COVID-19
Training for Health Professionals
Preparedness-Prevention-Treatment
March 30, 2020
The Basics: Epidemiology

- Median patient age: 59.
- Most cases in China (77.8%): ages 30–69.
- Case fatality rate: approximately 2%.
  - In patients >60 years: 3.6% in 60–69; 8% in 70–79; 14.8% in ≥80.
- Estimated basic reproduction number (Ro): 2.2.
- Estimated median incubation time: 5.1 days.
  - Symptoms appear by 11.5 days in 97.5% of infected persons.
- Mean interval between illness onset and hospitalization 9.1–12.5 days.

ARDS = Acute respiratory distress syndrome
Median time from onset of symptoms, including fever (in 98% of patients), cough (75%), myalgia or fatigue (44%) and others.
Common Symptoms

- Most common symptoms at illness onset among hospitalized patients:
  - Fever (77–98%)
  - Cough (46%–82%)
  - Myalgia or fatigue (11–52%)
  - Shortness of breath (3-31%)
  - Nausea or vomiting (5.0%)
  - Diarrhea (3.8%)

Case Fatality Rates

- If no underlying medical conditions: Overall 0.9%.
- For patients with comorbidities:
  - Cardiovascular disease: 10.5%.
  - Diabetes: 7%.
  - Cancer, chronic respiratory disease, hypertension: 6% for each.
- For patients developing respiratory failure, septic shock, multiple organ dysfunction: 49%.
# Symptoms: Cold vs Flu vs COVID-19

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>COLD</th>
<th>FLU</th>
<th>COVID-19*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>Rare</td>
<td>High</td>
<td>Common</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100–102°F / 37.8–38.9°C</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Can last 3–4 days</td>
<td></td>
</tr>
<tr>
<td>Headache</td>
<td>Rare</td>
<td>Intense</td>
<td>Sometimes</td>
</tr>
<tr>
<td>General Aches and Pains</td>
<td>Slight</td>
<td>Common</td>
<td>Sometimes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Often severe</td>
<td></td>
</tr>
<tr>
<td>Fatigue, Weakness</td>
<td>Slight</td>
<td>Common</td>
<td>Sometimes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Often severe, 2–3 weeks</td>
<td></td>
</tr>
<tr>
<td>Extreme Exhaustion</td>
<td>Never</td>
<td>Common</td>
<td>Sometimes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Starts early</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Progresses slowly</td>
<td></td>
</tr>
<tr>
<td>Stuffy Nose</td>
<td>Common</td>
<td>Sometimes</td>
<td>Rare</td>
</tr>
<tr>
<td>Sneezing</td>
<td>Common</td>
<td>Sometimes</td>
<td>Rare</td>
</tr>
<tr>
<td>Sore Throat</td>
<td>Common</td>
<td>Common</td>
<td>Rare</td>
</tr>
<tr>
<td>Cough</td>
<td>Mild to moderate</td>
<td>Common</td>
<td>Common</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Can become severe</td>
<td></td>
</tr>
<tr>
<td>Runny nose</td>
<td>Common</td>
<td>Sometimes</td>
<td>Rare</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>No</td>
<td>Sometimes</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Shortness of Breath</td>
<td>Rare</td>
<td>Rare</td>
<td>In serious infections</td>
</tr>
</tbody>
</table>
Transmission

- Respiratory secretions, Fecal–oral, Reported transmissibility in asymptomatic individuals, Reported transmission among individuals in latent period.

How Contagious Is COVID-19?

- Measles: 12-18
- Smallpox: 5-7
- Polio: 5-7
- Mumps: 4-7
- HIV/AIDS: 2-5
- SARS-CoV-1: 2-5
- Influenza: 2-3
- SARS-CoV-2: 1.4-2.5
- Ebola: 1.5-2.5

Based WHO estimates as of 23 January 2020

Source: WHO via Spiegel.de.
Labs and Radiology

Radiology (chest X-ray)
• Bilateral involvement in most patients.
• Multiple areas of consolidation and ground glass opacities.

Chest CT
• Ground glass.
• Consolidation.

Laboratory abnormalities among hospitalized patients with pneumonia on admission:

• Leukopenia (9–25%).
• Leukocytosis (24–30%).
• Lymphopenia (63%).

• Elevated alanine aminotransferase and aspartate aminotransferase levels (37%).
Progression

Patient 1 - March 12
Patient 1 - March 16
Patient 1 - March 18

Patient 2 - March 13
Patient 2 - March 14

Healthier Lives Worldwide
Complications

**Most Common Complications** –
- Sepsis
- Respiratory failure
- Acute respiratory distress syndrome (ARDS)
- Heart failure,
- Septic shock

**Survivor Patient Population Compared to Nonsurvivors**
- Frequency of the above complications were higher.
- 50% of nonsurvivors acquired secondary infection.
- 31% of nonsurvivors had ventilator-associated pneumonia.
- Baseline lymphocyte count was significantly lower.
- Levels of d-dimer, high-sensitivity cardiac troponin I, serum ferritin, lactate dehydrogenase, and IL-6 were higher in nonsurvivors.
Survivor Patient Population Compared to Nonsurvivors

**Survivors**

- Fever
- Cough
- Dyspnoea
- ICU admission
- Systemic corticosteroid
- SARS-CoV-2 RNA positive

Days after illness onset: Day 1, Day 2, Day 3, Day 4, Day 5, Day 6, Day 7, Day 8, Day 9, Day 10, Day 11, Day 12, Day 13, Day 14, Day 15, Day 16, Day 17, Day 18, Day 19, Day 20, Day 21, Day 22

- Sepsis
- ARDS
- Discharged

**Nonsurvivors**

- Fever
- Cough
- Dyspnoea
- ICU admission
- Invasive ventilation
- Systemic corticosteroid
- SARS-CoV-2 RNA positive

Days after illness onset: Day 1, Day 2, Day 3, Day 4, Day 5, Day 6, Day 7, Day 8, Day 9, Day 10, Day 11, Day 12, Day 13, Day 14, Day 15, Day 16, Day 17, Day 18, Day 19, Day 20

- Sepsis
- ARDS
- Acute kidney injury
- Acute cardiac injury
- Secondary infection
- Death
Study Findings

**Sepsis**
- SARS-CoV-2 might have caused the sepsis seen in >50% of older patients.

**Cardiac Complications**
- Higher levels of high-sensitivity cardiac troponin I detected in >50% of nonsurvivors.
- Cardiac dysfunction and ischemic and thrombotic events might arise from:
  - Systemic proinflammatory cytokine responses increasing atherosclerosis and plaque rupture.
  - Induction of procoagulant factors.
  - Hemodynamic changes that predispose to ischemia and thrombosis.
  - Possibility of direct cardiac involvement by the virus, as angiotensin converting enzyme 2, the receptor for SARS-CoV-2, is expressed on myocytes and vascular endothelial cells.

Older age is a risk factor for higher mortality.
Poor outcomes in older individuals might be caused by age-dependent defects in T-cell and B-cell function and excess production of type 2 cytokines.
Specific Recommendations Vary by Country

- Hospitalized patients with symptoms of COVID-19 infection, to inform infection control measures.
- Symptomatic individuals at higher risk of developing severe illness (e.g., older adults and those with chronic medical conditions and/or immunocompromised state).
- Healthcare personnel and others who have had close contact with a suspected or confirmed case within 14 days of symptom onset or who have traveled to an affected geographic area within 14 days of symptom onset.

Testing

- Reverse-transcription polymerase chain reaction, or RT-PCR&N (sensitivity 30–80%). Oro- or nasopharyngeal swab, sputum.
- Nucleic acid amplification test (NAAT).
Special Populations: Older Adults

▪ Adults aged 65 and up are at higher risk for severe and critical illness.
▪ In the US, between February 12 and March 16, adults older than 65 years accounted for:
  • 31% of illnesses.
  • 45% of hospitalizations.
  • 53% of ICU admissions.
  • 80% of deaths associated with COVID-19.

Comorbidities

▪ Large case series from the Chinese Center for Disease Control and Prevention reported increased case fatality rate among those with preexisting comorbidities:
  • Cardiovascular disease
  • Diabetes
  • Chronic respiratory disease
  • Hypertension
  • Cancer
Special Populations: Children

- Vast majority of infected children have mild or no symptoms.
- Data from 2,143 children in China infected January 16–February 8 showed:
  - Severe or critical illness in 6% compared to 18.5% of adults.
  - 4% of the children were asymptomatic, 51% had mild illness, and 39% had moderate illness.
  - Serious illness more frequent in infants than in older children: in approximately 11% of infants, compared to 7% of children aged 1–5, 4% of those 6–10, 4% of those 11–15, and 3% of those >16.
Data are limited on COVID-19 infection in people living with HIV/AIDS.

What is known does not indicate that the disease course differs from that in the general population.

PLHIV with comorbidities linked with an increased risk of severe disease (e.g., cardiovascular disease, lung disease) should avoid all risk of infection.

Until more is known, additional cautions are warranted for PLHIV, especially those with advanced or poorly controlled disease.

For those with suppressed HIV viral load and stable health: Consider postponing routine medical and laboratory exams.
# Prognosis with Preexisting Conditions

<table>
<thead>
<tr>
<th>Pre-Existing Condition</th>
<th>Death Rate (Confirmed Cases)</th>
<th>Death Rate (All Cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular Disease</td>
<td>13.2%</td>
<td>10.5%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>9.2%</td>
<td>7.3%</td>
</tr>
<tr>
<td>Chronic Respiratory Disease</td>
<td>8.0%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>8.4%</td>
<td>6.0%</td>
</tr>
<tr>
<td>Cancer</td>
<td>7.6%</td>
<td>5.6%</td>
</tr>
<tr>
<td>No pre-existing conditions</td>
<td>0.9%</td>
<td>0.9%</td>
</tr>
</tbody>
</table>
Clinical Prognosis and Recovery

Patterns of Disease Progression for COVID-19 in China

The size of the arrows above indicates the proportion of cases who recovered or died. Moderate cases have a mild form of pneumonia.
Case Fatality Rate by Age in China

- As of 20 February 2020.
- N=44,672.

Adapted from Zhang 2020, *China CDC Weekly Report* 2, no. 8: 113-122.
Preventing Exposure in the Community

- Handwashing (at least 20 seconds) particularly after touching surfaces in public.
- Use of hand sanitizer that contains at least 60% alcohol.
- Respiratory hygiene (e.g., covering coughs and sneezes).
- No touching of face (particularly eyes, nose, mouth).
- Avoiding crowds (particularly in poorly ventilated spaces) and close contact with sick people.
- Cleaning and disinfecting of frequently touched objects and surfaces.

Cover your mouth and nose with a tissue when you cough or sneeze. Put used tissue in the wastebasket.

You may be asked to put on a facemask to protect others.

Wash hands often with soap and water for 20 seconds. If not available, use an alcohol-based hand rub.
Nonpharmaceutical Interventions

- Case isolation in the home
- Self home quarantine
- Social distancing of those over 70 years
- Social distancing of entire population
- Closure of schools and universities
- Mask
- Hand Hygiene
Modeling Mitigation strategy scenarios for Gran Britain showing critical care (ICU) bed requirements

Source: Imperial College COVID-19 Response Team March 2020

Healthier Lives Worldwide
# Steps Healthcare Facilities Can Take Now to Prepare

<table>
<thead>
<tr>
<th>BE PREPARED</th>
<th>COMMUNICATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Stay informed about the local COVID-19 situation.</td>
<td>• With staff: Share information about the situation and preparedness plans.</td>
</tr>
<tr>
<td>• Make a HF emergency plan.</td>
<td>• With your patients: Update them on changes to appointments and nonurgent care.</td>
</tr>
<tr>
<td>• Establish relationships with key healthcare and public health partners.</td>
<td></td>
</tr>
<tr>
<td>• Make an emergency contact list.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROTECT YOUR WORKFORCE</th>
<th>PROTECT YOUR PATIENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Screen patients and visitors for symptoms of ARI.</td>
<td>• Stay up to date.</td>
</tr>
<tr>
<td>• Use personal protective equipment (PPE) properly.</td>
<td>• Separate patients with respiratory symptoms to prevent their waiting with others seeking care.</td>
</tr>
<tr>
<td>• Inventory available PPE.</td>
<td>• Strategize to prevent patients who can be cared for at home from coming to the HF, exposing themselves.</td>
</tr>
<tr>
<td>• Encourage sick employees to stay home when they develop symptoms.</td>
<td></td>
</tr>
</tbody>
</table>
Protect Patients and Staff
*CDC's Recommended Infection Control Procedures*

**Before patients arrive**

- Screen all patients for new respiratory symptoms
- Explore alternatives to face-to-face triage and visits to reduce risk of transmission
- Plan to receive patients via EMS. Follow agreed upon transport protocols

**Upon arrival**

- Consider limiting facility points of entry. Establishing triage entrance outside the facility
- Display signs all entrance about COVID-19 symptoms.
- Consider installing a barrier, such as a glass or plastic window, to limit between triage personnel and patients
**Protect Patients and Staff**

*CDC's Recommended Infection Control Procedures*

**During the visit**

- Reserve airborne infection isolation rooms for aerosol generating procedures. Consider cohorting patients with suspected or confirmed COVID-19.

- Provide respirators for fit-tested HCW during aerosol-generating procedures. When respirators aren't available, use the best available alternative, like a face mask paired with eye protection.

- Use PPE according to guidance from your facility. This includes clean, non-sterile gloves, gowns and eye protection, mask.

- Dedicate specific staff to care for only patients with suspected or confirmed COVID-19. Staff include medical, nursing, respiratory therapist, etc.
Home Care for COVID-19 Patients

- Appropriate for those with mild infection who can be adequately isolated in the outpatient setting. They should:
  - Stay home.
  - Separate themselves from household people and animals.
  - Wear a facemask.

- Discontinue home isolation when:
  - Fever resolves without fever-reducing medications.
  - Respiratory symptoms improve (e.g., cough, shortness of breath).
  - Test results come back negative.

  OR

- At least 7 days have passed since symptoms first appeared.
- At least 72 hours (three days) have passed since recovery of symptoms.

Healthier Lives Worldwide
Home Care for COVID-19 Patients

Therapeutic and Triage strategies


Healthier Lives Worldwide
Currently, there is no specific medicine to prevent or treat COVID-19.

- IV fluids, acetaminophen
- Remdesivir
- Chloroquine/hydroxychloroquine
- Ritonavir
- Tocilizumab
- Corticosteroids
- Mechanical ventilation (intubation)
- Inhaled prostacyclin
- Paralytics
- Prone positioning
- Extracorporeal membrane oxygenation (ECMO)

In search of a COVID-19 treatment, WHO launched a multinational trial on March 18. It will include drugs that CDC and WHO have approved for other uses plus drugs some countries have used in their COVID-19 response.
Countries with Imported Cases

**Recommendations**

- Immediately activate the highest level of national response management protocols to ensure all-of-government, all-of-society approaches to contain COVID-19 with nonpharmaceutical measures.

- Prioritize active, exhaustive case finding and immediate testing and isolation; painstaking contact tracing; rigorous quarantine of close contacts.

- Immediately expand surveillance to detect COVID-19 transmission chains:
  - Test all patients with atypical pneumonias.
  - Screen patients with upper respiratory illnesses or recent COVID-19 exposure.
  - Add testing for SARS-CoV-2 to existing surveillance systems (e.g., for influenza-like illness and SARI).

- Conduct multisector scenario planning and simulations for deployment of even more stringent measures to interrupt transmission chains (e.g., suspension of large gatherings, school and workplace closures).

- Provide constant, clear public communications (e.g., president’s daily message).

- Educate people on COVID-19’s seriousness and citizens’ role in preventing its spread (social distancing).
Countries without Infections

Recommendations

- Immediately activate the highest level of emergency response mechanisms to trigger all-of-government, all-of-society approaches essential to early COVID-19 containment.

  - Incorporate rapid detection, large-scale case isolation, respiratory support capacities, and rigorous contact tracing and management into national readiness and response plans and capacities.

- Enhance COVID-19 surveillance now:
  - Consider testing all patients with atypical pneumonia for COVID-19.
  - Add testing for SARS-CoV-2 to existing influenza surveillance systems.

- Begin now to enforce rigorous application of IPC measures in health facilities, especially in emergency departments and outpatient clinics (where COVID-19 will enter the health system).

- Rapidly assess general population understanding of COVID-19.
  - Adjust national health promotion materials and activities accordingly.
  - Engage clinical champions to communicate to the media.
References 1


References 2


Thank You!