Coronavirus Disease (COVID-19): Protecting the Public from Current Outbreak

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Objectives

1. Describe how the Coronavirus is transmitted
2. Identify current geographic distribution and possible spread of the virus
3. Identify the symptoms of a Coronavirus infection
4. Discuss key prevention and protection strategies for the Coronavirus
5. Develop communications messages for the public
Question
The current Coronavirus outbreak is:
1. The result of bioterrorism
2. A hoax
3. A new viral epidemic
4. A problem only in China and among Chinese

Question
The COVID19 epidemic appears to be:
1. More deadly than HIV
2. More infectious than measles
3. More deadly than seasonal influenza
4. More deadly among the young
Coronavirus

Enveloped +RNA virus named for solar corona-like appearance of their virions

Cause of 10 – 30% of cases of the common cold

- They replicate at lower temperatures, thus predilection for upper respiratory tract
- The corona helps the enveloped virus survive in the GI tract
- Control of transmission is difficult

What about Bats?

- Bats make up roughly 20% of all species of mammals and live to reach 40 years or more.
- Their ability to fly means they can transmit viruses far and wide.
- Bats have evolved to tolerate more viruses than other mammals and carry a significant proportion of zoonoses.
- Bats have suppressed their immune system thus allowing them to tolerate more viruses without getting sick.
  - Innate immunity likely works slightly differently in bats
- More than 500 coronaviruses in China come from bats.
  - China is a “hotspot” for bat-borne coronaviruses to emerge.
- Usually there is an intermediary animal which passes the virus to humans.
SARS-CoV

November 2002: Index patient infected in Guangzhou, in Guangdong Province.

March 2003: physician who had treated a SARS patient at a teaching hospital in Guangzhou goes to Hong Kong and spreads to others at “Hotel M” (super-spreader)

A new Coronavirus (SARS-CoV) discovered as cause of outbreak – civet cat intermediate host.

By April 2003, virus had spread to every continent on the globe, including 29 countries.

Between November 2002 to July 2003: 8,096 infections with 774 deaths (case fatality rate = 9.5%).

Source: WHO
SARS – Transmission within hospitals

Close proximity of people together with respiratory secretions makes health care workers vulnerable to transmission of droplet transmitted infections.

Before infection control measures were instituted, attack rates reached >50% in health care workers.

HCW accounted for 20-40% of the total number of SARS patients.

- Ex: One index patient directly or indirectly transmitted the infection to over 80 healthcare workers within 2 days of hospitalization.

SARS – Infection Prevention

Effective public health and infection control measures including contact tracing and quarantine of close contacts played an important role in preventing further transmission of SARS in the communities and hospitals.

- Extensive contact tracing of over 30,000 people for quarantine measures was carried out in 2003 in Beijing alone.
MERS CoV

First diagnosed September 2012, initially isolated from the respiratory tract of a patient from Bisha, Saudi Arabia.

- The patient developed severe pneumonia and acute renal failure in June 2012.

- Since 2012, there have been 2,494 cases with 858 deaths: case fatality rate = 34%
Wuhan pneumonia

Wuhan, a city in central China, is the capital of Hubei province.

31 December 2019: WHO China Country Office was informed of cases of pneumonia of unknown etiology detected in Wuhan.

07 January 2020: Chinese authorities identified a novel coronavirus (2019-nCoV) as the probable causative agent.
- Disease now named COVID-19 by WHO
- Virus named SARS-CoV-2
  (https://www.biorxiv.org/content/10.1101/2020.02.07.937862v1)

As of 29 February 2020:
- > 82,000 confirmed cases and 2,900 deaths
  - 98% are in Mainland China and 79.8% in Hubei province
- Human to Human transmission has been confirmed
  - > 1,700 HCW infections
The number of **people** that **one sick person** will infect (on average) is called $R_0$. Here are the maximum $R_0$ values for a few viruses.

- Hepatitis C (2)
- Ebola (2)
- HIV (4)
- SARS (4)
- Mumps (10)
- Measles (18)

**Wuhan coronavirus**
Most estimates put the mortality rate below 3%, and the number of transmissions between $1.5$ and $3.5$. 

**Spreads faster**
Clinical Presentation of COVID-19

- Incubation period is ~5 days
  - Ranges from 2 – 14 days
- Frequently signs and symptoms at illness onset
  - fever (83–98%)
  - dry cough (76%–82%)
  - myalgia or fatigue (11–44%)
- Chest imaging have shown bilateral involvement in most patients

Source: https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6

~ 2 - 3% Case “Fatality Rate”

https://emergency.cdc.gov/han/HAN00426.asp
Clinical Course of COVID-19

- Majority of patients have mild illness (~80%)
- Severity ranges from mild illness to severe or fatal illness
- Potential for clinical deterioration during the second week of illness
  - 23–32% of hospitalized patients required intensive care
  - ARDS developed in 17–29% of hospitalized patients
  - Secondary infections developed in 10%
  - Invasive mechanical ventilation in 4–10%
  - ECMO used in 3–5%


Global Coronavirus Outbreaks to Date

<table>
<thead>
<tr>
<th></th>
<th>SARS-CoV</th>
<th>MERS-CoV</th>
<th>2019-nCoV</th>
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</thead>
<tbody>
<tr>
<td>N</td>
<td>~8000</td>
<td>~2500</td>
<td>&gt;80,000 and counting</td>
</tr>
<tr>
<td>Case Fatality Rate</td>
<td>10%</td>
<td>35%</td>
<td>Unknown (proportion of fatal cases 2.5-3% overall; 10-15% in hospital pts)</td>
</tr>
<tr>
<td>Outbreak Contained</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
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Clinical Care

- Contact local infection control AND Public Health immediately if any concerns
- Care same as other viral pneumonias (eg influenza, RSV)
  - O2 support (invasive if needed)
  - Supportive care
- No known therapeutic or vaccine
  - Ramdesivir clinical trials ha started ([NCT04280705](https://clinicaltrials.gov/ct2/show/NCT04280705))
  - Ph 1 study of mRNA vaccine to be launched by NIH VTEUs March/April

[COVID-19 mortality rate by age](https://emergency.cdc.gov/han/HAN00426.asp)
Laboratory testing

- Contact Laboratory AND local public health if any concerns for 2019-nCoV
- Testing is only available at CDC and a few select laboratories
  - NP swab and Throat swab
  - Lower respiratory sample: sputum induced sputum, Mini-BAL or BAL
  - Serum
- Viral cultures not recommended

Criteria to Guide Evaluation of PUI for 2019-nCoV (CDC as of Feb 27, 2020)

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<tr>
<th>Clinical Features</th>
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<th>Epidemiologic Risk</th>
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<tr>
<td>Fever or signs/symptoms of lower respiratory illness (e.g., cough or shortness of breath)</td>
<td>AND</td>
<td>Any person, including healthcare workers, who has had close contact with a laboratory-confirmed COVID-19 patient within 14 days of symptom onset</td>
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<tr>
<td>Fever and signs/symptoms of a lower respiratory illness (e.g., cough or shortness of breath) requiring hospitalization</td>
<td>AND</td>
<td>A history of travel from affected geographic areas (see below) within 14 days of symptom onset</td>
</tr>
<tr>
<td>Fever with severe acute lower respiratory illness (e.g., pneumonia, ARDS) requiring hospitalization and without alternative explanatory diagnosis (e.g., influenza)</td>
<td>AND</td>
<td>No source of exposure has been identified</td>
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Quarantine vs. Isolation

Isolation
To separate ill persons who have a communicable disease from those who do not have that disease
Restricts the movement of ill persons to help stop the spread of certain diseases
Example: Isolation for patients with infectious tuberculosis

Quarantine
• To separate and restrict the movement of well persons who may have been exposed to a communicable disease
• Monitor to see if they become ill
• These people may have been exposed to a disease and do not know it, or they may have the disease but do not show symptoms.
• Quarantine can also help limit the spread of communicable disease.


Infection Control and Prevention (CDC)

• Identify, Isolate, and Inform
  • Identify patients with symptoms of respiratory illness as soon as possible and place in mask
  • Obtain travel history as soon as possible
  • If patient has traveled to areas of interest or has been in contact with a confirmed case or another PUI
    • Isolate patient as safely possible without causing alarm or disruption clinical areas
    • Maintain adherence to hand hygiene (both HCWs and patient)
  • Inform Infection Control and Public Health

https://emergency.cdc.gov/han/HAN00426.asp
Challenges in Infection Prevention

In the case of 2019-nCoV, the difficulty in controlling the virus includes:

- presence of many mild infections: difficulty in identifying and isolating cases at an early stage
- limited resources for isolation of cases and quarantine of their close contacts
- Training needed to donning and duffing PPE
  - Great video from NETEC: [https://www.youtube.com/watch?v=bG6zISnenPg](https://www.youtube.com/watch?v=bG6zISnenPg)
Personal Protective Equipment

Gown  Gloves  N-95 Respirator  Face Shield

Personal Protective Equipment are Single Use Only
Discard after leaving the patient room and perform hand hygiene

Personal Protective Equipment for COVID-19

1. Face Shield
2. N95 Respirator
3. Isolation Gown
4. One pair of gloves

Slide Courtesy of NETEC. See video at: https://www.youtube.com/watch?v=bG6zShenPg
Travel Advisories

21 January 2020: CDC issued travel advisory:
- Ongoing outbreak of pneumonia
- Person-to-person spread is occurring
- Travelers to Wuhan should avoid contact with sick people, animals, and markets.
- Travelers from Wuhan may be asked questions about health and travel history

22-23 January 2020: Chinese Health authorities issue travel restrictions to and from eight cities in Hubei province, including Wuhan city.

23 January 2020: CDC escalates travel advisory level to 3
- Avoid non-essential travel to China
- Seek evaluation if in China in last 14 days and you become ill

Week of 30 January 2020:
- Increasing restrictions in China on travel into and out of Wuhan
- Cancellation of flights to and from China by some airlines
- Increased screening at airports in U.S. and elsewhere

January 31 2020:
- Trump Administration declares a Public Health Emergency and issues strict travel restrictions

Public Health Emergencies of International Concern (PHEICs)

- 2009: Pandemic H1N1
- 2014: Polio Resurgence
- 2014: Ebola Virus Disease
- 2016: Zika
- 2020: COVID-19

“One can think of the middle of the 20th century as one of the most important social revolutions in history- the elimination of the infectious disease as a significant factor in social life”

Sir Frank MacFarland Burnet
Nobel Laureate for Medicine
Stigma

Stigmatization and discrimination are common during epidemics

“Stigmatization of potential SARS patients emerged early in the outbreak, as global media reported dramatic stories from Asia...”

Hotline: of sampled calls, 10% of callers expressed concerns related to fear, stigmatization, and discrimination. Major concerns included fear of buying Asian merchandise, working with Asians...

“In addition to their impact on human suffering, fear and stigma can seriously delay detection and treatment efforts, cooperation with contact tracing and isolation measures, and the effective distribution of resources for the prevention and control of infectious diseases.”

“Stigma is the enemy of public health”
CDC Director Dr. Robert Redfield

WHO Outbreak Communication Guidelines

- **Trust** - motive, honesty, competency (once lost, hard to regain); use credibility to counter misinformation
- **Timeliness** – first & frequent; “own” the story
- **Transparency** – candor, accountability; acknowledge unknowns, don’t overly reassure the public
- **Two-way communication** – surveillance(listen); share risk by asking more of people
- **Top-down commitment** – senior leadership onboard
Articles that public health can give the general public

1. COVID19 can make anyone sick regardless of race or ethnicity
2. The risk of getting COVID19 in the US is currently low
3. Someone who has completed quarantine or has been released from isolation does not pose a risk of infection to others
4. You can help stop COVID19 by knowing the signs and symptoms
5. There are simple things you can do to help keep yourself and others healthy


Five Communication Pitfalls

- Mixed messages from multiple experts
- Information released late
- Paternalistic attitudes
- Not countering rumors and myths in real time
- Public power struggles and confusion
Non-pharma Measures

- Border screenings/closures
- Mass gatherings
- Public transportation
- School closures
- Isolation of sick

School Closure

- Types of school closure: school, class dismissal, reactive closure, proactive closure
- Things to consider: timing of closure/intervention in the outbreak, disruption for healthcare systems, effects on communities, social and ethical issues (lower SES families will likely be disproportionately affected by a given intervention), cost/benefit analysis
- Cost effectiveness of closing schools. Think about the economic and social impact of closing schools in regard to the epidemiologic data available

Need to consider likely public response: “most respondents would comply with recommendations but would be challenged to do so if their income or job were severely compromised”

“During a pandemic, short-duration, rapid-turnaround public surveys can provide timely information to public health officials about the acceptability of recommendations and needed communication to the public if problems are found.”


The Future
Rapid Diagnostic Test
Antiviral Therapy?
Identification of “Super” spreaders, transmission routes, period of infectivity
Spectrum of Disease:
◦ asymptomatic transmission
Vaccines
Understanding why outbreak occurred
Additional Resources

- CDC
  - [https://www.cdc.gov/coronavirus/about/index.html](https://www.cdc.gov/coronavirus/about/index.html)

- WHO
  - [https://www.who.int/health-topics/coronavirus](https://www.who.int/health-topics/coronavirus)

- IDSA:
  - [https://www.idsociety.org/public-health/Novel-Coronavirus/](https://www.idsociety.org/public-health/Novel-Coronavirus/)

- FDA:

- Journals:
  - NEJM: [https://www.nejm.org/coronavirus](https://www.nejm.org/coronavirus)
  - JAMA: [https://jamanetwork.com/journals/jama/pages/coronavirus-alert](https://jamanetwork.com/journals/jama/pages/coronavirus-alert)
  - Science: [https://www.sciencemag.org/tags/coronavirus](https://www.sciencemag.org/tags/coronavirus)