Global Health Systems Preparedness

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Outline

• Previous Epidemics
• How Prepared are we
• Challenges for Global Preparedness
• Human and Economic Impacts
• Practicalities
• Research-treatment and vaccines
• Prevention
• Way Forward-policies
What are We Preparing for?

Pandemics

Large-scale outbreaks of infectious disease that can greatly increase morbidity and mortality

Over a wide geographic area

Cause significant economic, social, and political disruption.
Notable Pandemics since the Middle Ages

<table>
<thead>
<tr>
<th>Starting year</th>
<th>Event</th>
<th>Geographic extent</th>
<th>Estimated direct morbidity or mortality</th>
<th>Estimated economic, social, or political impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1347</td>
<td>Bubonic plague (Black Death) pandemic</td>
<td>Eurasia</td>
<td>30–50 percent mortality of the European population (DeWitte 2014)</td>
<td>Likely hastened end of the feudal system in Europe (Platt 2014)</td>
</tr>
<tr>
<td>Early 1500s</td>
<td>Introduction of smallpox</td>
<td>Americas</td>
<td>More than 50 percent mortality in some communities (Jones 2006)</td>
<td>Destroyed native societies, facilitating the hegemony of European countries (Diamond 2009)</td>
</tr>
<tr>
<td>1881</td>
<td>Fifth cholera pandemic</td>
<td>Global</td>
<td>More than 1.5 million deaths (9.7 per 10,000 persons) (Chisholm 1911)</td>
<td>Sparked attacks on Russian tsarist government and medical officials (Frieden 1977)</td>
</tr>
<tr>
<td>1918</td>
<td>Spanish flu influenza</td>
<td>Global</td>
<td>20 million–100 million deaths (111–555 deaths per 10,000 persons) (Johnson and Mueller 2002)</td>
<td>GDP loss of 3 percent in Australia, 15 percent in Canada, 17 percent in the United Kingdom, 11 percent in the United States (McKibbin and Sidorenko 2006)</td>
</tr>
<tr>
<td>1957</td>
<td>Asian flu influenza</td>
<td>Global</td>
<td>0.7 million–1.5 million deaths (2.4–5.1 deaths per 10,000 persons) (Viboud and others 2016)</td>
<td>GDP loss of 3 percent in Canada, Japan, the United Kingdom, and the United States (McKibbin and Sidorenko 2006)</td>
</tr>
<tr>
<td>1968</td>
<td>Hong Kong flu influenza</td>
<td>Global</td>
<td>1 million deaths (2.8 deaths per 10,000 persons) (Mathews and others 2009)</td>
<td>US$23 billion–US$26 billion direct and indirect costs in the United States (Kavet 1977)</td>
</tr>
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## Notable Pandemics since the Middle Ages

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<td>2003</td>
<td>SARS pandemic</td>
<td>4 continents, 37 countries</td>
<td>8,098 possible cases, 744 deaths (Wang and Jolly 2004)</td>
<td>GDP loss of US$4 billion in Hong Kong SAR, China; US$3 billion–US$6 billion in Canada; and US$5 billion in Singapore (Keogh-Brown and Smith 2008)</td>
</tr>
<tr>
<td>2009</td>
<td>Swine flu influenza pandemic</td>
<td>Global</td>
<td>151,700–575,500 deaths (0.2–0.8 per 10,000 persons) (Dawood and others 2012)</td>
<td>GDP loss of US$1 billion in the Republic of Korea (Kim, Yoon, and Oh 2013)</td>
</tr>
<tr>
<td>2015</td>
<td>Zika virus pandemic</td>
<td>76 countries</td>
<td>2,656 reported cases of microcephaly or central nervous system malformation (WHO 2017)</td>
<td>US$7 billion–US$18 billion loss in Latin America and the Caribbean (UNDP 2017)</td>
</tr>
</tbody>
</table>
The likelihood of Pandemics has increased because of

- Increased global travel and integration,
- Urbanization, changes in land use,
- Greater exploitation of the natural environment
  – Creating a new interface between humans and wildlife

- Of the 335 emerging infectious diseases they identified, 60.3 percent are zoonotic in origin.
How Prepared are we?

The Preparedness Index

- **Public health infrastructure** capable of identifying, tracing, managing, and treating cases
- **Adequate physical and communications** infrastructure to channel information and resources
- Fundamental bureaucratic and **public management** capacities
- **Capacity to mobilize financial resources** to pay for disease response and weather the economic shock of the outbreak
- Ability to undertake **effective risk communications**.

Countries are grouped into quintiles of epidemic preparedness (1 = most prepared, 5 = least prepared).
Why should this concern us?

Spark and spread risk

• Europe and US have high levels of preparedness.

• China has capacity too but lags behind.

• Geographic areas with high spark risk from wildlife species (including Central and West Africa) have some of the lowest preparedness scores globally.

• Potentially dangerous overlap of spark risk and spread risk
• Only 104 (57%) of 182 countries had the functional capacity to prevent, detect, and respond to an outbreak of a novel infectious disease at national and sub-national levels.

• 32 (18%) countries had low readiness and would require external resources to control an emerging infectious disease event.
Global Preparedness needs Intel!

• Situational Awareness-Surveillance

• Need an accurate, up-to-date view of potential or ongoing infectious disease threats.

• And resources - human, financial, informational, and institutional.
How do we know a Pandemic is coming?

Requires

• The health care workforce to **recognize** the illness and **report** it rapidly.

• Technical and laboratory capacity to **identify** the pathogen and respond to **surges** of clinical specimens in a timely manner.
Why You Cannot Delay!

During the 2003 SARS pandemic,

• A one-week delay in applying control measures may have nearly tripled the size of the outbreak and increased its duration by four weeks.

Wallinga and Teunis 2004.
Pandemic Impact on Health Care systems

• When pandemics cause spikes in morbidity and mortality they can overwhelm health systems.

• Overwhelmed health systems and other indirect effects may contribute to a 2.3-fold increase in all-cause mortality during pandemics.
  – During the 2009 influenza pandemic increases in acute myocardial infarction and stroke reported

• Rubinson et al. 2013
Impact on the Health Care Workforce

Even if health care workers do not die, their ability to provide care may be reduced.

At the peak of a severe influenza pandemic, up to 40 percent of healthcare workers might be unable to report for duty because they:

- Are ill themselves,
- Need to care for ill family members,
- Need to care for children because of school closures,
- Are afraid to come to work
Pandemics can have significant social and political consequences

• Creating clashes between States and citizens.
• Eroding state capacity.
• Driving population displacement.
• Heightening social tension and discrimination.
• Fear-induced behavioral changes

PriceSmith 2009
Preparedness for Economic Shutdown

- Employment Issues
- Governments closure of land borders and restricted entry of citizens from affected countries and migrant workers.
- Private sector can disrupt transport, trade, travel, and commerce by cancelling commercial flights and reducing shipping and cargo services.

World Bank 2014.
Estimated cost of selected emerging zoonotic diseases (1986–2006)
## Pandemic Preparedness Response Activities

<table>
<thead>
<tr>
<th>Prepandemic period (before a pandemic starts)</th>
<th>Spread period (after a pandemic starts)</th>
</tr>
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<tbody>
<tr>
<td>• Stockpile building</td>
<td>• Contact tracing, quarantine, and isolation</td>
</tr>
<tr>
<td>• Continuity planning</td>
<td>• Situational awareness(^a)</td>
</tr>
<tr>
<td>• Public health workforce training</td>
<td>• Global pandemic declaration</td>
</tr>
<tr>
<td>• Simulation exercises</td>
<td>• Risk communications</td>
</tr>
<tr>
<td>• Risk transfer mechanism set-up</td>
<td>• Contact tracing, quarantine, and isolation</td>
</tr>
<tr>
<td>• Situational awareness(^a)</td>
<td>• Social distancing</td>
</tr>
<tr>
<td></td>
<td>• Stockpile deployment</td>
</tr>
<tr>
<td><strong>Spark period (as a pandemic starts)</strong></td>
<td>• Vaccine or antiviral administration</td>
</tr>
<tr>
<td>• Initial outbreak detection</td>
<td>• Care and treatment</td>
</tr>
<tr>
<td>• Pathogen characterization or laboratory confirmation</td>
<td>• Situational awareness(^a)</td>
</tr>
<tr>
<td>• Risk communication and community engagement</td>
<td></td>
</tr>
<tr>
<td>• Animal disease control</td>
<td></td>
</tr>
</tbody>
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\(^a\) Situational awareness includes passive and active animal and human disease surveillance and monitoring of public health facilities and resources.
Preparedness - Practicalities

• Procurement and supply chain management must also be enhanced to ensure adequate stocks of personal Protective equipment and essential medications

• Enable equitable access to new diagnostics, therapeutics and vaccines during health emergencies
Preparedness - Practicalities

• We must scale up laboratory capacity and other surveillance capabilities,
• Augment the readiness of health systems to care for large numbers of seriously ill patients
• Safeguard the health-care workforce,
• Improve communication and coordination strategies

Jacobsen K Lancet 2020
Research

• Being ready to deliver clinically useful research in the narrow timeframe available during an infectious disease epidemic requires pre-planning pre-positioning and practice of research responses.

However time and again this narrow window of opportunity is missed
Preparedness for Drug Trials

- Regulatory Changes to approve studies
- Pilot to full trials need to be rapid
- Single drug versus combination therapies
- Antiviral versus anti-inflammatory
- Manufacturers ready to upscale
- Co-ordination crucial
Timing of Vaccine Development
Proactive and Reactive approach

Bloom et al PNAS 2017
Vaccine Preparedness

• Identify candidates early
• Significant efforts have focused on speeding up vaccine development and scaling up production.
• Vaccine manufacturers may need to take production risks...
• Need Capacity for last-mile delivery to rural areas,
• Populations willingness to adopt the vaccine.
The Coalition for Epidemic Preparedness Innovations (CEPI) has made an urgent call for $2 billion to support the development of a vaccine against the coronavirus responsible for COVID-19.
Preventing Pandemics

• Obtaining Data from outbreaks at the Animal Human Interface
• Understanding the determinants and risk factors through research
• Devising and testing mitigation strategies
• Policy uptake
Pandemic Prevention

The concept of One Health

Considers human health, animal health, and the environment to be fundamentally interconnected

Zinsstag et al 2005
Prevention
One Health activities

Understand the aetiology of pandemics

The surveillance of zoonotic pathogens of pandemic potential at the human-animal interface,

The modelling of evolutionary dynamics,

The risk assessments of zoonotic pathogens,

Understanding the interplay between Environmental changes and pathogen emergence

Paez-Espino et al 2016
Global organisations formally endorsing the One-health approach

- WHO,
- Food and Agriculture Organization (FAO) of the UN,
- World Organization for Animal Health (OIE),
- UN System Influenza Coordination (UNSIC),
- The World Bank.

Research-related efforts in the one-health arena supported by
- The European Commission
- The US Centers for Disease Control and Prevention (CDC),
- The US Agency for International Development,
- The Bill & Melinda Gates Foundation, and
- The Wellcome Trust

WHO, OIE, and FAO have created the Global Early Warning System (GLEWS), a platform shared by the three organisations to improve early warning and risk assessment on zoonoses and EIDs worldwide.
Other Ways forward-Policy

• Globally implement the International Health Regulations (IHR)

• “to prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade”

• WHO and the Global Preparedness Monitoring Board have shown that responses to urgent crises have improved under the IHR (2005), but important deficiencies in coverage still exist.
And Finally
Preparedness-Policy

Complement the IHR by The Sendai Framework

• This integrates infrastructure, climate change, and economic considerations into disaster management plans and promotes inclusive policies that protect vulnerable populations during all phases of mitigation, preparedness, response, and recovery.

Jacobsen K Lancet 2020