The Long History of What We Do

Looking Back Over Developments in Preventing the Spread of Communicable Diseases through Air Travel

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Agenda

• Distant history
• The situation in the 20\textsuperscript{th} century
• New threats and the revised International Health Regulations 2005
• Influenza A H5N1
  ✓ Ambitious early plans
  ✓ Realization of limitations
  ✓ The H1N1 experience
• CAPSCA
7th Century & earlier

The roots of what we do today
Long before the germ theory, persons with leprosy were isolated to protect the community.
542, first known plague pandemic to affect Europe
Moves along trade and land travel routes

Emperor Justinian
Constantinople
12\textsuperscript{th} through 17\textsuperscript{th} Centuries

A New Method to Accommodate Expanding Maritime Trade:
Quarantine
• Large crews, sustained shipboard outbreaks (cholera/plague)
• 1st quarantine stations *Lazzaretti*
Shipboard outbreaks impede commerce

- Laws & policies to stop disease introduction
- 1179: 1st international quarantine convention (leprosy)
- 1300s: China & Venice, armed enforcement of Q laws
- 1350-1630: Italy, hub of Q activity (plague)
  - Detain ships, cargoes, & persons, *quaranta giorni*
  - 1st maritime quarantine stations
  - Health officers evaluate & isolate ill persons
- 1520-1620: France (plague & cholera)
  - 1st maritime quarantine station at Marseilles
  - All visitors need medical examination & clearance
20th Century

The 1918-1919 Influenza Pandemic
The Rise of International Air Travel
The Decline of Quarantine
Prototype Pandemic: Spanish Flu, 1918-19. 20+ Million Deaths

6,000,000 Deaths From Influenza

This is Estimate For World For Past 12 Weeks:

Recalls Black Death

"Flu" Five Times Deadlier Than World War.

INFLUENZA DEATH RATE IN ONTARIO

London's Fatality List 329 Per 100,000 of Population.

Statistical report of the Medical Officer of Health for Ontario, indicating that in most of the cities in this province the death rate from Spanish influenza and complications is as great as in the United States cities. Toronto's death rate is given as 329 per 100,000. Kingston was the hardest hit in Ontario, the rate being 414 per 100,000, as compared with the rate of 236 per 100,000 in Winnipeg, according to the figures now available.

The death rate in that city is 744 per 100,000.

Camps near the Ohio river, where 30,000 soldiers were encamped, had the highest death rate of all. It being 2,851 in 100,000 of population.

The figures, which give an approximate period of six weeks, are:

<table>
<thead>
<tr>
<th>Place</th>
<th>Death Rate Per 100,000 Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>London</td>
<td>329</td>
</tr>
<tr>
<td>Kingston</td>
<td>414</td>
</tr>
<tr>
<td>Toronto</td>
<td>744</td>
</tr>
<tr>
<td>Montreal</td>
<td>236</td>
</tr>
<tr>
<td>Winnipeg</td>
<td>285</td>
</tr>
<tr>
<td>Hamilton</td>
<td>4,834</td>
</tr>
<tr>
<td>Hamilton</td>
<td>2,851</td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>

The following cities had the highest death rates:

- Toronto: 744 per 100,000
- Kingston: 414 per 100,000
- London: 329 per 100,000
- Montreal: 236 per 100,000
- Winnipeg: 285 per 100,000
Protective Effect of Maritime Quarantine in South Pacific, 1918-19 Influenza Pandemic

• Historical look at 11 Pacific jurisdictions
• Four had strict maritime quarantine
• American Samoa: 5 days
• Australia, Tasmania, New Caledonia: 7 days

McLeod et al. Emerging Infectious Diseases. 2008;14:468-70
Pandemic Arrival Time and Death Rates, 11 Pacific Jurisdictions, 1918-19
US Quarantine Program, 1960s

Increase air travel
Board aircraft
Review documents
Monitor illness
1960s-1970s: Decline of Quarantine functions

• Antibiotics & vaccinations, ↓ need for quarantine

• 1970s
  – Smallpox eradicated
  – Reduced size of CDC DQ; end routine inspections
Decline of the U.S. Quarantine Program

1953
- 52 seaports
- 41 airports
- 17 border stations
- 33 territory stations
- Panama Canal
- 41 U.S. consulates
- 50 maritime vessels

1967-70
- ~600 staff -> ~60
  - 6 airports + HQ
  - 1 medical officer

1996-2004
- ~60-80 staff
  - 8 airports + HQ
Influenza Pandemic, 1957

Fig. 2.7(A) Spread of the world influenza epidemic, 1957–8. Source: Stuart-Harris (1965, p. 103). (B) Diffusion of same epidemic on a local scale in northern England. Source: Hunter and Young (1971, p. 647).
Fast and Frequent Travelers
Few Cities are More than Two Stops from Anywhere Else

777-200
545,000-lb (247,210-kg) MTOW
305 three-class passengers

777-200ER
656,000-lb (297,556) MTOW
301 three-class passengers

777-200LR*
766,000-lb (347,450) MTOW**
301 three-class passengers

777-300
660,000-lb (299,370) MTOW
368 three-class passengers

777-300ER
775,000-lb (351,535) MTOW**
365 three-class passengers

- Typical mission rules
- Airways and traffic allowances included
- 85% annual winds

* Three auxiliary fuel tanks
**Fuel volume limited
Global Spread, 2000-2001

- Viral strains often originate in Asia
- Importance of international air travel
- Implications for pandemics

1. Scientists say the flu virus starts in China
2. From China, influenza moves across Asia to Alaska, where it works its way down to North America
3. The flu then mutates and moves through the U.S. over several weeks
4. The virus travels over the Atlantic Ocean and into Europe
5. It then jumps below the equator, showing up in Africa, South America, Australia, and New Zealand
“The flu is now arriving at gate 4 ...”
? The Most Important Development in the Past Decade

Revision of International Health Regulations
Limitations of IHR 1969

• Concerned only a few diseases: Cholera, plague, yellow fever
  – The old paradigm of case-based surveillance
  – Difficult to revise disease list
• Dependent on official notification from the member state
• No incentives to notification
  – Very few notifications
  – Notification seen by states as a very serious act
• No formal mechanisms for collaboration between member state and WHO
• No dynamic in the response for stopping international spread
The Revision Process

• 1995 (WHA 48): Decision to revise IHR
• 1995-2003: Workshops, consultations etc. (stalled)
• January 2004: First draft for consultation
• May 2005 (WHA 58): Adoption of the IHR
• June 2007: Entry into force
This Caught the World’s Attention

SARS
What You Need to Know
The New Age of Epidemics
This Caught Public Health’s Attention
This Caught Civil Aviation’s Attention
Emerging Communicable Diseases....Lots of them
Emergence of Human Influenza Viruses

Avian flu viruses

H9 → H7 → H5

Human flu viruses

H1N1 → Russian flu
H3N2 → Hong Kong flu
H2N2 → Asian flu
B → Spanish flu

1918 '57 '68 '77 '97 '99 2003
H5N1: Avian influenza, a pandemic threat
What’s new?

- From three diseases to all public health risks
- From preset measures to tailored response
- From control of borders to also include containment at source
Decision instrument (Annex 2) of IHR (2005) for Assessment and Notification

4 diseases that shall be notified: polio (wild-type polio virus), smallpox, human influenza new subtype, SARS.

Disease that shall always lead to utilization of the algorithm: cholera, pneumonic plague, yellow fever, VHF (Ebola, Lassa, Marburg), WNF, others.

Q1: public health impact serious?
Q2: unusual or unexpected?
Q3: risk of international spread?
Q4: risk of travel/trade restriction?

Insufficient information: reassess
Any event of potential international public health concern, including those of unknown causes or sources

<table>
<thead>
<tr>
<th>Is the public health impact of the event serious?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the event unusual or unexpected?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there a significant risk of international spread?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there a significant risk of int. travel and trade restrictions?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A case of the following diseases is unusual or unexpected and may have serious public health impact, and thus shall be notified: Smallpox, Poliomyelitis due to wild-type poliovirus, Human influenza caused by a new subtype, Severe acute respiratory syndrome (SARS).

Two or more yes → notify WHO. Other events → consult WHO.
PoE Core capacity requirements at all times (routine)

(a) Assessment and Medical care, staff & equipment

(b) Equipment & personnel for transport ill travellers

(c) Trained personnel for inspection of conveyances

(d) Ensure safe environment: water, food, waste, wash rooms & other potential risk areas - inspection programmes

(e) Trained staff and programme for vector control
PoE Capacity requirements for responding to potential PHEIC (emergency)

a. Public Health Emergency Contingency plan: coordinator, contact points for relevant PoE, PH & other agencies

b. Provide assessment & care for affected travellers, animals: arrangements with medical, veterinary facilities for isolation, treatment & other services

c. Provide space, separate from other travellers to interview suspect or affected persons

d. Provide for assessment, quarantine of suspect or affected persons

e. To apply recommended measures, disinsect, disinfect, decontaminate, baggage, cargo, containers, conveyances, goods, postal parcels etc

f. To apply entry/exit control for departing & arriving passengers

g. Provide access to required equipment, personnel with protection gear for transfer of travellers with infection/contamination
Containment at source

• **Rapid response at the source is:**
  • the most effective way to secure maximum protection against international spread of diseases
  • key to limiting unnecessary health-based restrictions on trade and travel
Impact on CDC: 20 CDC Quarantine Stations
Contributed to Development of CAPSCA
CAPSCA Origin

- SARS - 2003
- Avian Influenza (H5N1) - 2005
- CAPSCA launched in Asia-Pacific – 2006
- ICAO Public Health Emergency related SARPs in Annexes 6, 9, 11, 14 and PANS-ATM (Doc 4444) – 2007 & 2009
- Influenza A(H1N1) – 2009
- Haiti cholera outbreak - 2010
- Fukushima nuclear power plant accident – 2011
- E. Coli in Europe – 2011
- Novel Corona Virus - 2012
Interlinking guidelines

A guide for public health
Emergency contingency planning
at designated points of entry

Guide to hygiene and Sanitation in aviation

Case Management of Influenza A(H1N1)
in air transport

World Health Organization
International Health Regulations (2005)

International Civil Aviation Organization
civil aviation authority guidelines

Airports Council
International airport guidelines

International Air Transport Association
airline guidelines
CAPSCA Partner Organisations

Collaborative Arrangement for the Prevention and Management of Public Health Events in Civil Aviation

www.capsca.org
## CAPSCA Regional Projects

<table>
<thead>
<tr>
<th>Year of Establishment</th>
<th>Asia-Pacific</th>
<th>Africa</th>
<th>Americas</th>
<th>Europe</th>
<th>Middle East</th>
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<tr>
<td></td>
<td>2006</td>
<td>2007</td>
<td>2009</td>
<td>2011</td>
<td>2011</td>
</tr>
<tr>
<td>No. Member States</td>
<td>20</td>
<td>25</td>
<td>32</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>State Technical</td>
<td>2</td>
<td>4</td>
<td>12</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Advisors Trained by</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICAO (OJT completed)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State &amp; Airport</td>
<td>10</td>
<td>8</td>
<td>28</td>
<td>0</td>
<td>4</td>
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<tr>
<td>Assistance Visits</td>
<td></td>
<td></td>
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<tr>
<td>Completed</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

1 + 1 = 3

(2 + 1 added value)
Preparedness Challenges in Real Life

- Pre-H1N1
- The H1N1 experience
Adding New Quarantine Stations

• Very time consuming ....a year
• Very expensive...money ran out
• Finding staff was difficult...attrition became equal to hiring before the 21\textsuperscript{st} station was added
• Facilities for quarantining large numbers of passengers often not available
Pandemic Preparedness

- Most public health staff in US are state or local....they already had responsibilities
- Passenger screening at 20 quarantine stations would require several thousand people
- Thermal imaging alone would require 200-500 people
- We concluded thermal imaging would not work
- Training would be continuous because of attrition
- Deployment to remote locations would be
What Did We Expect?
Previous Influenza A Pandemics

- 1918-19, "Spanish flu" (H1N1)
  - 20-50M died world-wide (~500K in U.S.)
  - ~50% of deaths in young, healthy adults
  - Hemorrhagic pneumonia
- 1957-58, "Asian flu" (H2N2)
  - ~70,000 attributable deaths in U.S.
- 1968-69, "Hong Kong flu" (H3N2)
  - 34K excess U.S. deaths per year
Pandemic Severity Index

Case Fatality Ratio

>2.0%  Category 5  >1,800,000
1.0 - <2.0%  Category 4  900,000 - <1,800,000
0.5 - <1.0%  Category 3  450,000 - <900,000
0.1% - <0.5%  Category 2  90,000 - <450,000
<0.1%  Category 1  <90,000

Projected Number of Deaths* US Population, 2006

*Assumes 30% illness rate and unmitigated pandemic without interventions
**Pandemic Intervals**

<table>
<thead>
<tr>
<th>WHO Phase</th>
<th>Inter-Pandemic Period</th>
<th>Pandemic Alert Period</th>
<th>Pandemic Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>USG Stage</th>
<th>New Domestic Animal Outbreak in At-Risk Country</th>
<th>Suspected Human Outbreak Overseas</th>
<th>Confirmed Human Outbreak Overseas</th>
<th>Widespread Outbreaks Overseas</th>
<th>First Human Case in N.A.</th>
<th>Spread Throughout United States</th>
<th>Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CDC Interval</th>
<th>Investigation</th>
<th>Recognition</th>
<th>Initiation</th>
<th>Accel</th>
<th>Peak</th>
<th>Decel</th>
<th>Resolution</th>
</tr>
</thead>
</table>

- **"Quench"**
- **"Contain"**
- **"Mitigate"**
Countries reporting confirmed animal and/or human A/H5N1 infections in Dec 2003 – Jan 2006*

* WHO & FAO as of January 2006
Layered Defense Against a Pandemic

- Quarantine and isolation
- Health screening at ports of entry
- Distribution of inbound flights
- En route screening
- Health screening at ports of embarkation
- Possible travel restrictions from affected regions

- Containment at source: travel restrictions, antivirals, quarantine, and isolation (World Health Organization Rapid Rapid Reaction)
Most likely candidate for next pandemic influenza?
Influenza A H5N1
Lucky We had Changed Our Goals

1. Delay disease transmission and outbreak peak
2. Decompress peak burden on healthcare infrastructure
3. Diminish overall cases and health impacts
Real-Life Outbreak Epidemiology According to Sir Mick

“No, you can't always get what you want
You can't always get what you want
You can't always get what you want...
Some Challenges

• An unexpected virus was in the country and spreading internationally before we knew it existed
• Most of our previous plans didn’t apply
• State and local public health was overwhelmed
• Because it was mild, much of the public became complacent or...worse...thought we were intentionally exaggerating
• Decisions made without full data
Community Mitigation Activities

• Universal cough/hand hygiene
• Voluntary self-isolation of confirmed or probable cases and people with influenza-like illness
• Self-monitoring of contacts
• Enhanced surveillance at schools, health care facilities etc
• School closures--no longer recommended
• No restrictions on workplaces
• No restrictions on large gatherings
Influenza Positive Tests Reported to CDC by U.S. WHO/NREVSS Collaborating Laboratories, National Summary, 2008-09

- A (Novel H1N1)
- A (Could not be subtyped)
- A (H3)
- A (H1)
- A (Unsubtyped)
- B
- Percent Positive

Number of Positive Specimens

Week
A Big Issue...

• Even though we reacted well, many people believed that we had “cried wolf” in order to get more funding.
• Quarantine has fallen out of favor
Summary

• What we do is based on several thousand years of experience
• The revision of the International Health Regulations and the circumstances leading to it were among the most important developments
• Preparedness is difficult...flexibility is key
• CAPSCA goes back to the dawn of humanity
Thank You!