Pandemic Preparedness and Response: Lessons from COVID-19

Anthony S. Fauci, M.D.
Director
National Institute of Allergy and Infectious Diseases
National Institutes of Health
Novel Human Virus? Pneumonia Cases Linked to Seafood Market in China Stir Concern

By Dennis Normile

China Identifies New Strain of Coronavirus as Source of Pneumonia Outbreak
The Global COVID-19 Pandemic

Cumulative Cases 645,798,010
Cumulative Deaths 6,642,292

Lessons From COVID-19

- Global information sharing and collaborations are essential
- Existing clinical trial infrastructure should be utilized
- Prior scientific advances enable rapid vaccine development
- Prototype and priority pathogen approaches enable pandemic preparedness
- Continued surveillance of the human/animal interface is critical
- Longstanding systemic health and social inequities drive pandemic disparities
- Misinformation is the enemy of pandemic control
Lessons From COVID-19

- Global information sharing and collaborations are essential
- Existing clinical trial infrastructure should be utilized
- Prior scientific advances enable rapid vaccine development
- Prototype and priority pathogen approaches enable pandemic preparedness
- Continued surveillance of the human/animal interface is critical
- Longstanding systemic health and social inequities drive pandemic disparities
- Misinformation is the enemy of pandemic control
Global Information Sharing and Collaboration Are Essential

- Infected and convalescent patient samples
- Variant surveillance data
- Research reagents
- Viral genomic data
- Real-world clinical data
- Viral isolates
Lessons From COVID-19

- Global information sharing and collaborations are essential
- **Existing clinical trial infrastructure should be utilized**
- Prior scientific advances enable rapid vaccine development
- Prototype and priority pathogen approaches enable pandemic preparedness
- Continued surveillance of the human/animal interface is critical
- Longstanding systemic health and social inequities drive pandemic disparities
- Misinformation is the enemy of pandemic control
NIH Launches Clinical Trials Network to Test COVID-19 Vaccines and Other Prevention Tools

NIAID has established a new clinical trials network that aims to enroll thousands of volunteers in clinical trials testing investigational vaccines and monoclonal antibodies against COVID-19.

The COVID-19 Prevention Network (CoVPN) was established by merging four existing NIAID-funded clinical trials networks.
Covid-19 Prevention Network

HIV VACCINE TRIALS NETWORK

HPTN HIV Prevention Trials Network

Infectious Diseases Clinical Research Consortium

COVID-19 Prevention Network

AIDS CLINICAL TRIALS GROUP
Lessons From COVID-19

- Global information sharing and collaborations are essential
- Existing clinical trial infrastructure should be utilized
- **Prior scientific advances enable rapid vaccine development**
- Prototype and priority pathogen approaches enable pandemic preparedness
- Continued surveillance of the human/animal interface is critical
- Longstanding systemic health and social inequities drive pandemic disparities
- Misinformation is the enemy of pandemic control
“The speed and efficiency with which these highly efficacious vaccines were developed and their potential for saving millions of lives are due to an extraordinary multidisciplinary effort involving basic, preclinical, and clinical science that had been under way—out of the spotlight—for decades before the unfolding of the COVID-19 pandemic.”
Science’s Breakthrough of the Year 2020: COVID-19 Vaccines
<table>
<thead>
<tr>
<th>Platform</th>
<th>Immunogen</th>
<th>Developer</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nucleic Acid (mRNA)</td>
<td>S2P</td>
<td>Moderna</td>
<td>BLA (Age 18+); EUA (Age 6 mo-17)</td>
</tr>
<tr>
<td></td>
<td>S2P</td>
<td>BioNTech, Pfizer</td>
<td>BLA (Age 16+); EUA (Age 6 mo-15)</td>
</tr>
<tr>
<td>Adenovirus Vector</td>
<td>S2P, Wild-type</td>
<td>Johnson &amp; Johnson, AstraZeneca</td>
<td>EUA (Age 18+)</td>
</tr>
<tr>
<td></td>
<td>spike</td>
<td></td>
<td>EUA/BLA TBD</td>
</tr>
<tr>
<td>Recombinant Protein and Adjuvant</td>
<td>S2P</td>
<td>GSK, Sanofi, Novavax</td>
<td>EUA request 2/2022</td>
</tr>
<tr>
<td></td>
<td>S2P</td>
<td></td>
<td>EUA (Age 12+)</td>
</tr>
</tbody>
</table>
Lessons From COVID-19

- Global information sharing and collaborations are essential
- Existing clinical trial infrastructure should be utilized
- Prior scientific advances enable rapid vaccine development
- Prototype and priority pathogen approaches enable pandemic preparedness
- Continued surveillance of the human/animal interface is critical
- Longstanding systemic health and social inequities drive pandemic disparities
- Misinformation is the enemy of pandemic control
Vaccine Development for Emerging Infectious Diseases

- Priority pathogen approach
- Prototype pathogen approach
Vaccine Development for Emerging Infectious Diseases

- Priority pathogen approach

- Prototype pathogen approach
## WHO R&D Blueprint: Priority Diseases

<table>
<thead>
<tr>
<th>Priority Diseases</th>
<th>Source: WHO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ebola virus disease and Marburg virus disease</td>
<td></td>
</tr>
<tr>
<td>Lassa fever</td>
<td></td>
</tr>
<tr>
<td>Crimean-Congo haemorrhagic fever (CCHF)</td>
<td></td>
</tr>
<tr>
<td>Nipah and henipaviral diseases</td>
<td></td>
</tr>
<tr>
<td>Rift Valley fever (RVF)</td>
<td></td>
</tr>
<tr>
<td>Zika</td>
<td></td>
</tr>
<tr>
<td>Middle East respiratory syndrome coronavirus (MERS-CoV) and severe acute respiratory syndrome (SARS)</td>
<td></td>
</tr>
<tr>
<td>Disease X</td>
<td></td>
</tr>
<tr>
<td>COVID-19</td>
<td></td>
</tr>
</tbody>
</table>
Vaccine Development for Emerging Infectious Diseases

- Priority pathogen approach

- Prototype pathogen approach
Prototype Pathogen Approach for Pandemic Preparedness: World on Fire

Barney S. Graham and Kizzmekia S. Corbett
Prototype Pathogen Approach To Vaccine Development

Build on Prior Experiences
Viral Families/Orders of Concern

**Coronaviridae**
e.g., SARS, MERS

**Orthomyxoviridae**
e.g., Influenza viruses

**Bunyavirales**
e.g., Hemorrhagic fevers, Hantavirus, Lassa fever

**Filoviridae**
e.g., Ebola, Marburg

**Flaviviridae**
e.g., West Nile, Dengue

**Paramyxoviridae**
e.g., Nipah, RSV

**Picornaviridae**
e.g., Enterovirus D68

**Togaviridae**
e.g., Chikungunya
Applying Strategies and Tools from One Virus to Inform Vaccine Design for Related Viruses

- Basic virology (e.g., neutralization mechanisms)
- Assays for preclinical and clinical settings
- Animal models
- Antigenic targets
- Optimal platforms
- Potential immune correlates
- Manufacturing strategies
Lessons From COVID-19

- Global information sharing and collaborations are essential
- Existing clinical trial infrastructure should be utilized
- Prior scientific advances enable rapid vaccine development
- Prototype and priority pathogen approaches enable pandemic preparedness
- Continued surveillance of the human/animal interface is critical
- Longstanding systemic health and social inequities drive pandemic disparities
- Misinformation is the enemy of pandemic control
“The COVID-19 pandemic is yet another reminder, added to the rapidly growing archive of historical reminders, that in a human-dominated world, in which our human activities represent aggressive, damaging, and unbalanced interactions with nature, we will increasingly provoke new disease emergences.”
Emerging and re-emerging zoonotic infectious diseases are a perpetual challenge.

Human health is connected to the health of animals and our shared environment.

Source: CDC
The Huanan Seafood Wholesale Market in Wuhan Was the Early Epicenter of the COVID-19 Pandemic

M Worobey, KG Andersen et al.

The Molecular Epidemiology of Multiple Zoonotic Origins of SARS-CoV-2

JE Pekar, JO Wertheim et al.
Lessons From COVID-19

- Global information sharing and collaborations are essential
- Existing clinical trial infrastructure should be utilized
- Prior scientific advances enable rapid vaccine development
- Prototype and priority pathogen approaches enable pandemic preparedness
- Continued surveillance of the human/animal interface is critical

- Longstanding systemic health and social inequities drive pandemic disparities
- Misinformation is the enemy of pandemic control
The most pervasive disparities are observed among African American and Latino individuals, and where data exist, American Indian, Alaska Native, and Pacific Islander populations.
Longstanding Systemic Health and Social Inequities Drive COVID-19 Disparities

- Discrimination
- Limited healthcare access and use
- Occupation – disproportionately in essential work settings where remote work or physical distancing is impossible
- Educational, income, and wealth gaps
- Housing – some people living in crowded conditions; hard to follow prevention strategies
Lessons From COVID-19

- Global information sharing and collaborations are essential
- Existing clinical trial infrastructure should be utilized
- Prior scientific advances enable rapid vaccine development
- Prototype and priority pathogen approaches enable pandemic preparedness
- Continued surveillance of the human/animal interface is critical
- Longstanding systemic health and social inequities drive pandemic disparities
- Misinformation is the enemy of pandemic control
Why the Covid vaccines can’t contain a tracking microchip or make you magnetic

Widespread Misinformation About Infertility Continues to Create COVID-19 Vaccine Hesitancy

Fact Check: COVID-19 Is Not a Hoax to Eliminate Trump

“Johnson wrong on claim that COVID vaccines are killing athletes on the playing field”
COVID-19

The End Game for 2022 and Beyond
Smallpox Eradication

- Lack of animal reservoir
- Phenotypically stable virus
- Widely accepted global vaccination campaign
- Durability of vaccine- and infection-induced immunity
Elimination of Polio and Measles in the United States

Polio elimination: 1979

- Lack of animal reservoir
- Phenotypically stable virus
- Widely accepted national vaccination campaign

Measles elimination: 2000

- Durability of vaccine- and infection-induced immunity
SARS-CoV-2 (Spike Protein)

- Established animal reservoirs
- Evolution of genotypically and phenotypically diverse variants
- Lack of a wide acceptance of safe and effective vaccines
- Waning of vaccine- and infection-induced immunity
Control

Common sense respiratory hygiene, voluntary masking, attention to ventilation

Return to “Normalcy”

Requirement for intermittent vaccination

Endemicity

Availability of effective antivirals and monoclonal Abs

Similar to other respiratory viruses: RSV, common cold coronaviruses, influenza, etc.
Emerging Infections: A Perpetual Challenge

DM Morens, GK Folkers, and AS Fauci