2019 Novel Coronavirus (2019-nCoV) – Clinician Update

Julio Figueroa, MD
Joseph Kanter, MD, MPH
Joanne Maffei, MD
All participants are required to complete an evaluation for this activity. Please submit one at the end of this session or complete one electronically using the tag reader system.
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Disclosure

Julio Figueroa, MD
Joseph Kanter, MD, MPH
Joanne Maffei, MD

I **do not** have relationship(s) with commercial interests.
Learning Objectives

• Describe the isolation precautions needed to care for a patient that may have this novel coronavirus
• Describe the Public Health response to this outbreak
• Explain possible vaccine targets based on virology of the 2019 Novel Coronavirus
Part 1

2019 NOVEL CORONAVIRUS OUTBREAK AND CLINICAL INFO
New Virus Discovered by Chinese Scientists Investigating Pneumonia Outbreak

Latest tally of people sickened in Wuhan is 59, with 7 in a critical condition

Chinese scientists investigating a mystery illness that has sickened dozens in central China have discovered a new strain of coronavirus, a development that will test the country’s upgraded capabilities for dealing with unfamiliar infectious diseases.

The novel coronavirus was genetically sequenced from a sample from 1 patient and subsequently found in some of the others affected in the city of Wuhan, according to people familiar with the findings. Chinese authorities haven’t concluded that the strain is the underlying cause of sickness in all the patients who have been isolated in Wuhan since the infection 1st broke out in early December [2019], the people said.

There are many known coronaviruses -- some can cause ailments like common colds in humans, while others don't affect humans at all. Some - such as severe acute respiratory syndrome, or SARS, in 2003 - have led to deadly outbreaks, lending urgency to efforts to contain the current situation.

High Alert

Some past coronavirus outbreaks, such as SARS and MERS, have had high death rates. Yet, there is no suggestion this new illness would cause such issues so far.
BACK TO THE FUTURE
SARS OUTBREAK 2003
Severe Acute Respiratory Syndrome (SARS)

- SARS-CoV – SARS associated coronavirus
- Highlighted numerous breaches in Infection Prevention and Control, use of PPE
- Respiratory Hygiene/Cough Etiquette – emphasized
- Healthcare worker infections and deaths
- Rapid worldwide spread
- No cases in the world since 2004
  - (in China – laboratory acquired)
SARS Timeline (OPH)

1. 11/16/02 FOSHAN
   First case in city

2. 02/02/03 CHINESE NEW YEAR
   Millions of infected migrants in Guangdong return home and spread the disease

3. 02/12/93 CANTON
   The provincial government reports 305 cases / 5 deaths.

4. 02/15/03 HONG KONG
   An infected physician from Canton comes to Hotel Metropole. He contaminates several other persons

5. 03/02/03 HANOI
   A business man from Hong Kong is hospitalized and infects several care providers

6. 03/05/03 CANADA
   A Canadian infected at Hotel M brings SARS to Toronto

7. 03/12/03 SWITZERLAND
   WHO Alert

8. To EUROPE & USA
Spread from Hotel M
Reported as of March 28, 2003 (CDC)

- Guangdong Province, China
- Hong Kong SAR
  - 95 HCW
  - >100 close contacts
- Vietnam
  - 37 HCW
  - 21 close contacts
- Singapore
  - 34 HCW
  - 37 close contacts
- United States
  - 1 HCW
- Canada
  - 18 HCW
  - 11 close contacts
- Ireland
  - 0 HCW

Additional cases reported:
- I, L, M
FIGURE 2. Probable cases of severe acute respiratory syndrome, by reported source of infection* — Singapore, February 25–April 30, 2003

Patient 1 represents Case 1; Patient 6, Case 2; Patient 35, Case 3; Patient 130, Case 4; and Patient 127, Case 5. Excludes 22 cases with either no or poorly defined direct contacts or who were cases translocated to Singapore and the seven contacts of one of these cases.

SARS 11/1/02 - 7/31/03 Stats

– Worldwide - 8098 cases, 774 deaths
– Case fatality ratio 9.6% (0 – 50% range)
  • Toronto - overall fatality - 12 %
  • over 65 yrs old 28/61 =  46% fatality
– 1707 (21%) HCW infected
– Cost to US - 30 to 100 billion US dollars
– Cost to China - 48 billion US dollars
– Disaster for Toronto Hospitals - shut down
MIDDLE EAST RESPIRATORY SYNDROME CORONAVIRUS (MERS-CoV)
MERS Epidemiology

• MERS-CoV - first identified in Saudi Arabia in 2012

• Zoonotic virus with pandemic potential
  – Humans infected through direct or indirect contact with infected dromedary camels
  – Virus may have originated in bats and was transmitted to camels sometime in distant past

• Human-to-human transmission – limited, close contact (HCW, family), no sustained transmission

MERS Epidemiology
WHO 4/2012 – 12/2019

• 2499 cases lab-confirmed MERS
  – 861 deaths - Case-fatality rate 34.4%
  – 27 countries reported cases globally

• Majority of cases from Saudi Arabia
  – 2106 cases
  – 783 deaths - Case-fatality rate 37.2%

http://www.emro.who.int/health-topics/mers-cov/mers-outbreaks.html
MERS United States Cases

- 5/2/2014 HCW who worked in hospital in Saudi Arabia which had MERS patients – Indiana
- 5/11/2014 HCW who lived and worked in Saudi Arabia – Florida
- US Cases not linked
2019 NOVEL CORONAVIRUS
(2019-nCoV)
2019-nCoV EPIDEMIOLOGY
Saturday 2/1/2020
Monday 2/3/2020
Coronavirus 2019-nCoV Global Cases by Johns Hopkins CSSE

Total Confirmed: 24,505

Confirmed Cases by Country/Region:
- 24,292 Mainland China
- 25 Thailand
- 24 Singapore
- 22 Japan
- 18 Hong Kong
- 16 South Korea
- 13 Australia
- 12 Germany
- 11 US
- 11 Taiwan
- 10 Macau

Total Deaths: 493

- 479 deaths: Hubei Mainland China
- 2 deaths: Henan Mainland China
- 2 deaths: Chongqing Mainland China
- 1 death: Sichuan Mainland China
- 1 death: Shanghai Mainland China

Total Recovered: 906

- 520 recovered: Hubei Mainland China
- 65 recovered: Zhejiang Mainland China
- 41 recovered: Henan Mainland China
- 35 recovered: Hunan Mainland China
- 32 recovered: Guangdong Mainland China

Data sources: WHO, CDC, ECDC, NHC and DXY. Read more in this blog. Contact us.
Point level: City level - US, Canada and Australia; Province level - China; Country level - other.

LSU Health
School of Medicine

Tuesday 2/4/2020
Coronavirus 2019-nCoV Global Cases by Johns Hopkins CSSE

Total Confirmed: 28,274

Confirmed Cases by Country/Region:
- Mainland China: 28,017
- Japan: 45
- Singapore: 28
- Thailand: 25
- South Korea: 23
- Hong Kong: 21
- Australia: 14
- Germany: 12
- US: 12
- Malaysia: 12
- Taiwan: 11
- Vietnam: 10

Last Updated at 2/5/2020, 10:13 PM

Wednesday 2/5/2020
Thursday 2/6/2020
Map of US Cases as of 2/5/20 (n=11)

Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus–Infected Pneumonia

Qun Li, M.Med., Xuhua Guan, Ph.D., Peng Wu, Ph.D., Xiaoye Wang, M.P.H.,
Lei Zhou, M.Med., Yeqing Tong, Ph.D., Ruiqi Ren, M.Med.,
Kathy S.M. Leung, Ph.D., Eric H.Y. Lau, Ph.D., Jessica Y. Wong, Ph.D.,
Xuesen Xing, Ph.D., Nijuan Xiang, M.Med., Yang Wu, M.Sc., Chao Li, M.P.H.,
Qi Chen, M.Sc., Dan Li, M.P.H., Tian Liu, B.Med., Jing Zhao, M.Sc.,
Rui Yang, M.Med., Qi Wang, M.P.H., Suhua Zhou, M.Med., Rui Wang, M.D.,
Huan Li, M.P.H., Zhongfa Tao, M.P.H., Yang Yang, M.Med.,
Zhiqiang Deng, M.Med., Boxi Liu, M.P.H., Zhitao Ma, M.Med.,
Yanping Zhang, M.Med., Guoqing Shi, M.P.H., Tommy T.Y. Lam, Ph.D.,
Joseph T. Wu, Ph.D., George F. Gao, D.Phil., Benjamin J. Cowling, Ph.D.,
Bo Yang, M.Sc., Gabriel M. Leung, M.D., and Zijian Feng, M.Med.
2019-nCoV Pneumonia

• December 29, 2019 – the first 4 cases reported by local hospitals using surveillance mechanism for “pneumonia of unknown etiology” that was established after SARS outbreak
  – all cases linked to the Huanan (Southern China) Seafood Wholesale Market
2019-nCoV Pneumonia

• First 425 cases
  – Median age 59 years (15 – 89 range)
  – 56% male (240/425)
  – Majority of cases (55%) with onset before 1/1/20 were linked to the Hunan Seafood Wholesale Market

• 8.6% of subsequent cases were linked
2019-nCoV Pneumonia

• Mean incubation period 5.2 days
• Duration from illness onset to first medical visit mean 4.6 - 5.8 days
• Duration from illness onset to hospital admission 9.1 – 12.5 days
• Reproductive number - approximately 2.2
  – each patient spreads infection to 2.2 other people
2019-nCoV Clinical Presentation

• CAVEAT
  – Data based on clinically identified cases mostly inpatients with pneumonia
  – Nearly all reported cases are in adults
  – MAY change as more cases are analyzed

2019-nCoV Clinical Presentation

• Clinical signs and symptoms at illness onset
  – Fever (83–98%) – can be prolonged or intermittent
  – Cough (76%–82%)
  – Myalgia or fatigue (11–44%)
  – Less common
    • Sputum production, hemoptysis
    • Diarrhea
    • Headache
  – ??? % asymptomatic ???

A Novel Coronavirus from Patients with Pneumonia in China, 2019

Na Zhu, Ph.D., Dingyu Zhang, M.D., Wenling Wang, Ph.D., Xingwang Li, M.D., Bo Yang, M.S., Jingdong Song, Ph.D., Xiang Zhao, Ph.D., Baoying Huang, Ph.D., Weifeng Shi, Ph.D., Roujian Lu, M.D., Peihua Niu, Ph.D., Faxian Zhan, Ph.D., Xuejun Ma, Ph.D., Dayan Wang, Ph.D., Wenbo Xu, M.D., Guizhen Wu, M.D., George F. Gao, D.P.Hil., and Wenjie Tan, M.D., Ph.D., for the China Novel Coronavirus Investigating and Research Team

61 y/o male reported fever and cough on 12/20/2019
He had been frequent visitor to the seafood wholesale market
He was admitted 12/27/2019 (day 7) in respiratory distress
CXR A (top) is day 8 of illness
Worsened over the next 2 days
Mechanical ventilation started
CXR B (bottom) is day 11 of illness
Patient died on January 9 (day 20)
2019-nCoV Clinical Presentation

- Severity of clinical course variable
  - Asymptomatic <-> ARDS and death
  - 1/3 to 1/2 patients with comorbidities
    - Including DM, HTN, CVD

Family cluster all tested positive

*Chan, The Lancet, 2020*
DOI: 10.1016/S0140-6736(20)30154-9

2019-nCoV Clinical Presentation

- Severity of clinical course variable
  - Asymptomatic <-> ARDS and death
  - 1/3 to 1/2 patients with comorbidities
    - Including DM, HTN, CVD

Family cluster all tested positive

Symptomatic 65 years
Symptomatic 66 years
Symptomatic 37 years

Chan, The Lancet, 2020
DOI: 10.1016/S0140-6736(20)30154-9

2019-nCoV Clinical Presentation

• Severity of clinical course variable
  – Asymptomatic <-> ARDS and death
  – 1/3 to 1/2 patients with comorbidities
    • Including DM, HTN, CVD

Family cluster all tested positive

Symptomatic 65 years
Symptomatic 66 years
Symptomatic 37 years
Asymptomatic 10 years

Chan, The Lancet, 2020
DOI: 10.1016/S0140-6736(20)30154-9

2019-nCoV Clinical Presentation

- Lab abnormalities
  - CBC
    - Leukopenia (9–25%)
    - Leukocytosis (24–30%)
    - Lymphopenia (63%)
  - Elevated AST ALT (37%)
  - Procalcitonin – mostly normal on admission

- Radiography CT chest
  - Multiple areas of consolidation
  - Ground glass appearance

2019-nCoV Clinical Presentation

• Progression in more severe cases
  – Worsening noted median 8 days after symptoms
  – ARDS - 17–29% of hospitalized patients
    • ICU - 23–32%
    • Mechanical ventilation - 4–10%
  – Secondary infection - ~10%
  – Acute cardiac injury - 12%
  – Acute kidney injury 4–7%

• Mortality rate for hospitalized pneumonia pts - as high as 11–15%

• Overall mortality – ~2-4%

2019-nCoV Clinical Presentation

• Treatment
  – Supportive care
  – Treat secondary infections
  – AVOID steroids unless absolutely needed
    • Prolonged MERS shedding
  – Other potential antiviral treatment to be discussed later

<table>
<thead>
<tr>
<th></th>
<th>2019-nCoV*</th>
<th>MERS-CoV</th>
<th>SARS-CoV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographic</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>December, 2019</td>
<td>June, 2012</td>
<td>November, 2002</td>
</tr>
<tr>
<td>Location of first detection</td>
<td>Wuhan, China</td>
<td>Jeddah, Saudi Arabia</td>
<td>Guangdong, China</td>
</tr>
<tr>
<td>Age, years (range)</td>
<td>49 (21–76)</td>
<td>56 (14–94)</td>
<td>39·9 (1–91)</td>
</tr>
<tr>
<td>Male:female sex ratio</td>
<td>2·7:1</td>
<td>3·3:1</td>
<td>1:1·25</td>
</tr>
<tr>
<td>Confirmed cases</td>
<td>835†</td>
<td>2494</td>
<td>8096</td>
</tr>
<tr>
<td>Mortality</td>
<td>25† (2·9%)</td>
<td>858 (37%)</td>
<td>744 (10%)</td>
</tr>
<tr>
<td>Health-care workers</td>
<td>16‡</td>
<td>9·8%</td>
<td>23·1%</td>
</tr>
<tr>
<td><strong>Symptoms</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fever</td>
<td>40 (98%)</td>
<td>98%</td>
<td>99–100%</td>
</tr>
<tr>
<td>Dry cough</td>
<td>31 (76%)</td>
<td>47%</td>
<td>29–75%</td>
</tr>
<tr>
<td>Dyspnoea</td>
<td>22 (55%)</td>
<td>72%</td>
<td>40–42%</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>1 (3%)</td>
<td>26%</td>
<td>20–25%</td>
</tr>
<tr>
<td>Sore throat</td>
<td>0</td>
<td>21%</td>
<td>13–25%</td>
</tr>
<tr>
<td>Ventilatory support</td>
<td>9·8%</td>
<td>80%</td>
<td>14–20%</td>
</tr>
</tbody>
</table>

Data are n, age (range), or n (%) unless otherwise stated. 2019-nCoV=2019 novel coronavirus. MERS-CoV=Middle East respiratory syndrome coronavirus. SARS-CoV=severe acute respiratory syndrome coronavirus. *Demographics and symptoms for 2019-nCoV infection are based on data from the first 41 patients reported by Chaolin Huang and colleagues (admitted before Jan 2, 2020).† Case numbers and mortalities are updated up to Jan 21, 2020) as disclosed by the Chinese Health Commission. ‡ Data as of Jan 23, 2020. § Data as of Jan 21, 2020.

Table: Characteristics of patients who have been infected with 2019-nCoV, MERS-CoV, and SARS-CoV*.
CDC estimates* that, from October 1, 2019, through January 25, 2020, there have been:

- 19,000,000 – 26,000,000 flu illnesses
- 8,600,000 – 12,000,000 flu medical visits
- 180,000 – 310,000 flu hospitalizations
- 10,000 – 25,000 flu deaths

[https://www.cdc.gov/flu/about/burden/preliminary-in-season-estimates.htm](https://www.cdc.gov/flu/about/burden/preliminary-in-season-estimates.htm)
Respiratory Hygiene
Cough Etiquette
Respiratory Hygiene/Cough Etiquette

• Cover the nose/mouth when coughing or sneezing

• Use tissues to contain respiratory secretions and dispose of them in the nearest waste receptacle after use

• Perform hand hygiene (e.g., hand washing with soap and water, or alcohol-based hand rub) after having contact with respiratory secretions and contaminated objects
Respiratory Protection

- Droplet Precaution distance - 6 ft. from pt.
  - Can get 15 - 20 ft. projection - cough or sneeze
- Factors influencing infectiousness
  - Organism
  - Environmental
  - Droplet size and composition
  - Mucinous and proteinaceous material from ill patients different than experimental particles
- Multiple variables during outbreak - interventions, adherence, exposures at home and hospital
Quantifying Exposure Risk: Surgical Masks and Respirators

- “Source” and “Recipient” head

- Source control with good air exchanges overwhelmingly more important than what mask the recipient was wearing
Interim Infection Prevention and Control Recommendations for Patients with Confirmed 2019 Novel Coronavirus (2019-nCoV) or Patients Under Investigation for 2019-nCoV in Healthcare Settings

Updated February 3, 2020

Minimize Chance for Exposures

• Before Arrival
  – instruct patients to call ahead and inform about respiratory symptoms, wear facemask upon entry
  – EMS should contact the facility
  – Post signage

• Upon Arrival and During Visit
  – Respiratory hygiene cough etiquette, hand hygiene
  – Rapid triage and remove from general population
  – Have patient wait in car and call on cell phone

Standard, Contact, Airborne Precautions Including Eye Protection

• Patient placement in Airborne Infection Isolation Room (AIIR) (negative pressure)
  – Keep door closed
  – Monitor negative pressure
  – Facemask on patient when transport out of room medically necessary

• If no AIIR available, place patient in private room, keep facemask on patient at all times

Facemask for Patients

Ear loop mask preferred
Standard, Contact, Airborne Precautions Including Eye Protection

- Personnel entering room use PPE
- Only essential personnel enter room
- Keep a log of personnel entering room
- Dedicated or disposable equipment
- After patient leaves the room – allow time for air to clear, wear mask if need to enter room
- Environmental cleaning of room

Personal Protective Equipment (PPE)

• Hand Hygiene before and after use
• Gowns
• Gloves

Personal Protective Equipment (PPE)

- fit-tested NIOSH-certified disposable N95 filtering respirator
  - **NO BEARDS!!!**
- If powered air purifying respirator (PAPR) used, clean and disinfect after each use

Personal Protective Equipment (PPE)

• Eye protection
  – Disposable Face shield that covers front and sides of face
  – Goggles
  – Reusable goggles must be cleaned and disinfected
SEQUENCE FOR PUTTING ON PERSONAL PROTECTIVE EQUIPMENT (PPE)

The type of PPE used will vary based on the level of precautions required, such as standard and contact, droplet or airborne infection isolation precautions. The procedure for putting on and removing PPE should be tailored to the specific type of PPE.

1. GOWN
   - Fully cover torso from neck to knees, arms to end of wrists, and wrap around the back
   - Fasten in back of neck and waist

2. MASK OR RESPIRATOR
   - Secure ties or elastic bands at middle of head and neck
   - Fit flexible band to nose bridge
   - Fit snug to face and below chin
   - Fit-check respirator

3. GOGGLES OR FACE SHIELD
   - Place over face and eyes and adjust to fit

4. GLOVES
   - Extend to cover wrist of isolation gown

USE SAFE WORK PRACTICES TO PROTECT YOURSELF AND LIMIT THE SPREAD OF CONTAMINATION

- Keep hands away from face
- Limit surfaces touched
- Change gloves when torn or heavily contaminated
- Perform hand hygiene
HCW N95 Respirator/Eye Protection

Hospital Respiratory Protection Program Toolkit: Resources for Respirator Program Administrators May 2015
Three Key Factors Required for a Respirator to be Effective

Correct*

1. The respirator must be put on correctly and worn during the exposure.

2. The respirator must fit snugly against the user’s face to ensure that there are no gaps between the user’s skin and respirator seal.

Incorrect

3. The respirator filter must capture more than 95% of the particles from the air that passes through it.

*If your respirator has a metal band or a molded nose cushion, it should rest over the nose and not the chin area.

School of Medicine
Putting On The Respirator

1. Position the respirator in your hands with the nose piece at your fingertips.
2. Cup the respirator in your hand allowing the headbands to hang below your hand. Hold the respirator under your chin with the nosepiece up.
3. The top strap (on single or double strap respirators) goes over and rests at the top back of your head. The bottom strap is positioned around the neck and below the ears. Do not crisscross straps.
4. Place your fingertips from both hands at the top of the metal nose clip (if present). Slide fingertips down both sides of the metal strip to mold the nose area to the shape of your nose.

Checking Your Seal

1. Place both hands over the respirator, take a quick breath in to check whether the respirator seals tightly to the face.
2. Place both hands completely over the respirator and exhale. If you feel leakage, there is not a proper seal.
3. If air leaks around the nose, readjust the nosepiece as described. If air leaks at the mask edges, re-adjust the straps along the sides of your head until a proper seal is achieved.
4. If you cannot achieve a proper seal due to air leakage, ask for help or try a different size or model.
HOW TO SAFELY REMOVE PERSONAL PROTECTIVE EQUIPMENT (PPE)
EXAMPLE 2

Here is another way to safely remove PPE without contaminating your clothing, skin, or mucous membranes with potentially infectious materials. Remove all PPE before exiting the patient room except a respirator, if worn. Remove the respirator after leaving the patient room and closing the door. Remove PPE in the following sequence:

1. GOWN AND GLOVES
   • Gown front and sleeves and the outside of gloves are contaminated!
   • If your hands get contaminated during gown or glove removal, immediately wash your hands or use an alcohol-based hand sanitizer
   • Grasp the gown in the front and pull away from your body so that the ties break, touching outside of gown only with gloved hands
   • While removing the gown, fold or roll the gown inside-out into a bundle
   • As you are removing the gown, peel off your gloves at the same time, only touching the inside of the gloves and gown with your bare hands. Place the gown and gloves into a waste container

2. GOGGLES OR FACE SHIELD
   • Outside of goggles or face shield are contaminated!
   • If your hands get contaminated during goggle or face shield removal, immediately wash your hands or use an alcohol-based hand sanitizer
   • Remove goggles or face shield from the back by lifting head band and without touching the front of the gogggles or face shield
   • If the item is reusable, place in designated receptacle for reprocessing. Otherwise, discard in a waste container

3. MASK OR RESPIRATOR
   • Front of mask/respirator is contaminated — DO NOT TOUCH!
   • If your hands get contaminated during mask/respirator removal, immediately wash your hands or use an alcohol-based hand sanitizer
   • Grasp bottom ties or elastics of the mask/respirator, then the ones at the top, and remove without touching the front
   • Discard in a waste container

4. WASH HANDS OR USE AN ALCOHOL-BASED HAND SANITIZER IMMEDIATELY AFTER REMOVING ALL PPE

PERFORM HAND HYGIENE BETWEEN STEPS IF HANDS BECOME CONTAMINATED AND IMMEDIATELY AFTER REMOVING ALL PPE
Removing Your Respirator

DO NOT TOUCH the front of the respirator! It may be contaminated!

Remove by pulling the bottom strap over back of head, followed by the top strap, without touching the respirator.

Discard in waste container. WASH YOUR HANDS!
Aerosol-Generating Procedures

• Sputum induction, open suctioning of airways
• Collecting diagnostic respiratory specimens
  – likely to induce coughing or sneezing
• Should take place in an AIIR or exam room with door closed
• Consider using PAPR
Healthcare personnel wearing a powered air-purifying respirator while treating a patient.
Duration of Isolation Precautions

- Case-by-case basis in conjunction with local, state and federal health authorities
Manage Visitor Access and Movement

• Restrict visitors from entering room of known or suspected 2019-nCoV patients
• Use video conferencing, calls on phone/tablet
• Consider exceptions - end-of-life, psychosocial
• Schedule and control access of visitors
  – Screen for acute respiratory illness before entering
  – Maintain log
Healthcare Personnel

• Monitor exposed healthcare workers according to public health recommendations
• Sick leave policies should be non-punitive, flexible and c/w public health recs
• Train and educate
• Medically clear, fit test for N95 mask
• Medically clear and train for PAPR
Infection Prevention and Control Precautions for 2019-nCoV

• Airborne
  – Airborne Infection Isolation Room (AIIR)
  – N95 respirator

• Contact
  – Gowns
  – Gloves
  – Eye Protection: goggles or face shield
Infection Prevention and Control
Precautions for 2019-nCoV

• Caution w/aerosol-generating procedures
  – bronchoscopy, sputum induction, intubation, extubation, CPR, open suctioning of airways
Criteria for Patients Under Investigation (PUI) for 2019-nCoV (2/2/2020)

<table>
<thead>
<tr>
<th>Clinical Features</th>
<th>&amp;</th>
<th>Epidemiologic Risk</th>
</tr>
</thead>
<tbody>
<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 health care workers, who has had close contact with a laboratory-confirmed 2019-nCoV patient within 14 days of symptom onset</td>
</tr>
<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 Hubei Province, China within 14 days of symptom onset</td>
</tr>
</tbody>
</table>

Fever may be subjective or confirmed
Close contact – within 6 feet, contact with infectious secretions
Discuss with Health Departments on case-by-case basis

2019-nCoV Process at UMC

- Travel screening
- Isolate
- Notify
  - Infection Prevention and Control
    - Infectious Diseases on call if after hours/weekend
  - Administrator On Call
  - Microbiology Lab
  - Louisiana Department of Health (800) 256-2748
Laboratory Testing for 2019-nCoV

- LDH (800) 256-2748 for approval of testing
- Lower Respiratory – BAL, sputum
- Upper Respiratory – Includes one of the following types:
  - Nasopharyngeal AND Oropharyngeal swab OR
  - Nasopharyngeal wash/aspirate or nasal aspirate
- Blood (Serum)
- Stool and Urine
There’s an App for that...

- UMC specific information
  UMC Companion App -> UMCNO Kit -> Infection Control -> Coronavirus Updates
- No App, no problem
  – access the App online via the University Medical Center Intranet (Link available from the desktop)
  – https://companion.umcno.org/
Part 2

2019 NOVEL CORONAVIRUS
PUBLIC HEALTH RESPONSE
Public Health Response to a Fast-Paced Epidemic
Timeline of Key Events and Interventions

- **Dec 21, 2019**: 1\textsuperscript{st} case of pneumonia of unknown etiology presents to hospital in Wuhan City, China

- **Dec 27**: 3 additional patients (49F, 61M, 32M) admitted to hospitals in Wuhan City with severe pneumonia of unknown etiology
Patient 2

A Novel Coronavirus from Patients with Pneumonia in China, 2019.
Timeline of Key Events and Interventions

• **Dec 29:** 4 pneumonia cases in Wuhan linked to Hunan Seafood Wholesale Market

• **Dec 31:** China announces to WHO an outbreak of respiratory illnesses, cause unknown

• **Jan 1, 2020:** China closes the Hunan Seafood Wholesale Market

• **Jan 3:** China completes genome sequencing of novel virus
Timeline of Key Events and Interventions

- **Jan 4:** FDA grants CDC “Emergency Use Authorization” to develop and implement a PCR diagnostic test

- **Jan 7:** China announces outbreak is due to a novel coronavirus; CDC stands up their incident Management Structure

- **Jan 10:** China publically shares genome sequencing

- **Jan 13:** 1st case outside of China identified (Thailand)
Timeline of Key Events and Interventions

- **Jan 15:** China raises their Emergency Response Level to 1
- **Jan 16:** China enacts exit screening for individuals wishing to leave Hubei Province, anyone febrile barred from leaving
- **Jan 17:** US-bound travelers from Wuhan City routed by DHS to SFO, LAX, or JFK airports, soon expanded to ATL and ORD. Accounts for 85% of pre-outbreak traveler volume from Wuhan to US.
Timeline of Key Events and Interventions

- **Jan 19:** 1st case in China outside of Hubei Province announced (although almost certainly there had been others); 35M presents to an urgent care in Snohomish County, Washington reporting 4 days of fever and cough, returned from Wuhan City 4 days prior

- **Jan 20:** Washington State announces 1st US case

- **Jan 21:** CDC activates 24-hr Emergency Operations Center
Timeline of Key Events and Interventions

- **Jan 23**: WHO International Health Regulations Emergency Committee meets, declines to declare PH Emergency

- **Jan 24**: China restricts travel in/out of Hubei Province; CDC makes assay protocol for PCR test publically available and announces they are growing virus in cell cultures to be made available for research
  
  *830 cases in 9 countries, 26 deaths*

- **Jan 27**: CDC issues Level 3 travel notice for China
Timeline of Key Events and Interventions

- **Jan 29**: US State Dept evacuates 195 Americans from Wuhan

- **Jan 30**: International Health Regulations Emergency Committee of WHO reconvenes, declares 2019-nCoV a “Public Health Emergency of International Concern (PHEIC)”
  
  9,976 cases in 21 countries

- **Jan 31**: Secretary Azar declares federal PH Emergency and signs “Proclamation of Suspension of Entry as Immigrants and Nonimmigrants of Persons who Pose a Risk of Transmitting 2019 Novel Coronavirus”
Timeline of Key Events and Interventions

- **Feb 4:** FDA grants CDC emergency allowance to share PCR test with state PH labs; 2 additional repatriation flights leave Wuhan for US, approx. 550 Americans
  
  *20,471 cases in 27 countries, 425 deaths, 11 US cases*

- **Feb 6:** CDC begins shipping RT-PCR test kits to state PH labs and international partners; China implements massive quarantine complexes in Wuhan City

  As of 5pm on Feb 6:

  *31,161 cases in 28 countries, 636 deaths, 12 US cases with 76 PUI pending results (206 PUI tested negative)*
Entry Screening and Risk Stratification

• Aggressive entry restrictions

• Allowed travelers from China routed to 1 of 11 airports: JFK, ORD, SFO, SEA, HNL, LAX, ATL, IAD, EWR, DFW, DTW

• CDC and CBP performing screening...
High Risk

- Living in the same household as, being an intimate partner of, or providing care in a nonhealthcare setting (such as a home) for a person with symptomatic laboratory-confirmed 2019-nCoV infection **without using recommended precautions** for home care and home isolation
  - The same risk assessment applies for the above-listed exposures to a person diagnosed clinically with 2019-nCoV infection outside of the United States who did not have laboratory testing.
- Travel from Hubel Province, China

Medium Risk

- Close contact with a person with symptomatic laboratory-confirmed 2019-nCoV infection, and not having any exposures that meet a high-risk definition.
  - The same risk assessment applies for close contact with a person diagnosed clinically with 2019-nCoV infection outside of the United States who did not have laboratory testing.
  - On an aircraft, being seated within 6 feet (two meters) of a traveler with symptomatic laboratory-confirmed 2019-nCoV infection; this distance correlates approximately with 2 seats in each direction ([refer to graphic above](#)).
- Living in the same household as, an intimate partner of, or caring for a person in a nonhealthcare setting (such as a home) to a person with symptomatic laboratory-confirmed 2019-nCoV infection **while consistently using recommended precautions** for home care and home isolation
- Travel from mainland China outside Hubel Province AND not having any exposures that meet a high-risk definition

Low Risk

- Being in the same indoor environment (e.g., a classroom, a hospital waiting room) as a person with symptomatic laboratory-confirmed 2019-nCoV infection for a prolonged period of time but not meeting the definition of close contact.
- On an aircraft, being seated within two rows of a traveler with symptomatic laboratory-confirmed 2019-nCoV infection but not within 6 feet (2 meters) ([refer to graphic above](#)) AND not having any exposures that meet a medium- or a high-risk definition ([refer to graphic above](#))
<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Movement Restrictions and Public Activities</th>
<th>Medical Evaluation</th>
<th>Travel</th>
</tr>
</thead>
<tbody>
<tr>
<td>High risk</td>
<td>Immediate isolation.</td>
<td>Medical evaluation is recommended; diagnostic testing for 2019-nCoV should be guided by CDC’s PUI definition but is recommended for symptomatic people with a known high-risk exposure. If medical evaluation is needed, it should occur with pre-notification to the receiving HCF and EMS, if EMS transport indicated, and with all recommended infection control precautions in place.</td>
<td>Controlled; air travel only via air medical transport. Local travel is only allowed by medical transport (e.g., ambulance) or private vehicle while symptomatic person is wearing a face mask.</td>
</tr>
<tr>
<td>Medium risk</td>
<td>Immediate isolation.</td>
<td>Medical evaluation and care should be guided by clinical presentation; diagnostic testing for 2019-nCoV should be guided by CDC’s PUI definition. If medical evaluation is needed, it should occur with pre-notification to the receiving HCF and EMS, if EMS transport indicated, and with all recommended infection control precautions in place.</td>
<td>Controlled; air travel only via approved air medical transport. Local travel is only allowed by medical transport (e.g., ambulance) or private vehicle while symptomatic person is wearing a face mask.</td>
</tr>
<tr>
<td>Low risk</td>
<td>Recommendation to avoid contact with others and public activities while symptomatic</td>
<td>Person should seek health advice to determine if medical evaluation is needed. If sought, medical evaluation and care should be guided by clinical presentation; diagnostic testing for 2019-nCoV should be guided by CDC’s PUI definition.</td>
<td>Recommendation to not travel on long-distance commercial conveyances or local public transport while symptomatic</td>
</tr>
<tr>
<td>No Identifiable Risk</td>
<td>No restriction</td>
<td>Routine medical care</td>
<td>No restriction</td>
</tr>
</tbody>
</table>
# ASYMPTOMATIC

<table>
<thead>
<tr>
<th>Risk Category</th>
<th>Movement Restrictions and Public Activities</th>
<th>Monitoring</th>
<th>Travel</th>
</tr>
</thead>
<tbody>
<tr>
<td>High risk</td>
<td>Remain quarantined (voluntary or under public health orders on a case-by-case basis) in a location to be determined by public health authorities. No public activities.</td>
<td>Daily active monitoring</td>
<td>Controlled</td>
</tr>
</tbody>
</table>
| Medium risk        | To the extent possible, remain at home or in a comparable setting. Avoid congregate settings, limit public activities, and practice social distancing.                                                                                                   | Travelers from mainland China outside Hubei Province with no known high-risk exposure: Self-monitoring with public health supervision  
All others in this category: Active monitoring | Recommendation to postpone additional long-distance travel after they reach their final destination. People who intend to travel should be advised that they might not be able to return if they become symptomatic during travel. |
| Low risk           | No restriction                                                                                                                                                                                                                             | Self-observation                            | No restriction                |
| No Identifiable Risk | No restriction                                                                                                                                                                                                                           | None                                        | No restriction                |
Entry Screening and Risk Stratification

• For shipping (Port of New Orleans)
  – Duration of travel is protective
  – Standard notifications via CDC quarantine station if ill passenger and within 15 days of port
  – Additional notification if China among last 5 ports of call
Louisiana Department of Health Role

- Identify potential cases in conjunction with front-line clinicians, test when indicated
  - 24-hr ID-Epi Hotline: 800.256.2748

- Oversee active monitoring of returning travelers when indicated

- Provide education
  - ldh.la.gov/coronavirus
  - Coronavirus General Info Line: 855.523.2652
Louisiana Department of Health Role

• **If a confirmed case...**
  – Establish isolation and/or quarantine if indicated
  – Preform contact tracing
  – Emergency declarations as necessary
How should we judge the response?
Part 3

2019 NOVEL CORONAVIRUS VIROLOGY
Coronaviruses

Photo Credit: Content Providers(s): CDC/Dr. Fred Murphy - Centers for Disease Control and Prevention’s Public Health Image Library (PHIL), with identification number #4814.
Coronaviruses

Adapted from Lai and Homes. In Fields' Virology. Lippincott
Coronaviruses

Adapted from Lai and Homes. In Fields’ Virology. Lippincott

Zhou, https://doi.org/10.1101/2020.01.22.914952
Common reservoir

Banerjee, Viruses 2019 Jan; 11(1): 41
Common reservoir

• Bats carry lots of viruses

  – Rarely symptomatic
  – Robust Type I interferon response
  – Diversity of coronaviruses correlated with diversity of bats
  – Bats carrying multiple coronaviruses can lead to recombination events
  – Viral pulses in bats -> “spillover”

Banerjee, Viruses 2019 Jan; 11(1): 41
Cell entry

- Spike protein critical
  - RBD sequence
  - Enzymatic processing

- ACE2 is receptor
  - Not at enzymatic site 😂

- Not endocytosis but FUSION
  - Process identified by Dr. Gallaher at LSU
  - Common pathway for viruses including HIV

Du, Nature Reviews Microbiology 7(3):226-36
Vero E6 cell cytopathic effect

Channappanavar R, Perlman S. 
Semin Immunopathol. 
doi:10.1007/s00281-017-0629-x
Current Rx

All off-label indications

- Interferon +/- Ribavirin
  - modest effective but no difference in mortality

- HIV Protease inhibitors
  - Anecdotal (nelfinavir, lopinavir, darunavir)
  - Randomized trial in MERS with interferon

- Avoid steroids


doi:10.1007/s00281-017-0629-x

Rabaan et al., Journal of Medical Microbiology 2017;66:1261–1274

Future Vaccine or Treatments

- Spike protein
  - RBD sequence -> vaccine target
  - Enzymatic processing -> Enzymatic inhibitors
- Fusion inhibitors
- Protease inhibitors
  - Sheahan, Nat Commun. 2020; 11, 222

Du, Nature Reviews Microbiology 7(3):226-36
The future may be here soon

- **1st US case**
- **Drug given evening of day 7**
- **No adverse effects**

The future may be here soon.

Mild/Moderate 2019-nCoV Remdesivir RCT

The safety and scientific validity of this study is the responsibility of the study sponsor and investigators. Listing a study does not mean it has been evaluated by the U.S. Federal Government. Know the risks and potential benefits of clinical studies and talk to your health care provider before participating. Read our disclaimer for details.

ClinicalTrials.gov Identifier: NCT04252664

Recruitment Status: Not yet recruiting
First Posted: February 5, 2020
Last Update Posted: February 5, 2020

Design

Study Type: Interventional (Clinical Trial)

Estimated Enrollment: 308 participants

Allocation: Randomized

Intervention Model: Parallel Assignment

Masking: Quadruple (Participant, Care Provider, Investigator, Outcomes Assessor)

Primary Purpose: Treatment

Official Title:
A Phase 3 Randomized, Double-blind, Placebo-controlled Multicenter Study to Evaluate the Efficacy and Safety of Remdesivir in Hospitalized Adult Patients With Mild and Moderate 2019-nCoV Respiratory Disease.

Estimated Study Start Date: February 5, 2020

Estimated Primary Completion Date: April 10, 2020

Estimated Study Completion Date: April 27, 2020
Conclusions from Virology

Current
- No current vaccine
- Current drugs only modestly helpful – NO FDA approved
  - Interferons, ribavirin
  - HIV protease inhibitors
  - Current clinical trial with Lopinavir and Interferon-beta for MERS

Future
- Vaccine development - Spike
- Drug development
  - Fusion inhibitors
  - Novel protease inhibitors
  - Enzyme inhibitors for Spike protein
Identify
Isolate
Inform
LSU Health 2019 Novel Coronavirus

https://911.lsuhsc.edu/coronavirus/
Questions?