
Global PPE Supply Chain

- Global shortage caused by: rising demand, panic buying, hoarding, misuse
  - WHO working with Pandemic Supply Chain Network (PSCN)
- Need to use PPE properly and responsibly: donning and doffing, storage, maintenance, use
- Those at most risk should be the ones getting it (i.e., HCW, first responders)
- We might have to ration PPE
  - CDC encouraging healthcare systems to implement strategies to conserve supplies
  - Shortfalls next 3-4 months
  - National stockpile integrity just checked (2003-2013)
  - Extended use and limited reuse of respirators
OSHA Memo – Temporary Enforcement Guidance Annual Fit-Testing for N95s


• Video also currently being made with UNMC HEROES on extended use and re-use of N95s and other disposable respirators
…additionally lots of discussion and use about cloth facial coverings

<table>
<thead>
<tr>
<th>Understanding the Difference</th>
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<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Surgical Mask</strong></td>
</tr>
<tr>
<td><strong>Testing and Approval</strong></td>
</tr>
<tr>
<td><strong>Intended Use and Purpose</strong></td>
</tr>
<tr>
<td><strong>Face Seal Fit</strong></td>
</tr>
<tr>
<td><strong>Fit Testing Requirement</strong></td>
</tr>
<tr>
<td><strong>User Seal Check Requirement</strong></td>
</tr>
<tr>
<td><strong>Filtration</strong></td>
</tr>
<tr>
<td><strong>Leakage</strong></td>
</tr>
<tr>
<td><strong>Use Limitations</strong></td>
</tr>
</tbody>
</table>

- Surgical Mask
  - Cleared by the U.S. Food and Drug Administration (FDA)
  - Fluid resistant and provides the wearer protection against large droplets, splashes, or sprays of bodily or other hazardous fluids. Protects the patient from the wearer’s respiratory emissions.
  - Loose-fitting
  - No fit testing requirement
  - No user seal check requirement
  - Does NOT provide the wearer with a reliable level of protection from inhaling smaller airborne particles and is not considered respiratory protection
  - Leakage occurs around the edge of the mask when user inhales
  - Disposable. Discard after each patient encounter.

- N95 Respirator
  - Evaluated, tested, and approved by NIOSH as per the requirements in 42 CFR Part 84
  - Reduces wearer's exposure to particles including small particle aerosols and large droplets (only non-oil aerosol).
  - Tight-fitting
  - Yes to fit testing requirement
  - Yes. Required each time the respirator is donned (put on)
  - Filters out at least 95% of airborne particles including large and small particles
  - When properly fitted and donned, minimal leakage occurs around edges of the respirator when user inhales
  - Ideally should be discarded after each patient encounter and after aerosol-generating procedures. It should also be discarded when it becomes damaged or deformed; no longer forms an effective seal to the face; becomes wet or visibly dirty; breathing becomes difficult; or if it becomes contaminated with blood, respiratory or nasal secretions, or other bodily fluids from patients.

Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
Hospital workers battling coronavirus turn to bandannas, sports goggles and homemade face shields amid shortages

President Trump invokes war-scale manufacturing — but some worry about consequences of delays
Strategies for Optimizing the Supply of N95 Respirators: Crisis/Alternate Strategies


Personal Protective Equipment and Respiratory Protection

• Use of respirators beyond the manufacturer-designated shelf life for healthcare delivery
• Use of respirators approved under standards used in other countries that are similar to NIOSH-approved N95 respirators
• Limited re-use of N95 respirators for COVID-19 patients
• Use of additional respirators beyond the manufacturer-designated shelf life for healthcare delivery
• Prioritize the use of N95 respirators and facemasks by activity type
Strategies for Optimizing the Supply of N95 Respirators: Crisis/Alternate Strategies

When No Respirators are Left
  • Administrative Controls
  • Engineering Controls

Personal Protective Equipment and Respiratory Protection

HCP use of non-NIOSH approved masks or homemade masks

In settings where N95 respirators are so limited that routinely practiced standards of care for wearing N95 respirators and equivalent or higher level of protection respirators are no longer possible, and surgical masks are not available, as a last resort, it may be necessary for HCP to use masks that have never been evaluated or approved by NIOSH or homemade masks. It may be considered to use these masks for care of patients with COVID-19, tuberculosis, measles, and varicella. However, caution should be exercised when considering this option.\textsuperscript{1,2}
Social Distancing & Infection Control Precautions

• Family Consultation
• Funeral Ceremony
  • Decontamination between services
• Graveside Service
• Memorial Service
• Viewing/Visitation
• Wake
NFDA

https://www.nfda.org/covid-19/practical-guidance-webinars

Practical Guidance Webinars & Videos for Funeral Directors

A Conversation with the CDC

CDC COVID-19 Response Update
National Funeral Directors Association
March 16, 2020

CAPT Jill M. Shugart
Dr. Sarah Reagan-Steiner
Dr. David Berendes

For more information: www.cdc.gov/COVID19

Handling Families with COVID-19
NFDA

https://www.nfda.org/covid-19/frequently-asked-questions

COVID-19: Frequently Asked Questions

Funeral professionals have had many questions about how they can safely continue to serve families during the COVID-19 pandemic. NFDA has compiled a list of the frequently asked questions, which cover issues related to business operations, liability, funerals and visitation, technical questions, and more.

Please click on the button below or use the side bar navigation to navigate between topics.

If you do not find an answer to your question, please use the form below and an NFDA staff member will respond to you as soon as we can.

Please note: Because this is a rapidly evolving situation, NFDA will be updating the Frequently Asked Questions sections as new information becomes available. We will also add questions and answers should new issues emerge.
Additional Resources

• UNMC HEROES
  • https://app1.unmc.edu/nursing/heroes/
  • PPE donning and doffing videos, hospital decontamination, biological preparedness and response, etc.
• Pathogen Safety Data Sheets from the Government of Canada
  • Human coronavirus listed
  • For each pathogen has infectious agent, hazard identification, stability and viability, first aid/medical
• Nebraska Medicine COVID-19 Resources for Providers
  • https://www.nebraskamed.com/for-providers/covid19
  • PPE, protocols and checklists, specimen collection protocols
Questions?