Western Occupational & Environmental Medical Association
A Component Society of the American College of Occupational and Environmental Medicine

Anticipating the COVID-19 Epidemic in the United States –
An Exploration of Public Health Impacts and Critical Planning Issues
March 12, 2020

“Speed is everything.” - World Health Organization (WHO), on the impending Covid-19 epidemic

Introduction

The American College of Occupational and Environmental Medicine (ACOEM) and the Western Occupational and Environmental Medical Association (WOEMA) are professional associations of preventive medicine providers and other health care specialists with expertise in workplace safety and employee health, who champion safe workplaces, healthy workplaces, and healthy and sustainable environments. Our members routinely advise public and private sector organizations concerning population health management and emergency preparedness. Accordingly, the evolving COVID-19 worldwide epidemic is of great interest to our organizations.

We believe that there is an urgent need to mobilize public health resources to contain and mitigate the spread of COVID-19, prepare health care facilities to handle patients, coordinate personnel, and make medical equipment available to care for the millions of Americans likely to be affected.

This paper will:
- Outline key information about the COVID-19 epidemic
- Predict community impacts foreseeable in the next few months
- Pose key public health challenges and questions for national and local government and business leaders to answer urgently

Key Information about the COVID-19 Epidemic

COVID-19 is caused by SARS coronavirus 2 (SARS-CoV-2), a new coronavirus strain that apparently originated in bats or other animals that come into close contact with people. It was first identified in the city of Wuhan in the Hubei province of the People’s Republic of China (PRC) in late December 2019. It is related to the coronavirus trains responsible for the Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) which have caused outbreaks in the past decade. COVID-19 similarly affects the lungs and causes breathing problems.

SARS-CoV-2 is spread similarly to the influenza virus, through contact with droplets arising when people cough, sneeze or talk. It can also spread when people touch contaminated surfaces and then
touch their mouths or noses. The virus has also been detected in stool, making fecal-oral contact an important potential route of infection.\(^1\) The virus can remain infectious on contaminated surfaces for as long as two days, and even longer at very low temperatures.\(^2,3\) COVID-19 may also spread by inhaling infected aerosols (very fine airborne droplets) that can remain in the air even after an infected person is no longer present.

Although it appears that many infected persons will develop no symptoms, or at worst mild symptoms, many infected persons can become quite ill, with cough, fever, and shortness of breath, which may progress to viral pneumonia and respiratory failure. The onset of symptoms typically occurs several days to as long as two weeks after exposure.

According to WHO “Situation Reports,” as of March 9, 2020, the Chinese province of Hubei (population 59.1 million), has had 67,743 confirmed cases, and 3,007 deaths.\(^4\) The great majority of these cases appeared to occur in the city of Wuhan (population 11 million). Accordingly, we estimate that in the first 8 weeks of the epidemic, the rate of symptomatic infections has been at least 0.11% of the population in Hubei province, and might range up to 0.5% in the city of Wuhan. The total number of cases, including asymptomatic and mildly symptomatic cases, is probably much higher.

About 13.8% of patients identified with symptomatic COVID-19 infections were found to have “severe disease,” with respiratory distress and a low blood oxygen levels (pO2), requiring hospitalization and respiratory support.\(^5\) The case-fatality rate has been difficult to estimate, because so many asymptomatic and mildly symptomatic cases were not counted among the symptomatic cases cited above. An analysis of this data by the Center for Infectious Disease and Policy (CIDRAP) found that the case-fatality rate, as a percentage of symptomatic cases, has been about 2.3% in Hubei.\(^6\) We calculate that the crude death rate from COVID-19 infections in Hubei province has been about 5 per 100,000 (3,007 deaths / 59.1 million), and probably about 25 per 100,000 (approx. 2,500 deaths / 11.1 million) in the city of Wuhan.

Age appears to be an important risk factor for serious infections, with persons over the age of 65 at least three times more likely to experience respiratory distress.\(^7\) The likelihood of severe infection in children and young adults appears to be much lower.\(^8\)

Occupational exposure has been recognized as a significant source of infection, with health care workers proving particularly vulnerable. In Wuhan, healthcare workers who had cared for infected COVID-19 patients represented 29% of first 138 COVID-19 patients hospitalized there.\(^9\)

In China on average two or three people became infected after exposure to one infected person. Social distancing (include limiting large groups of people coming together, closing buildings, and canceling public gatherings) and personal hygiene measures appear to have already decreased the number of new cases of infection. Until there is a COVID-19 vaccine, modification of personal behaviors is the only thing that will slow the epidemic.\(^10\) It is imperative that major efforts are made for accurate and effective public education to encourage behavioral changes.

Appendix 1 lists additional details about the number of COVID-19 cases, with graphs of the epidemic curves.\(^11,12\) The data strongly implies that COVID-19 will profoundly impact the nation and the world.
WHO has projected that “acceleration of the pandemic [is] expected by late March or early April 2020 in the United States.”

**Projections of Possible COVID-19 cases in WOEMA states, and in the United States**

Based on a simple extrapolation from observed outcomes in Hubei province over the first 8 weeks of the COVID-19 outbreak, the following table lists the POSSIBLE number of symptomatic cases, hospitalizations, and deaths due to COVID-19 projected to occur in the United States and in WOEMA’s member states. Of importance, these projections do not depend on estimates of asymptomatic or only mildly symptomatic cases, which are very uncertain at this point. Note that these are lower bound estimates and the actual impacts may be higher. Since the age-specific population distributions are very similar in the United States and China, there is reason to believe that the course of the epidemic will not be substantially different in the United States, compared to China’s initial experience.

Of course, to the extent that the number of cases reported in China represents an undercount, the projections below would also underestimate the number of affected patients elsewhere.

### POSSIBLE Symptomatic Cases, Hospitalizations, and Deaths, COVID-19 Based on Extrapolation from Outcomes in Hubei Province, China

<table>
<thead>
<tr>
<th>Population (2020), in millions</th>
<th>USA</th>
<th>Arizona</th>
<th>California</th>
<th>Hawaii</th>
<th>Nevada</th>
<th>Utah</th>
</tr>
</thead>
<tbody>
<tr>
<td>331.0</td>
<td>6.9</td>
<td>39.1</td>
<td>1.4</td>
<td>2.9</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td><strong>Expected population RATE of symptomatic COVID-19 infections by May 1, 2020</strong></td>
<td>0.1 - 0.5%</td>
<td>0.1 - 0.5%</td>
<td>0.1 - 0.5%</td>
<td>0.1 - 0.5%</td>
<td>0.1 - 0.5%</td>
<td>0.1 - 0.5%</td>
</tr>
<tr>
<td><strong>POSSIBLE number of symptomatic COVID-19 infections (lower bound) by May 1, 2020</strong></td>
<td>331,000</td>
<td>6,900</td>
<td>39,000</td>
<td>11,200</td>
<td>23,200</td>
<td>24,000</td>
</tr>
<tr>
<td><strong>Expected case RATE of COVID-19 cases needing hospitalization, by May 1, 2020</strong></td>
<td>14% of above cases</td>
<td>14% of above cases</td>
<td>14% of above cases</td>
<td>14% of above cases</td>
<td>14% of above cases</td>
<td>14% of above cases</td>
</tr>
<tr>
<td><strong>POSSIBLE Number of Hospitalizations for COVID-19 infections by May 1, 2020, (lower bound)</strong></td>
<td>46,340</td>
<td>966</td>
<td>5,460</td>
<td>196</td>
<td>406</td>
<td>420</td>
</tr>
<tr>
<td>Total # of hospital beds in jurisdiction</td>
<td>924,107</td>
<td>13,296</td>
<td>74,186</td>
<td>2,583</td>
<td>5,726</td>
<td>4,630</td>
</tr>
<tr>
<td><strong>POSSIBLE population fatality rate (per 100,000 population), due to COVID-19</strong></td>
<td>5 to 25</td>
<td>5 to 25</td>
<td>5 to 25</td>
<td>5 to 25</td>
<td>5 to 25</td>
<td>5 to 25</td>
</tr>
<tr>
<td><strong>POSSIBLE number of deaths from COVID-19 infections by May 1, 2020 (lower bound)</strong></td>
<td>16,550</td>
<td>345</td>
<td>1,955</td>
<td>70</td>
<td>145</td>
<td>150</td>
</tr>
</tbody>
</table>
Questions and Concerns for Policy Leaders

A. Overall coordination of the public health response
   a. PUBLIC ANNOUNCEMENTS: Should state health departments or the state executive branches provide emergency proclamations and encourage local city and county officials to improve the availability of resources and increase education to mitigate COVID-19’s spread?
   b. INCIDENT COMMAND SYSTEM: Since CDC activated its Emergency Operations Center in January,¹⁵ should states and other public health jurisdictions activate elements of their Incident Command Systems, to prepare for heightened planning, logistical, and communications activities?

B. Surge Capacity for Emergency Response and Medical Treatment
   a. HOSPITAL BED SHORTAGES: How will the nation and the states coordinate with healthcare facilities assure enough hospital beds will be available to meet anticipated needs? This is a significant issue since our projections suggest that the number of COVID-19 patients needing hospital admission and respiratory support will severely strain the nation’s hospital bed capacity.
   b. MOBILE HOSPITALS: Are plans present for mobile field or makeshift hospitals to increase surge capacity? What steps have been or are being taken to coordinate emergency service agencies, private enterprise, or military to make temporary hospital facilities available in a timely manner?¹⁶
   c. MEDICAL STAFFING: What steps are currently in progress to meet medical staffing needs for the anticipated surge due to increased patient demands with staffing reductions due to COVID-19 infection?
   d. PPE: What steps are being or have been taken to ensure adequate supply and distribution of personal protective equipment (PPE) for medical providers and masks for patients? What plans are in place safeguard and distribute stockpiled supplies in the face of huge demand and current shortage?
   e. OTHER MEDICAL SUPPLIES: What steps are currently in progress or have been done to ensure an adequate supply of essential durable and non-durable medical equipment such as respirators, oxygen tanks, respirator masks and tubing, and IV supplies?
   f. CORONERS: What preparations have been made to assure that coroners will have adequate resources to deal with fatal COVID-19 cases?

C. Diagnostic Testing
   a. TEST KITS: What provisions have been made for the development of alternate test kits for COVID-19, and for distributing them widely?
   b. COMMUNITY SURVEILLANCE: Will we soon see COVID-19 testing of large subsets of populations in targeted communities, as an early indicator of impending localized outbreaks?

D. Messaging and dissemination of public health guidance
   a. UPDATES: Are state and federal officials planning to update their communications to the public, to stress the time-urgency of all of these preparations?
b. **STAFFING OF PUBLIC INFORMATION OFFICES:** Should federal and state officials increase the staffing and resources available to Public Information Officers?

c. **COMMUNITY WARNINGS:** Are federal and state officials developing a communications and marketing plan in multiple languages, with appropriate print and media materials, to inform the public about precautions and infection control measures?

E. **Planning for business continuity**
   
a. **CRITICAL STAFF:** Have federal and state officials begun efforts to identify key staff for critical operations, involving essential government functions (such as public safety, utilities, and emergency response) and essential business functions including the delivery of essential consumer goods?

b. **SUPPLY CHAINS:** What preparations are in place to identify and cope with anticipated disruptions of critical supply chains?

c. **MARKETPLACE ACTIVITIES:** Until the COVID-19 epidemic ends, how should routine marketplace activities be restructured, including food shopping, routine medical and dental visits, and other personal services?

F. **Workforce and employer guidance**
   
a. **GUIDANCE:** Have federal and state officials considered sending *guidance to workplaces* and employers about infection control measures in the workplace, including respiratory etiquette, ad hygiene, detailed information about the timing of sick leave and quarantine practices, and the use of personal protective equipment (PPE) in the workplace?

b. **SICK LEAVE INCENTIVES:** Are federal and state officials exploring strategies to incentivize workers to stay home when they’re sick?

c. **DISENFECTIONANTS:** Is there consideration for giving guidance on identifying and recommend use of *optimal disinfectants, and on protocols for cleaning* both hard surfaces and especially for cleansing different kinds of equipment that is reused, (e.g., audiometer earphones, spirometry equipment and BP cuffs in health facilities; touch screens in retail businesses, etc.)

**APPENDIX 1: Epidemic curve of COVID-19 infections, China and other countries**

The number of new cases outside China has continued to climb since late February, with an observed doubling time of about one week (WHO Situation Report, March 7, 2020). By contrast, the number of new cases in China has begun to decline, apparently in response to China’s strenuous social distancing policies. As of this writing, COVID-19 infections have spread to scores of other countries, with an explosion of cases in several countries, including Italy, Iran and South Korea.

The following graphs illustrate the epidemic curve of this outbreak
**Figure 2. Epidemic curve of confirmed COVID-19 cases reported outside of China (n=24,727), by date of report and WHO region through 08 March 2020**

**Daily number of new coronavirus cases worldwide:**
New cases confirmed outside China exceed those reported in China for six consecutive days

For the first time, more new cases were reported in countries outside China than in China.

Source: World Health Organization
References

1 Ong SWX et al. Air, Surface Environmental, and Personal Protective Equipment Contamination by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) From a Symptomatic Patient. JAMA. Published online March 04, 2020.


16 During the Ebola outbreak of 2014-2015 in West Africa, the US military deployed substantial resources to three West African nations, including material and supplies for about 50 “Ebola Treatment Centers” supported by over 3,000 service personnel. See (archived) Situation Reports from the World Health Organization, for 2014 and 2015, available at https://www.who.int/csr/disease/ebola/situation-reports/archive/en/