Introduction to SARS-CoV-2 and COVID-19

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2009 influenza H1N1 pandemic - Transmissible but not severe

Estimating the Burden of 2009 Pandemic Influenza A (H1N1) in the United States (April 2009–April 2010)

- Spread rapidly worldwide
- Not possible to contain
- Estimated 61 million cases in the United States first year of pandemic
- 12,500 deaths (less than for seasonal influenza)

Shrestha, SS et al. CID 2011;52:S75-S82.
SARS and MERS- Severe but not highly transmissible

2014 MERS-CoV Outbreak in Jeddah — A Link to Health Care Facilities

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ABSTRACT

BACKGROUND

A marked increase in the number of cases of Middle East respiratory syndrome coronavirus (MERS-CoV) infection occurred in Jeddah, Saudi Arabia, in early 2014.
Novel coronavirus - Severe and highly transmissible

- Novel coronavirus reported from China in early January
- Paper published two weeks before first US death
- A transmissible virus would be difficult to contain
- Would likely not have adequate ventilators, masks etc.

Effective prevention and control will not be easy if there is sustained transmission and will require the full attention of public health, federal and local governments, the private sector, and every citizen.
Human Coronaviruses:
- 229E (alpha coronavirus)
- NL63 (alpha coronavirus)
- OC43 (beta coronavirus)
- HKU1 (beta coronavirus)
- SARS-CoV (beta coronavirus)
- MERS-CoV (beta coronavirus)
- SARS-CoV-2 (beta coronavirus)
COVID-19 Pandemic Spreading at Unprecedented Pace

31-Dec-19: a pneumonia of unknown cause detected in Wuhan, China, first reported to WHO Country Office in China

08-Jan-20: pathogen identified as a novel coronavirus 2019

30-Jan-20: outbreak declared a Public Health Emergency of International Concern

12-Feb-20: virus officially named as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and WHO officially named the disease caused by it as coronavirus disease 2019 (COVID-19)

11-Mar-20: WHO upgraded the COVID-19 outbreak from epidemic to pandemic

Source: Johns Hopkins University
SARS CoV-2- what we have learned

• Genetically similar to SARS-CoV and bat coronaviruses
• Highly transmissible (Ro= 2.2)
• Detected in upper respiratory tract, especially nose
  • Detected in the first week of illness
  • Detected from asymptomatic and mildly ill patients
• Likely transmitted through droplets, close contacts, fomites, ? airborne
• Asymptomatic infections common, and transmission from asymptomatic and presymptomatic persons occurs
• Causes pneumonia but other syndromes being reported
• High risk groups
Clinical features and timeline of signs and symptoms in COVID-19

Severe symptoms including respiratory failure begin in second week
May be due to cytokine storm
Age distribution, United States

FIGURE 1. Laboratory-confirmed coronavirus disease 2019 (COVID-19)–associated hospitalization rates,* by age group — COVID-NET, 14 states,† March 1–28, 2020

Per 100,000 population

Age group (yrs)

0-4  5-17  18-49  50-64  65-74  75-84  ≥85  All  ≥65
COVID-19 cases and deaths by day, United States, May 31, 2020

Cases per day

Deaths per day

https://www.worldometers.info/coronavirus/country/us/
SARS-CoV-2 Spike and Receptor Binding Domain

SARS-CoV-2 (3D Model)

SARS-CoV-2 Spike Protein 3D Structure
(Wrapp et al., 2020, Science)

Breakthroughs that change patients’ lives
Pfizer’s Robust Response to Develop Potential Vaccines and Treatments for COVID-19

Leveraging expertise from across our organization

Vaccine
- Developing a Vaccine to Potentially Prevent Infections using mRNA technology
- Collaboration with BioNTech

Antiviral
- Advancing Our Protease Inhibitors

Exploratory
- Pfizer Existing Pipeline Assets