From SARS to Pandemic Influenza planning – Some lessons learnt in Singapore

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Contents

• Introduction
• SARS epidemiology
• Surveillance and Contact Tracing
• Public Health Measures in Practice
• Organizational lessons – Applying them to Emerging Infectious Diseases
SARS.101.

- Severe Acute Respiratory Syndrome (SARS)
- First reports of an atypical viral pneumonia November 2002 in Guangdong, China
- By March 2003, similar outbreaks noted in Toronto, Vietnam, Singapore and other places
- Identified as a novel corona virus in April
- Believed to be transmitted from civet cats to humans
SARS - with frequent flier miles

HCW used PPE for nursing the initial cases

All HCW with any patient contact don PPE

Total Cases 239
Recovered 206
Deaths 35 (14%)
CHAIN EFFECT
How one person infected more than 120 people. SALMA KHALIK traces the links.

SUPER SPREADER 1
Esther* was in ward 5A before she was isolated at Tan Tock Seng Hospital
*Esther Mok and two other women who stayed at Metropolis Hotel in Hong Kong where they got the virus from a Guangdong professor, who has since died.
Note: Esther was among seven people who was infected overseas. But she was the only one who was so highly infectious.

SUPER SPREADER 2
Nurse worked in ward 5A, discharged

SUPER SPREADER 3
Madam Pakiah Abdullah, Patient in ward 6A, died March 29

SUPER SPREADER 4
Hospital staff or patient at SGH

THE SGH CLUSTER

UNCONFIRMED CASE
Orange Valley Nursing Home
Male nurse at the nursing home
Her friend
His girlfriend, also a nurse at the nursing home
Her daughter-in-law, a Mediacorp employee in intensive care

LEGEND
- SARS patients who infect many others
- SARS patients who infect others
- SARS patients who infect one other
- SARS patients who infect no others
- SARS patients still in Tan Tock Seng Hospital
- SARS patients transferred to other hospitals
- SARS patients discharged
- SARS patients in intensive care
Super spreaders

- The first “super spreader” transmitted to 25 people and accounted for 120 cases

- 5 super spreaders directly accounted for 105 cases
The age, gender and ethnicity distribution reflected the distribution of healthcare workers in Singapore.
# Location of transmission

<table>
<thead>
<tr>
<th>Location</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital/Nursing Home</td>
<td>178</td>
<td>74.8</td>
</tr>
<tr>
<td>Household</td>
<td>33</td>
<td>15.5</td>
</tr>
<tr>
<td>Overseas</td>
<td>8</td>
<td>3.4</td>
</tr>
<tr>
<td>Community</td>
<td>7</td>
<td>2.9</td>
</tr>
<tr>
<td>Pasir Panjang Wholesale Market</td>
<td>3</td>
<td>1.3</td>
</tr>
<tr>
<td>Taxi</td>
<td>2</td>
<td>0.8</td>
</tr>
<tr>
<td>Flight</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Undefined</td>
<td>6</td>
<td>2.5</td>
</tr>
</tbody>
</table>

_Heng BH, Chen M et al_
### Profile of Probable Cases

<table>
<thead>
<tr>
<th>Category</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthcare workers</td>
<td>97</td>
<td>40.8</td>
</tr>
<tr>
<td>Family / household members</td>
<td>55</td>
<td>23.1</td>
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<tr>
<td>Inpatients</td>
<td>31</td>
<td>13.0</td>
</tr>
<tr>
<td>Visitors to hospital</td>
<td>20</td>
<td>8.4</td>
</tr>
<tr>
<td>Social contacts</td>
<td>15</td>
<td>6.3</td>
</tr>
<tr>
<td>Imported</td>
<td>8</td>
<td>3.4</td>
</tr>
<tr>
<td>Co-workers in market</td>
<td>3</td>
<td>1.3</td>
</tr>
<tr>
<td>Taxi drivers</td>
<td>2</td>
<td>0.8</td>
</tr>
<tr>
<td>Flight stewardess</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Undefined</td>
<td>6</td>
<td>2.5</td>
</tr>
</tbody>
</table>

*Heng BH, Chen M et al*
Surveillance
And Contact
Tracing

Surveillance Strategies

• Open source surveillance – via the internet, email, news reports
• Broad-based local surveillance
  – Self-monitoring
  – Large events
  – Workplaces
  – Schools
  – Clinics
  – Hospitals
  – Nursing homes
• Issue of super spreaders increased the emphasis on Sensitivity > Specificity
Surveillance is KEY
Case Definition of SARS

• Suspect Cases
  – *Fever* >38C/100.4F
  – AND Cough OR Breathlessness
  – AND close contact with SARS patient, travel to known transmission area
  – Unexplained Respiratory Distress Syndrome (RDS)
  – AND close contact with SARS patient
  – OR travel with known transmission area

• Probable Case
  – Suspect case with radiographic evidence of atypical pneumonia/RDS
  – Suspect case that is *assayed positive for SARS corona virus*
  – Suspect case that has autopsy finding consistent with RDS
Types for Surveillance

- Fever screening
  - Personal thermometers
  - Ear thermometers
  - Thermal imagers
- Symptom questionnaire
- Travel declarations
- Laboratory testing
Locations

– Borders: Land, sea and air entry points
– Crowded places or areas with high risk
  • Healthcare facilities
  • Nursing Homes
  • Schools
  • Workplaces
Processes

• Thermometers issued to every household

• Fever and symptom triage at public places

• Thermal Imagers for high throughput areas (screening)

• Identification of screened persons

• Identification and monitoring of working adults who travelled to affected countries

• Declaration at entry points of workplaces
Communications

• Mandatory notifications
• Contact Tracing Center
• SARS Hotline
• SARS Ambulance
• SARS-TV?!
Contact Tracing

- The logical conclusion to surveillance
- To break the chain of transmission
  - Identify contacts
  - Isolate

Contact Tracing Period

- RIP
- Infected
- Visits GP - Isolated
- Lab confirmation

Contact tracing interview

Symptomatic

Hospitalized
Contact Tracing

- Diagram flow of MOH Contact Tracing Center.
- Over 200 officers at its peak.
- Obtaining patient movement during symptomatic period
- Identifying all contacts
- Following up all contacts for 10 days.

Quarantine – derived from “quarantaine”, meaning “a group of 40”, and was frequently denoted a detention of 40 days.
Forward Fever Triage

- Temperature taking and screening were conducted outside in open, well ventilated areas
- Patients triaged
  - Non-fever ("clean")
  - Fever or respiratory symptoms or travel history ("dirty")
Linear Workflow

- Completely separate areas for clean and dirty areas
- Uni-directional flow of patients

Figure 1  SARS screening and treatment area.

Hygiene

- Basic hygiene measures do work!
- Multiple studies have shown poor physician compliance to hand washing
- Wiping down of all surfaces with disinfectant
- Sharing of food, utensils, dishes
- Calling in sick
- Reducing respiratory droplets
Personal Protective Equipment

- N-95
  - Require fitting
  - Uncomfortable
  - Technique to don and doff
  - Verbal and visual communications
  - In short supply
- Powered Air Respirators
  - Cumbersome
  - Noisy
  - Require charging
  - Cleaning after use
- Suits, googles, gloves and showercaps
  - Significant heat load
  - Cumbersome during procedures
Cohorting

- Designated Hospital(s)
- Clean and dirty wards
- Tasks grouped by patient, not function
- End-to-end team based care (self-contained)
Isolation and Quarantine

• Disease control by empirical methods of detection
• Rapid and aggressive isolation of suspected cases

Issues
- Housing
- Utilities
- Food
- Comfort measures
- Security
- Compliance
Home Quarantine Orders

Facts and Figures

• 238 cases amongst 7863 people served with HQOs

• Ratio of 38 HQOs : per case

• 26 persons broke HQO (0.03%) and were served up penalties, such as fines and electronic tagging.

• Interesting fact – 2110 webcams were bought and deployed as home quarantine tools in Singapore. A world first!

• Ooi PL et al, Use of Quarantine in the control of SARS in Singapore, Amer. J. of Infection Ctrl, 35(5):252-257, June 2005

Problems

• Huge numbers

• Monitoring
  – by phone
  – by webcam

• Lack of suitable facilities

• Children

• Foreign nationals
  – Home within 24hr if afebrile
  – Or quarantine center

• Loss of income for self-employed

• Transportation
During the height of the severe acute respiratory syndrome (SARS) epidemic last spring, researchers emphasized that basic infection control and personal responsibility were vital to check the spread of the disease. Maybe they should have taken their own prescription. The latest SARS patient, a medical researcher and lieutenant colonel in Taiwan's army surnamed Chan, apparently contracted the disease in a SARS research lab on Dec. 6. Authorities in Taiwan believe Chan was in a rush to catch a plane to Singapore for a medical conference and hurriedly cleaned up a spill in his lab from a leaky waste bag. Chan told investigators that he thought the spill was safe because it was several days old and therefore any virus in it should have
Public Places

• Emphasizing personal responsibility
• Limiting hospital visitors
• Closure of areas of known community spread
• School, childcare center closures
ORGANIZATIONAL LESSONS – APPLYING THEM TO EMERGING INFECTIOUS DISEASES
Elements of National Strategy

• Coordinated national effort – spanning multiple ministries, agencies and the public.
• Early detection, isolation and quarantine
• Prevention of import and export of disease
• International exchange of information
Comparing SARS to Emerging Infectious Disease

- No reliable diagnostic test available initially
- Supportive care – no/limited vaccine or cure
- Significant mortality rate
- Droplet infection or airborne
- Long incubation period
- Asymptomatic but infective
- Specificity of signs and symptoms
  - Low: cough, running nose, headache
  - High: high fever, hypotension, hematuria, etc

- Even amongst airborne or droplet spread disease, there are differences that may cause the plan to change tremendously
Aggressive Control Measures

• Prevention of spread
  – Tight control at high risk areas
  – Stringent enhanced PPE policy
  – Strict Monitoring of staff and patients

• Rapid contact tracing

• Low-threshold for quarantine (in absence of a sensitive and specific test)
SOCIAL ASPECTS

• Irrational fear is expected
  – Hoarding and depletion of hygiene and sanitation related goods
  – Discrimination against HCWs
  – Channel irrationality into positive use

• Mental preparation
  – building resilience with good planning and clear communication
  – Clear sense of mission and goals

• Psychological support and grief counseling

• Closures and decontamination may have little scientific basis but were used to alleviate public pressure
• What are SARS symptoms?
  – Fever
  – Cough or
  – Shortness of breath

• Communications and good media management make a world of difference in a crisis

Baltimore physician has SARS symptoms
Doctor, 40, shows signs after trip to Toronto
By Erika Niedowski | Sun Staff
April 24, 2003

A 40-year-old Baltimore doctor who developed symptoms of SARS after a trip to Toronto was admitted yesterday to Johns Hopkins Hospital - two days after he showed up sick for work at another local hospital and was sent home.

Health officials said the doctor, a resident at Sinai Hospital working a rotation at the Kennedy Krieger Institute, did not come into contact with patients while he was on the job Monday, although his supervisor was sent home as a precaution.

Meanwhile, fears about another possible SARS case in Baltimore eased yesterday as a 28-year-old Hong Kong woman with symptoms of the deadly respiratory illness improved at Maryland General Hospital.

Dr. Peter L. Balson, the city health commissioner, said the woman could be released as early as today. Nine family members in voluntary isolation at the Sutton Place apartment building in Bolton Hill have developed no signs of SARS, and those visiting from out of town could be cleared to return home tomorrow.

Woman in Md. hospital monitored for SARS
Relatives are isolated; officials say they're taking overly cautious approach
By Erika Niedowski | Sun Staff
April 23, 2003

A 26-year-old Hong Kong woman who traveled to the United States last week is under watch at a Baltimore hospital as the state's first potential SARS patient, and nine of her family members have been isolated in a Bolton Hill apartment building.

The woman's symptoms do not fully match the definition of a SARS case, and the only relative who had any signs of illness - a 17-year-old cousin, also from Hong Kong - was released from Maryland General Hospital yesterday after doctors determined he did not have the disease.
Contingency Planning

- Critical items need to be identified BEFORE a crisis and stockpiled
  - Respirator masks *sizing and fitting*
  - Thermometers
  - Disinfectant handrubs
  - Anti-virals, chemoprophylaxis *shelf-life*
  - Vaccines, making capacity *long lead time*
Contingency Planning

• Business Continuity Planning
  – Drawer plans
  – Redundancy in **critical processes**
  – Maintaining essential services
  – Prioritizing everything else
  – Alternative workplaces
    • off-site
    • work from home
  – Simple framework to improve execution of strategy - “SARSCON”
Expect tremendous economic hardship

- All 6 public hospitals reported sought to cover loss of business due to SARS under “business interruption” insurance coverage

- Claims due to loss of profits and higher operating cost due to tremendous expenditure of masks, gowns, gloves.
Economic Impact

• No longer a “medical” problem but a societal problem
  – Airlines: SIA alone cancelled 1,150 flights in May 03 and posted an operating loss of S$370 million in April/May
  – Hotels: occupancy dropped from 70% to 15%
  – F&B and retail: Drop in local people going out and low levels of tourists arrivals

• Direct hospital expenditure over S$200 million during 3 months of SARS
• Additional S$100+ million in infrastructure
• In addition, S$230 million emergency financial relief package was created for small businesses and tourism related industries that were affected.
Preparation against airborne/respiratory illness

• Outbreaks of respiratory illness have the greatest potential to overwhelm a healthcare system
Prepare for a paradigm shift

• Conceptual shift in Pandemic Influenza strategy compared to SARS

• In SARS, fever mass screening was an effective strategy for detecting patients.

• In PI, fever screening cannot detect infectious patients who are asymptomatic.

• Patients may be infectious 24-48hrs before the first symptom shows (which are not specific)

• The strategy for PI has to be focused on layers of force protection to reduce the infectivity of the disease and outbreak response to manage cases

• Is prevention possible?
Pandemic Flu Planning

• Short incubation
• 2 or more waves lasting 6 weeks each
• 2\textsuperscript{nd} wave 3-9 months later
• Infectious 24hrs before the onset of symptoms
• Asymptomatic and sub-clinical cases can be contagious
• Vaccine requires 6-9 months lead time to make
At least some people got something positive out of it...
New definition of SARS
Severe Absence of Romance & Sex

→ no contact history = got SARS
→ contact history = no SARS

shortness of breath,
myalgia, shivers

Any questions?

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