COVID-19 Research at the University of Minnesota

Prospects for a Vaccine

Timothy Schacker, MD
Vice Dean for Research, Medical School
Professor of Medicine and Infectious Diseases
Pneumonia of unknown cause – China

Disease outbreak news
5 January 2020

On 31 December 2019, the WHO China Country Office was informed of cases of pneumonia of unknown etiology (unknown cause) detected in Wuhan City, Hubei Province of China. As of 3 January 2020, a total of 44 patients with pneumonia of unknown etiology have been reported to WHO by the national authorities in China. Of the 44 cases reported, 11 are severely ill, while the remaining 33 patients are in stable condition. According to media reports, the concerned market in Wuhan was closed on 1 January 2020 for environmental sanitation and disinfection.
# COVID-19 Case Rates
*(Nov. 8, 2020)*

<table>
<thead>
<tr>
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<th>Global</th>
<th>U.S.</th>
<th>Minnesota</th>
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<tbody>
<tr>
<td>Total Cases</td>
<td>50,052,204</td>
<td>9,879,323</td>
<td>180,862</td>
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<tr>
<td>Total Deaths</td>
<td>1,256,110</td>
<td>237,192</td>
<td>2,656</td>
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<td>Mortality</td>
<td>2.5%</td>
<td>2.4%</td>
<td>1.5%</td>
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## Minnesota Case Overview

Due to the need to confirm reports and reporting delays, data may be incomplete.
1918 Influenza Pandemic: ~ 50 million deaths
SORRY did my CIVIL RIGHTS
Get in the way of Your VIRUS?
Mask controversy in 1918
Influenza pandemic
Even before a coronavirus vaccine becomes available, some activists are ready to attack it; this woman attended a “Reopen Virginia” protest in Richmond in April.  MATTHEW RODIER/SIPA USA/AP IMAGES

Just 50% of Americans plan to get a COVID-19 vaccine. Here’s how to win over the rest

By Warren Cornwall | Jun. 30, 2020, 4:25 PM
Beware! The Vaccine
From a French caricature of the XVIII century
Medical School Rapid Response Grants

- 170 rapid response grants received (161 basic science, 9 clinical research)
- Funded 75 grants
- Total awarded $818,659
Molecular diagnostics for SARS-CoV-2 (PCR of nasal swabs)

- Designed a PCR test independent of a supply chain in less than 1 week
- Established a new diagnostic laboratory in the Microbiology Research Facility in less than 1 week
- Partnered with U of MN’s Genomics Center to rapidly increase capacity
- Increased testing capacity from 100 /day to 10,000 tests / day in 3 months
- Partnered with Veterinary Diagnostic Lab to increase capacity
- Developing new technologies to increase capacity (e.g., extractionless assay)
- Established the COVID lab at ARDL to restore MRF to Pre-CoVID function
- Established MN Testing Partnership with Mayo Clinic and MDH to meet daily needs of MN
  - As of October 25, we have performed more than 545,000 tests

Sophia Yohe, MD  Andrew Nelson, MD, PhD  Kenny Beckman, PhD
Testing Activity Sept-Nov 8

Tests Performed

- Sept: 100,000
- Oct: 180,000
- Nov (Nov 8): 20,000

Positive Test Rate (% of all tests)

- Sept: 1%
- Oct: 4%
- Nov (Nov 8): 8%
Increasing Rate of Detection With MDH Saliva Testing
SARS-CoV-2 Antibody test

March 29: Began developing serology assay (antibody test)

April 6: Antibody test transitioned to Advanced Research and Diagnostic Laboratory

April 13: Validated antibody test for clinical use

Current capacity: 15,000–20,000 tests/day

Marc Jenkins, PhD
Amy Karger, MD, PhD

Seroprevalence (%)
Wastewater Detection of SARS-CoV-2

• Can we use samples collected from regional wastewater plants to act as an “early warning system”?
• Twice weekly sampling with SARS-CoV-2 PCR

Glenn Simmons, PhD

Richard Melvin, PhD
Composite analysis of wastewater analysis in cities <100,000 people in Minnesota

- Lift stay at home order
- Phase 2: open bars, restaurants, gyms, and salons
- Mandatory mask order
The Quest for a Vaccine
Types of Vaccines

- **Protein (subunit)**: Hepatitis B, Pneumovax
- **Inactivated (killed)**: Hepatitis A, Rabies
- **Attenuated (Live virus)**: MMR, Yellow Fever
- **Nanoparticle (e.g., Novavax)**
- **mRNA (e.g., Moderna)**
Nanoparticle Vaccines

Diagram showing the components of a nanoparticle vaccine:
- Antigen
- Targeting molecules
- Stabilizing agent
- Encapsulated antigen
Nanoparticle Vaccines
Immunogenicity of the Nanoparticle Vaccine by Novavax

![Graph showing immunogenicity data]

- **Anti-Spike IgG (EU/ml)**
- **Day**: 0, 21, 35
- **Groups**: Placebo (dose 1 and 2), 25 μg, 5 μg, 25 μg, 25 μg
- **Human Convalescent Serum**
  - Asymptomatic
  - Outpatient symptomatic
  - Hospitalized

- **No. of Patients (dose 1/dose 2)**
  - Placebo (dose 1 and 2): 23/21
  - 25 μg: 25/25
  - 5 μg: 29/29
  - 25 μg: 28/27
  - 25 μg: 26/26

**Legend**
- 8344
- 53,391
- 7420
- 1661
In 300 days we went from a published sequence to > 90,000 people on phase 3 vaccine trials

How long it took to develop other notable vaccines

- Polio: 7 years (1948-1955)
- Measles: 9 years (1954-1963)
- Chickenpox: 34 years (1954-1988)
- Mumps: 4 years (1963-1967)
- HPV: 15 years (1991-2006)

Average vaccine development: 10.7 years
Wear Your Mask

ANTI-MASK MEETING
TONIGHT (Saturday) JAN. 25
DREAMLAND RINK
To Protest Against the Unhealthy Mask Ordinance
Disease Prevention

Maintain social distancing

Source: WHO
Get the Vaccine When It Is Available
Questions?