Quarantine: Community Response and Containment for SARS

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Outline

• Definitions
• Principles of quarantine
• Strategies used in early 2003 SARS response
  – United States
  – Elsewhere
• Planning and preparedness activities
Definitions

• **Isolation**
  – Separation and restricted movement of *ill* persons with contagious disease
  – Often in a hospital setting
  – Primarily individual level, may be populations

• **Quarantine**
  – Separation and restricted movement of *well* persons presumed exposed to contagion
  – Often at home, may be designated residential facility
  – Applied at the individual or community level
  – *Voluntary or mandatory*
Definitions

• **Contact surveillance**
  – Monitoring for signs and symptoms in well person(s) exposed to a contagious disease
  – May be passive or active
  – May be done with or without quarantine
Historic Roots of Quarantine

• Biblical accounts of quarantine practices for persons with leprosy
• Epidemic plague in 14th century Europe had profound impact on commerce
  – 1348: System for treatment of infected ships, travelers, and merchandise
  – 1485: Venice established 40-day (Latin Quadragina) harbor detention or quarantine
“Quarantine” = Torture, exile, and death

Death in a sailor’s uniform holding the yellow quarantine flag knocking on the door of NYC during the 1898 yellow fever epidemic

*Frank Leslie’s Illustrated Newspaper, Sept. 1878*
Quarantine Dichotomy

• “Quarantine” may have negative connotations
  – Black Death, Yellow fever, Pandemic Flu
  – Detention camps equate disease with crime
  – Stigmatizes victims (e.g., foreign born)
  – Historical abuses of power

• Quarantine works
  – Effective tool to prevent spread of contagion
  – As good or better than other tools in the box
Epidemic Exponentiation

$R_0 = 2.0$, Progression $= 1:2:4:8:16$
Slowly Progressing Epidemic

\[ R_0 = 1.34, \text{ Progression} = 1:2:4:5:7 \]
Percolating Epidemic

Ro = 1.0, Progression = 1:2:4:4:4
Epidemic Suppression

$R_0 = 0.67$, Progression = 1:2:4:3:2
Contagion Epidemic Modeling
Goal: $R < 1$, Extinction or Quenching

Period of communicability

Time (days)

- Infection Exposure: $d(\text{exp})$
- Symptom onset: $d(\text{sx})$
- Pt seeks health care: $d(\text{hc})$
- SARS diagnosis: $d(\text{ddx})$
- Appropriate infection control isolation: $d(\text{ic onset})$
- Duration of isolation: $d(\text{ic end})$

Incubation 2-10

Period of risk for epidemic propagation

2º contacts exposed and infected

Contact tracing

Public health notified

2º case ascertainment
Quarantine

_A collective action for the common good_

Public good \hspace{1cm} Individual liberties

Paramount to meet needs of individuals infected and exposed
Modern Quarantine may be used if:

- A person or group of people has been exposed to a highly *dangerous* and *contagious* disease
- Exposed *well* persons are separated from *ill* cases
- **Resources** are available to implement, support and maintain the quarantine
  - Provide essential goods and services
  - Monitor health status (active vs. passive)
  - Provide immediate triage & medical care / isolation
Principles of Modern Quarantine (2)

Modern quarantine encompasses a range of strategies:

• Short-term, voluntary home curfew
• Suspension or restrictions on group assembly
• Cancellation of public events
• Closure of mass public transit
• Closing of public places
• Restriction or scaling back of non-essential travel
• “Snow days” or “shelter-in-place”
• *Cordon sanitaire* (sanitary barrier erected around an area)
Ways to Increase “Social Distance”

- Implement “Snow Day” restrictions (shelter-in-place)
  - Close schools, daycare centers, etc.
  - Cancel large public gatherings (concerts, theaters)
  - Minimize other exposures (markets, churches, public transit)

- Encourage non-essential workers to stay home
  - Telecommuting can minimize economic impact

- Consider additional measures
  - Distribution of surgical masks?
  - Scaling back transportation services (holiday schedule)
Advantages of “Snow Day” Approach

• Intuitive
• Leverages the public’s instinct for self-preservation
  Cordon sanitaire conflicts with this instinct
• Can be implemented instantaneously
• Does not require similar level of dedicated resources as full-scale quarantine
Modern quarantine is used in combination with other interventions
• Enhanced disease surveillance and symptom monitoring
• Rapid diagnosis and treatment for those who become ill
• Primary and 20 preventive interventions, including vaccination or prophylactic antibiotics, PPE
Principles of Modern Quarantine

(4)

Quarantined persons must be among the first to receive all available disease-preventing interventions

• Vaccination (e.g., smallpox)
• Antibiotics (e.g., plague)
• Early and rapid diagnostic testing and symptom monitoring
• Early treatment if symptoms appear
Principles of Modern Quarantine (5)

Modern quarantine lasts only as long as necessary to ensure that quarantined persons do not become ill

- Maximum quarantine duration related to the incubation period of disease
- “Due process” rights among those subjected to quarantine restrictions
Principles of Modern Quarantine (6)

Modern quarantine does not have to be absolute to be effective

• Even partial or “leaky” quarantine can reduce disease spread

• Partial quarantine can be an effective supplement to vaccination
Impact of Varying $R_0$ and % Quarantined on Total Smallpox Cases*

*K. Roy, S. Maloney, M. Meltzer, M. Cetron, (preliminary results)

SP aerosol release $R_0$ inside plane = 500 exposed
Modern quarantine is more likely to involve small numbers of exposed persons in small areas

- Exposed persons on conveyance containing ill passenger(s)
- Exposed persons in a theater where an intentional release has been announced
- Close contact to a person with SARS (e.g. healthcare worker, household member)
Principles of Modern Quarantine (8)

Implementation of modern quarantine requires—

• clear understanding of public health roles at local, state, and federal levels
• well-understood legal authorities at each level
Principles of Modern Quarantine (9)

Implementation of modern quarantine requires coordinated planning by many partners:

• Public health practitioners
• Health-care providers
• Transportation authorities
• Emergency response teams
• Law enforcement
• Security / Credentials for personnel
Principles of Modern Quarantine (10)

Implementation of modern quarantine requires *trust and participation* of the general public:

- Informed of the dangers of “quarantinable” infectious diseases before an epidemic/outbreak occurs.
- Informed of the justifications for quarantine when an outbreak is in progress.
- Informed of anticipated duration and endpoints of control measures.
SARS Containment Strategy

- Early Detection
- Surveillance/ Monitoring
- Isolation
- Quarantine
SARS Containment Strategy

• **Elements of Response**
  – Case management
  – Contact management
  – Hospital/facility infection control
  – Community response and quarantine
  – Border responses

• **Levels of Response**
  – Magnitude and scope of outbreak
  – Resources
  – Community cooperation and trust
SARS Containment Strategy

• **Case management: isolation of ill persons**
  – United States
    • Home isolation
    • Hospital isolation if medically necessary
  – Other countries
    • Hospital isolation for all patients
Isolation
SARS Containment Strategy

• **Contact management:**
  - **Quarantine and surveillance**
    - United States
      - “Furlough” of exposed HCWs at home
      - Passive symptom surveillance
    - Other countries
      - Home quarantine for close contacts
      - “Work” quarantine
      - Institutional quarantine in selective settings
      - Range of monitoring and surveillance
Contact Management: Home Quarantine for Close Contacts

Quarantined residents in Jihe Public Housing project, Taiwan
Contact Management:
Institutional Quarantine for selected HCWs and close contacts
SARS Containment Strategy
Community response and quarantine

– United States
  • *Early detection and rapid isolation*
  • SARS EOC
  • Public information and education

– Other countries: **ISOLATION** plus
  • Large-scale quarantine
  • Required fever screening
  • Mandatory masks
  • Population-wide monitoring
  • Disinfection
Community Response: Required Fever Screening for Public Buildings
Community Response

Mandated mask use for

– Travel on public transport
– Taxi drivers
Community Mobilization: Population-wide Body Temperature Monitoring Campaign and SARS Hotline
Community Response: Community Disinfection

City Disinfection, Taiwan
SARS Containment Strategy

Border and travel response

– United States
  • Travel advisories and alerts
  • Distribution of health alert notices
  • Responding to ill passengers

– Other countries
  • Pre-departure and arrival screening
  • Quarantine of travelers from areas with SARS
## Travel Alerts and Advisories for SARS, March–July 2003

<table>
<thead>
<tr>
<th>Region</th>
<th>Advisory Started</th>
<th>Advisory Stopped</th>
<th>Alert Started</th>
<th>Alert Stopped</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainland China</td>
<td>3/13/03</td>
<td>6/17/03</td>
<td>6/17/03</td>
<td>7/3/03</td>
</tr>
<tr>
<td>Beijing, China</td>
<td>6/17/03</td>
<td>6/25/03</td>
<td>6/25/03</td>
<td>7/11/03</td>
</tr>
<tr>
<td>Taiwan</td>
<td>6/25/03</td>
<td>6/25/03</td>
<td>6/25/03</td>
<td>7/15/03</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>5/1/03</td>
<td>6/25/03</td>
<td>6/25/03</td>
<td>7/1/03*</td>
</tr>
<tr>
<td>Hanoi, Vietnam</td>
<td>3/13/03</td>
<td>4/29/03</td>
<td>4/29/03</td>
<td>5/15/03</td>
</tr>
<tr>
<td>Toronto</td>
<td>Never had an advisory</td>
<td>Never had an advisory</td>
<td>4/23/03 restarted: 5/23/03</td>
<td>5/20/03 restopped: 7/8/03</td>
</tr>
<tr>
<td>Singapore</td>
<td>3/13/03</td>
<td>5/4/03</td>
<td>5/4/03</td>
<td>6/4/03</td>
</tr>
</tbody>
</table>

*This change was posted on 7/9/03, retroactive to 7/1/03.*
HEALTH ALERT NOTICE
FOR INTERNATIONAL TRAVELERS ARRIVING IN OR RETURNING TO THE
USA FROM HONG KONG AND GUANGDONG PROVINCE, PEOPLE’S
REPUBLIC OF CHINA, AND HANOI, VIETNAM

TO THE TRAVELER: During your recent travel, you may have been exposed to cases of severe acute respiratory disease syndrome. You should monitor your health for at least 7 days. If you become ill with fever accompanied by cough or difficulty in breathing, you should consult a physician. To help your physician make a diagnosis, tell him or her about your recent travel to these regions and whether you were in contact with someone who had these symptoms. Please save this card and give it to your physician if you become ill.

TO THE PHYSICIAN: The patient presenting this card may have recently traveled to Hong Kong or Guangdong Province in the People’s Republic of China or Hanoi, Vietnam, where cases of atypical pneumonia have been identified. If you suspect atypical pneumonia (also being called severe acute respiratory disease syndrome [SARS]), please contact your city, county, or state health officer (see http://www.cdc.gov or call the CDC Emergency Operations Center 770-488-7100).

For public inquiries, call Centers for Disease Control and Prevention (CDC) hotline: English 888-246-2675, Español 888-246-2657, TTY 866-874-2646.
Distributed at 13 US-Canada land crossings and the Toronto airport

TO THE TRAVELER: During your recent travel to areas affected by severe acute respiratory disease syndrome (SARS), including Toronto, you may have been exposed to cases of SARS. You should monitor your health for at least 10 days. If you become ill with fever, cough, or difficulty in breathing, you should consult a physician. In advance of your visit to the physician, tell him or her about your recent travel to these regions and whether you were in contact with someone who had these symptoms. Please save this card and give it to your physician if you become ill.

TO THE PHYSICIAN: The patient presenting this card may have recently traveled to SARS-affected areas, including Toronto, where cases of SARS have been identified. If you suspect that this patient may have SARS, please contact your city, county, or state health officer (see http://www.cdc.gov or call the CDC Emergency Operations Center at 770-488-7100).
Empty jewelry showcases from Hong Kong and Singapore
Zurich Trade Fair
Economic Impact of SARS

Percent reporting they…

Avoided Asian restaurants or stores
- Americans: 9%
- Toronto Area Residents: 19%

Avoided public events
- Americans: 7%
- Toronto Area Residents: 16%

Among those reporting international travel in the past year (n=208 in Toronto, n=171 in US)
Avoided international air travel
- Americans: 9%
- Toronto Area Residents: 9%

Source: Harvard School of Public Health/Health Canada, June 2003
Bookings: U.S.-Toronto vs. U.S.-Other Canada
January 1, 2003 – April 30, 2003

-35.0%
-30.0%
-25.0%
-20.0%
-15.0%
-10.0%
-5.0%
0.0%
5.0%
10.0%
15.0%

Week Ended

Source: Daily MIDT booking data, all points of sale
Percent experiencing problems while quarantined

**BASE:** Toronto area residents who had been quarantined or had a friend or family member who had been quarantined (n=111)

In general, being quarantined was a problem

- **Major Problem**
  - 24%

- **Minor Problem**
  - 51%

**Specific Problems**

- Emotional difficulties being confined
  - 11%

- Not getting paid because they missed work
  - 10%
  - 11%

*Robert Blendon, Harvard School of Public Health*

Source: Harvard School of Public Health/Health Canada, June 2003
Border Responses

- Travel Alerts
- Arrival and departure notices
- Pre-departure and arrival fever screening
- Required mask use on conveyances (intermittent)
Pre-departure Screening: Symptoms Temperature
Is it me or is something different about airport security these days?

WELCOME HOME!
Been to Asia or Canada?

SPIT.

COUGH.

Is that a metal detector?

Joking about S.A.R.S. is a punishable offense.

GET IN
X-RAY

NOPE. IT'S A THERMOMETER. BE BRAVE.
Range of Responses to SARS at the Local, State, and Community Level

Public Health Criteria for Community Response

- Number of cases/exposed
- Exposure category
  - Known
    - Travel
    - Close contact
      - Health care-related
      - Household
    - Unknown (unlinked)
- Generations of transmission
- Morbidity and mortality
- Ease/rapidity of spread
- Movement in/out of community
- Resources
- Need urgent public health action
- Risk of public panic

No restrictions

Targeted restrictions
- Population-specific
  (i.e., congregate settings or group gatherings)

- Voluntary general movement restrictions
  - “Shelter in Place” or “Snow Day”
  - Closing of public places
  - Suspension of public gatherings
  - Restriction of mass transit schedules

- Compulsory movement/activity restrictions
  - Curfews on activities
  - Closing of mass transit
  - Closing access routes
    - Roads, Airports, Seaports
  - Closing borders
    - Border surveillance/monitoring
      - “SARS checkpoints”
      - Travel permits
Range of Responses to SARS at Borders

Public Health Criteria for Border Response

- Number of global cases/exposed
- Adequacy of global surveillance/control
- Volume of travel
- Morbidity and mortality
- Ease/rapidity of spread
- Characteristics of local outbreaks
- Community response levels
- Border and local resources
- Need urgent public health action
- Risk for public panic

- Travel alerts, advisories, press releases
  - Meet all SARS-affected arriving flights
    - Visual inspection
    - Disembarkation notices
    - HAN distribution
  - Triage ill passengers
    - Contact follow-up and surveillance

- Intensified arrival screening
  - Questionnaire
  - Temperature monitoring
  - Active registration with local health department
  - Health certification
  - Pre-departure screening

- Restrict departures and flights
- Suspend travel and other visa issuance
- Quarantine any arrivals from affected areas
- Close borders?
Preparedness Planning

General

- Establish incident command structure
- Establish relationship with essential partners
- Plan for monitoring and assessing appropriate response
- Develop message strategies for various responses and groups
- Plan for adequate hospital based surge capacity
Constructing a SARS Hospital in Beijing
Preparedness Planning

Case and Contact Management

– Ensure management protocols up to date
– Establish supplies for non-hospital management
– Establish telecommunications plan
– Plan for ensuring essential services
Preparedness Planning

Community Containment

– Ensure that necessary legal authorities and procedures are in place
– Identify key partners and personnel for implementing and supporting quarantine
– Develop training programs and drills
– Develop plans for mobilization and deployment
Preparedness Planning

Non-hospital facility management

– Identify community-based facilities for case isolation and quarantine of contacts
– Ensure procedures for suitability assessment
– Develop protocols for evaluation and management of arriving ill passengers
Conclusions

• “Quarantine” or “Snow Day” Measures
  – Are important public health tools used in conjunction with other disease containment measures
  – Represent a range of scalable interventions, voluntary and compulsory
  – May be resource- and labor-intensive
  – May have unintended negative consequences (e.g. stigma, economic impact, concealment, flight)
  – Require education and public trust

• Effective implementation of modern quarantine and other containment measures requires coordinated planning and preparedness.
First Indian SARS patient, Punde, Goa  NYT April 2003