All Appropriate Measures: Biosafety and Biosecurity in an Era of Global Health Threats

GRiffin Lecture Award
ABSA International 61St Annual Biological Safety Conference, 12-17 Oct 2018
Charleston, SC

Something Old
“...(t)he cholera was something outlandish, unknown, monstrous; its tremendous ravages, so long foreseen and feared, so little to be explained, its insidious march over whole continents, its apparent defiance of all the known and conventional precautions against the spread of epidemic disease, invested it with a mystery and a terror which thoroughly took hold of the public mind, and seemed to recall the memory of the great epidemics of the middle ages.”

– W. T. Gairdner, 1832
“There are certain circumstances, however, connected with the progress of cholera, which may be stated in a general way. It travels along the great tracks of human intercourse, never going faster than people travel, and generally much more slowly.”

On the Mode of Communication of Cholera
John Snow, MD (1855)
http://www.ph.ucla.edu/epi/snow/snowbook.html

Fidler, Bull WHO 2001; 79(9):842.
China/Hong Kong (2002-3)

- Atypical pneumonia case treated in Foshan City, Guangdong Province, China
- Additional cases - histories of preparing exotic game meats, family contacts, health workers (30%)
- Chinese MOH reports 305 cases of respiratory disease to WHO
- Doctor who had treated atypical pneumonia cases travels from Guangdong Province to Hong Kong
- After a day of sightseeing, the doctor is hospitalized with respiratory failure

Chain of transmission among guests at Hotel M—Hong Kong, 2003


LETTER

Isolation and characterization of a bat SARS-like coronavirus that uses the ACE2 receptor

The SARS-CoV-2 pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is one of the most significant public health threats in recent history. An ongoing outbreak of Middle East respiratory syndrome coronavirus (MERS-CoV) suggests that this group of viruses remains a threat and that their distribution is wider than previously recognized. Although SARS-CoV-2 has been associated with the bat SARS coronavirus (SARSr-CoV), the bat host reservoir remains unknown. MERS-CoV is also thought to have a bat host reservoir, and the bat host of the coronavirus may play a role in geographic expansion. The infection of bats with SARS-CoV-2 suggests that bats may be a possible host for SARS-CoV-2-like coronaviruses. The emergence of SARS-CoV-2 in China in 2019 was linked to a study of bats in Yunnan Province, China. The sequence data support the hypothesis that SARS-CoV-2 and bat SARS-CoV are closely related and that the bat host reservoir of SARS-CoV-2 is bats. The identification of a bat SARS-like coronavirus that uses the ACE2 receptor suggests that bats may be a reservoir for similar coronaviruses, including SARS-CoV-2.

Institute of Preventive Medicine, National Defence University, Taipei (1)
National Institute of Virology Laboratory, Beijing (2 direct, 8 linked)
Environmental Health Institute, Singapore (1)
“Two of the recently reported cases were conducting research at the laboratory: a 26-year-old female postgraduate student from Anhui Province, and a 31-year-old man. The dates of symptom onset in the two cases are widely separated (23 days), suggesting that more than one opportunity for exposure may have occurred in the laboratory from mid-March through early April.

Authorities have closed the virology institute and placed its more than 200 employees under medical observation. Numerous environmental samples from the laboratory have been taken to help assess possible sources of contamination, and these samples will be shared with WHO.”

http://www.who.int/csr/sars/archive/en/
The International Health Regulations (IHR)

The IHR (2005) - a legally binding commitment among 196 States Parties to achieve early detection and rapid response

- The IHR entered into force in 2007, beginning a period of cooperative capacity-building

What did States Parties agree to do?
(Articles 4, 5, 13, 44 and Annex 1)

- **Communications**
  - Designate a National IHR Focal Point

- **Core Capacities**
  - Meet minimum requirements to detect, assess, report, and respond to public health events

- **Points of Entry**
  - Support disease detection and control at designated ports and borders

- **Notification**
  - Develop a framework for notifying WHO within 24 hours of a potential PHEIC

- **Collaboration and assistance**
  - Provide technical, logistical, or financial support to facilitate implementation

- **Evaluate status**
  - Conduct self-assessments and report to WHO
Annex 1 defines IHR core capacity requirements

National
- Detect unexpected disease or deaths
- Assess reports within 48 hours
- Notify WHO
- Support or implement control measures

Intermediate
- Detect unexpected disease or deaths
- Assess and confirm reported events
- Report to national level
- Support or implement control measures

Local
- Detect unexpected disease or deaths
- Assess events immediately
- Report essential information to appropriate level
- Implement preliminary control measures

• Epidemiological, laboratory, logistical support
• Containment and control measures
• Coordination with other ministries
• Information sharing
• Operational national public health emergency response plan
• Deployable rapid response teams

Trends and drivers of disease emergence

Environmental
- Climate changes
- Weather/extreme weather events
- Wildlife biodiversity
- Pathogen and vector ecology

Geopolitical
- Legal/regulatory frameworks
- War and conflict
- Governance
- Technology/industry

Socioeconomic
- Population density
- Population mobility
- Agricultural practices
- Markets and trade
- Land use
- Antimicrobial use
**HSITAIWAN 2016**

**Grand Prize High School Section** winners, Team HSITAIWAN, worked to create a series of cheap, user-friendly E. coli biosensor that can detect the poison inside the Chinese Medicine by just examining the fluorescence intensity.
Something Borrowed

- Every index case is a daughter, son, sister, brother, mother, or father.
- Every incident is, at the least, a sleepless night.
- Most lessons learned were learned the hard way – but we only we learn and act when we believe.

Global Health Security Agenda (GHSA) launched in February 2014

- Accelerate implementation of IHR and other health security frameworks
- Advance progress toward a world safe and secure from infectious disease threats
- Bring together nations to make new, concrete commitments to capacity building
- Elevate global health security as a priority for leaders worldwide
GHSA member countries

GHSA Action Packages
GHSA Action Package – Prevent-3

**Five-Year Target:** A whole-of-government national biosafety and biosecurity system is in place, ensuring that especially dangerous pathogens are identified, held, secured and monitored in a minimal number of facilities according to best practices; biological risk management training and educational outreach are conducted to promote a shared culture of responsibility, reduce dual use risks, mitigate biological proliferation and deliberate use threats, and ensure safe transfer of biological agents; and country-specific biosafety and biosecurity legislation, laboratory licensing, and pathogen control measures are in place as appropriate.

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<tr>
<th>Leading</th>
<th>Contributing</th>
<th>International organizations</th>
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<td>• Canada, Denmark, Kenya, Peru, Portugal, Spain</td>
<td>• Azerbaijan, Bangladesh, Cote d’Ivoire, Finland, Germany, Ghana, Jordan, Republic of Korea, Saudi Arabia, Singapore, United Kingdom, United States</td>
<td>• FAO, IAEA, INTERPOL, OIE, WHO</td>
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**GHSA country commitments**

- **Country commitment**
  - Gap analysis through country assessment
  - Multisectoral engagement

- **Plan and actions for capacity building**
  - 11 Action Package Targets

- **Partner commitments**
  - Funding
  - Training
  - Expertise
  - Infrastructure/equipment

**Strengthened capability for health security**
Something Blue

What comes next?

Proactive  Partnering  Patience
Our Family

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