

**Mar 26**  
**Notification of Amoy Gardens Cluster**



- DH received hospital report of 15 cases from 7 families residing in Block E of Amoy Gardens
- Field visit
  - Household interviews – no common activities
  - Contact tracing and medical surveillance
  - Letters to alert residents; pamphlets
  - Building disinfection

**Mar 27-29**  
**Intensive investigations and surveillance**



- Exploratory epidemiologic questionnaire to identify possible risk factors
- Medical surveillance of residents; set up medical stations
- Multi-disciplinary team
  - Water supplies
  - Garbage disposal
  - Sewer system integrity
  - Elevators and lift shafts
  - Pests infestations
  - Ventilation and water systems at shopping arcade

**Mar 30**

## **Decision to isolate Block E**



- Continued steep rise in number of cases in Block E (93 reported); more than all other blocks combined
- Prevent infected persons in Block E from spreading disease to the community
- Protect health of residents in Amoy Gardens

**Mar 31**

## **Sewer linked suspected**



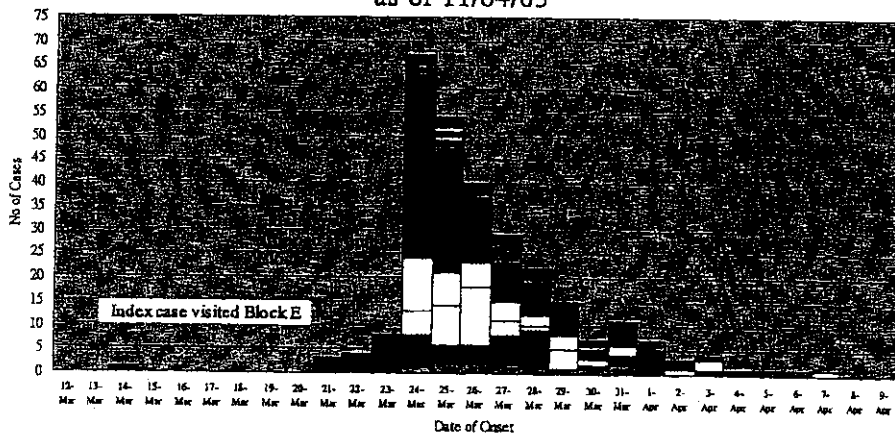
- Isolation order served to Block E in early morning
- Investigations that day raised possibility of virus transmission through dried up U-traps in the bathroom floor drain connected to soil stack

## Apr 1-10 Block E residents moved to camp



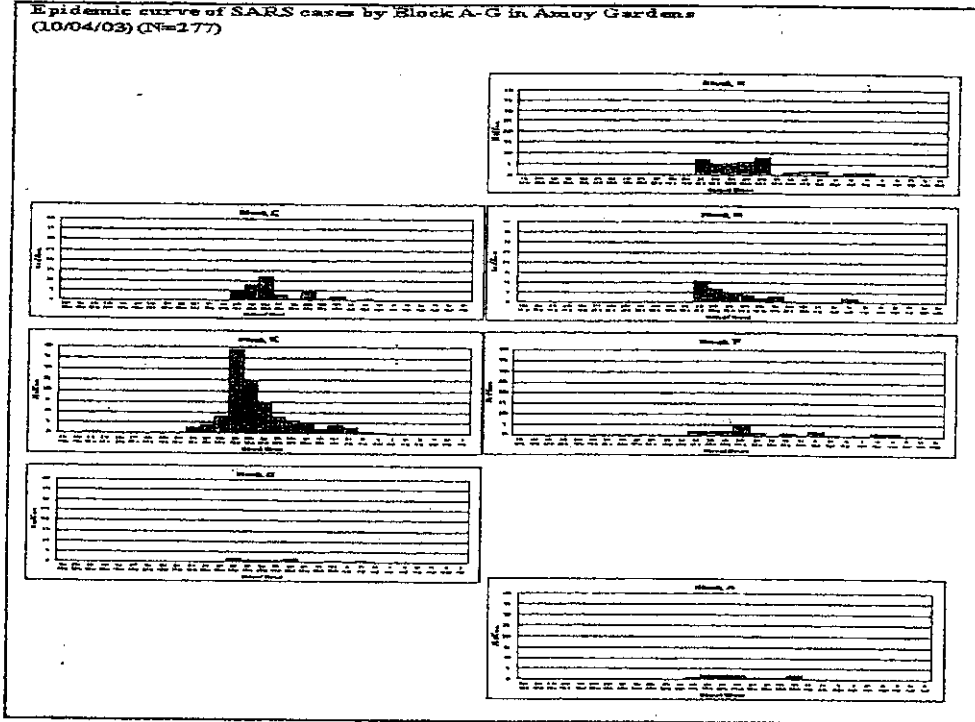
- 247 Block E residents evacuated to 3 holiday camps for isolation
- Intensive investigations and disinfection exercise at Amoy Gardens
- Residents moved back to homes on Apr 10

Epidemic curve of confirmed SARS cases in Amoy Garden  
as of 11/04/03

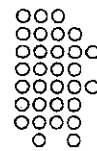


■ Bk A ■ Bk B □ Bk C □ Bk D ■ Bk E ■ Bk F ■ Bk G □ Bk H ■ Bk J ■ Bk K □ Bk N □ Bk P ■ Bk Q ■ Bk S

Epidemic curve of SARS cases by Block A-G in Amoy Gardens (10/04/03) (N=277)

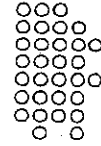


### Case characteristics



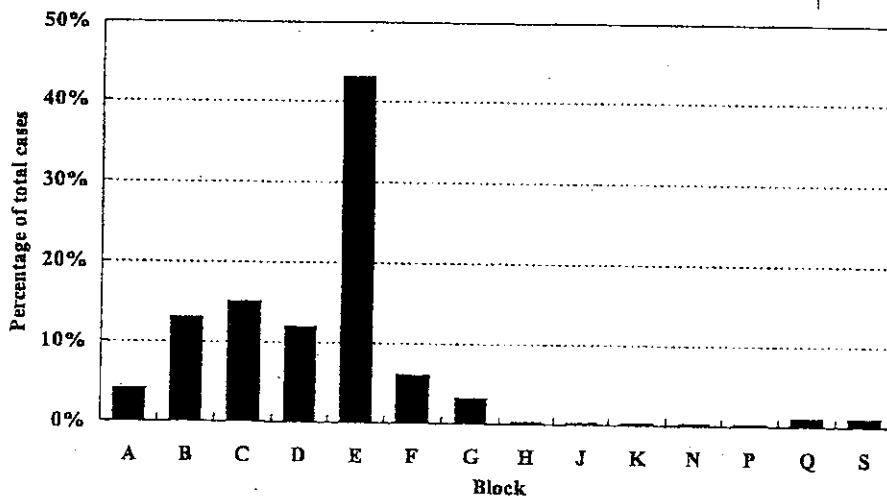
Characteristic	Percentage
Sex	
Male	45%
Female	55%
Age	
0- 14	10%
15-49	74%
50-64	13%
≥65	3%

## Case characteristics

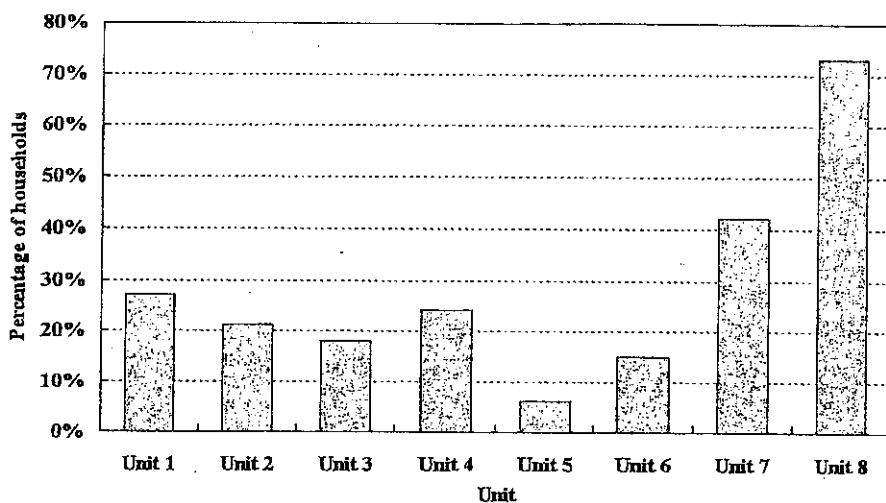


Characteristic	Percentage
<b>Symptom</b>	
Fever	95%
Temperature $\geq 39^{\circ}\text{C}$	51%
Chills	67%
Diarrhea	66%
Headache	56%
Cough	44%
Dizziness	38%
Sore throat	28%
Abdominal pain	24%
Contact with SARS case	4%
Visit to Mainland	8%

Percentage of SARS cases by block in Arroy Garden as of 10.4.03



### Percentage of households affected in Block E of Amoy Gardens as of 10.4.03



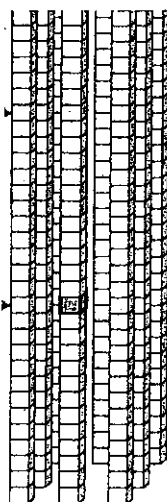
### Amoy Gardens SARS Outbreak Block E 3-D Animation 14-28<sup>th</sup> March






Cumulative Cases per Apartment By Day of Disease Onset

14<sup>th</sup> March

Index case/apartment

Apartment Number  
(Same on each floor)



-  0 cases
-  1 case
-  2 cases
-  3 cases
-  4 cases



**Amoy Gardens SARS Outbreak Block E**

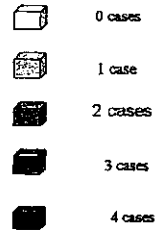
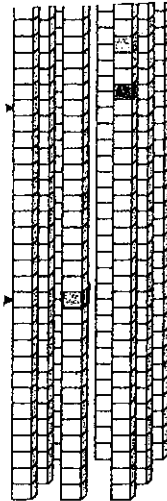
3-D Animation 14-28<sup>th</sup> March

Apartment Number  
(Same on each floor)

Cumulative Cases per  
Apartment By Day of  
Disease Onset

**21<sup>st</sup> March**

 Index case/apartment



**Amoy Gardens SARS Outbreak Block E**

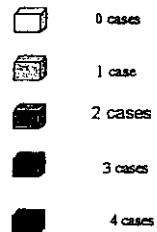
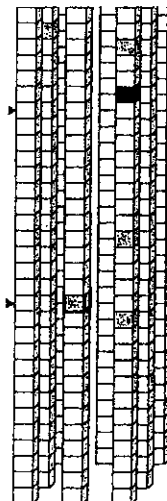
3-D Animation 14-28<sup>th</sup> March

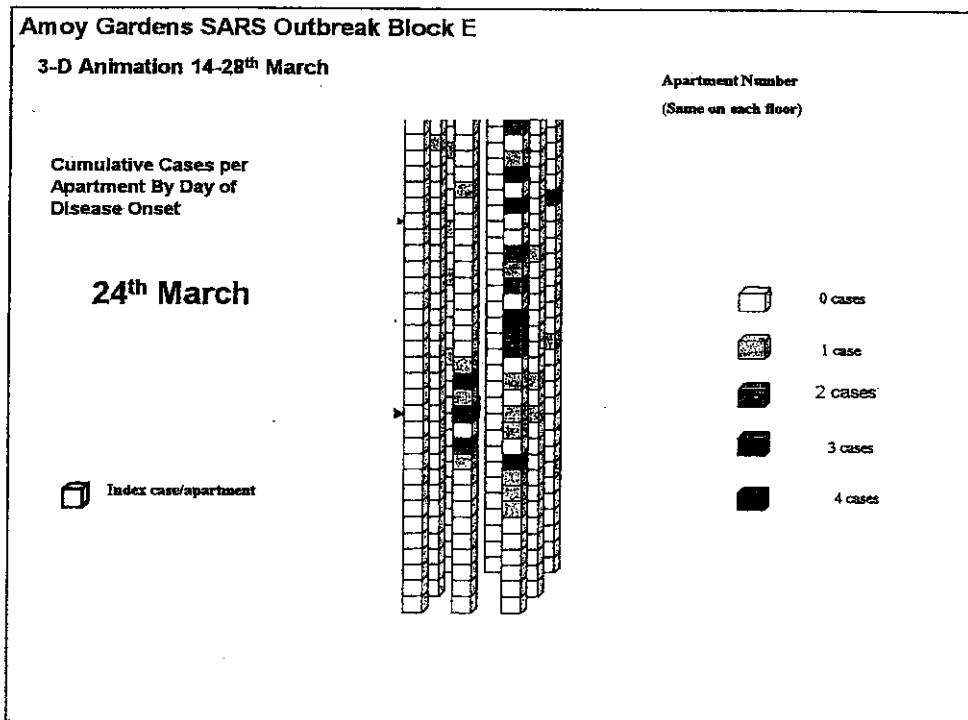
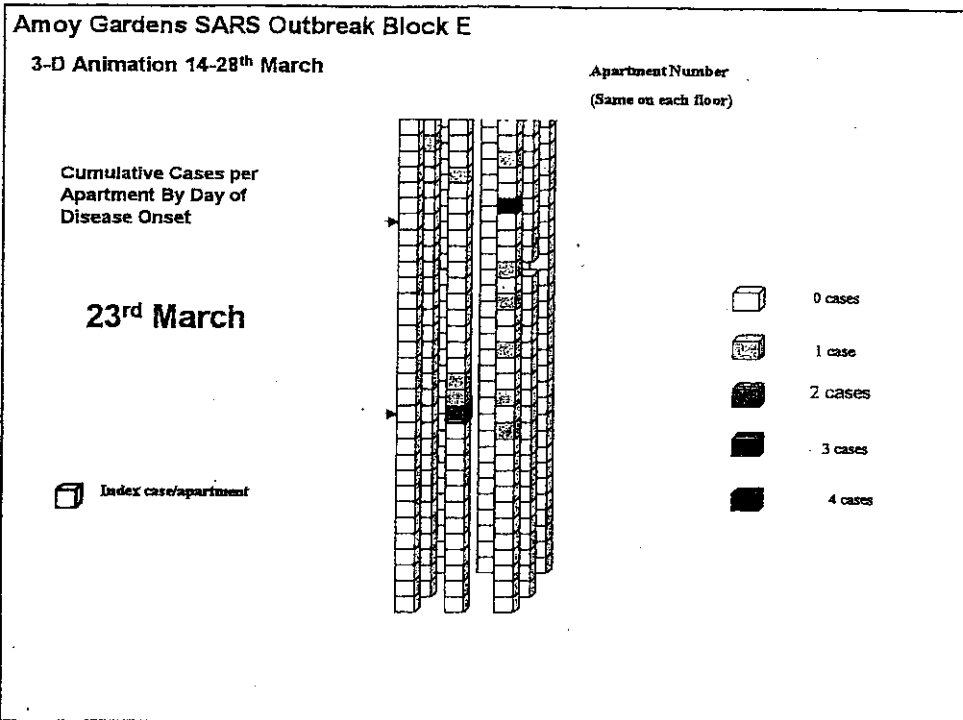
Apartment Number  
(Same on each floor)

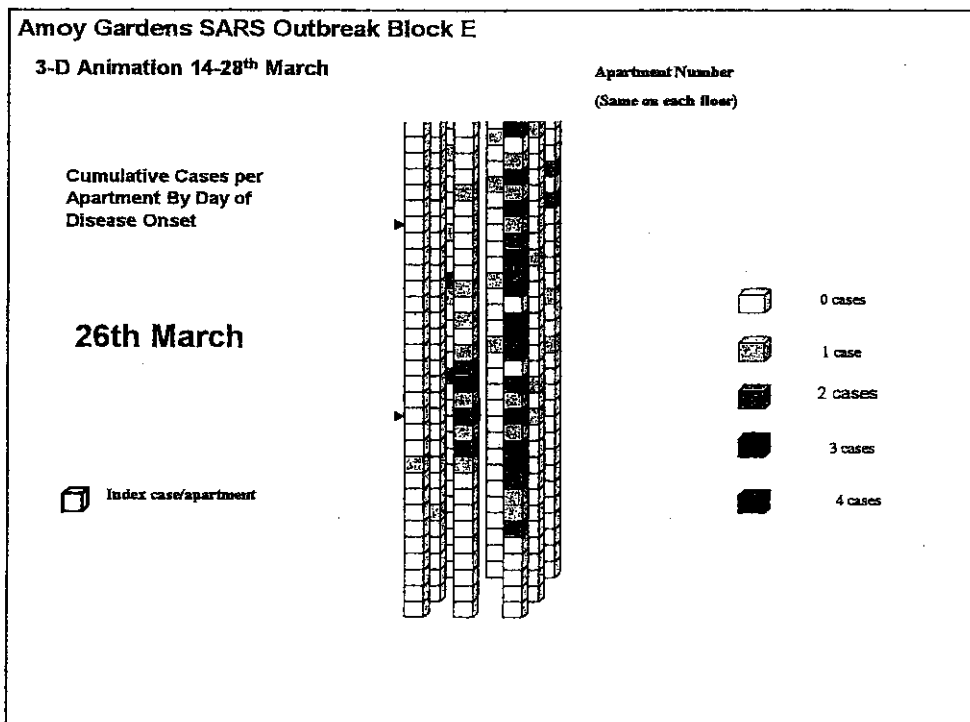
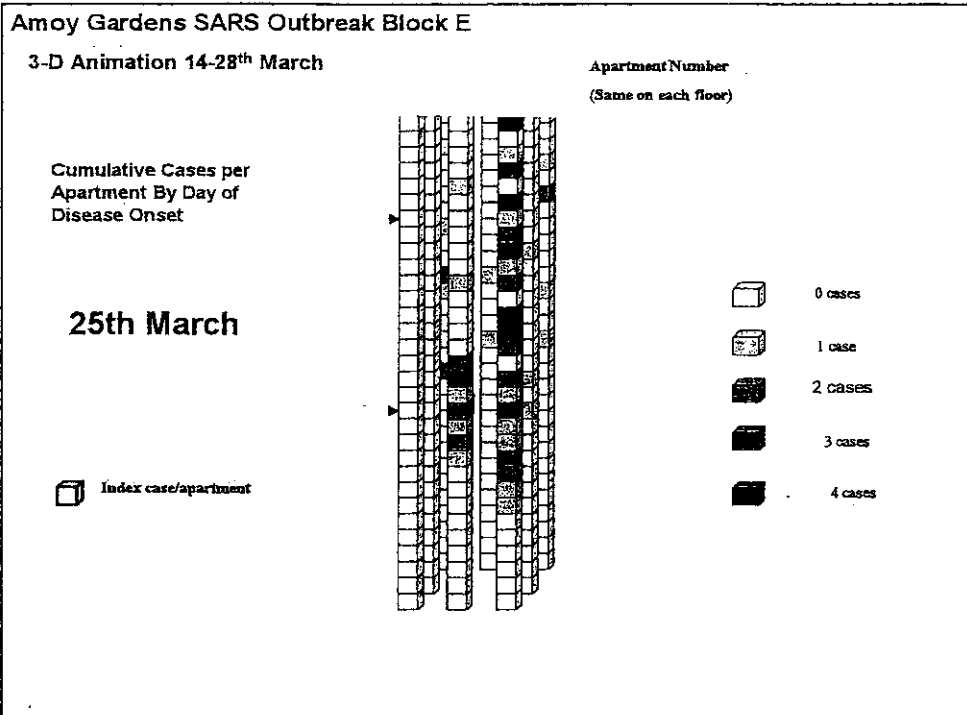
Cumulative Cases per  
Apartment By Day of  
Disease Onset

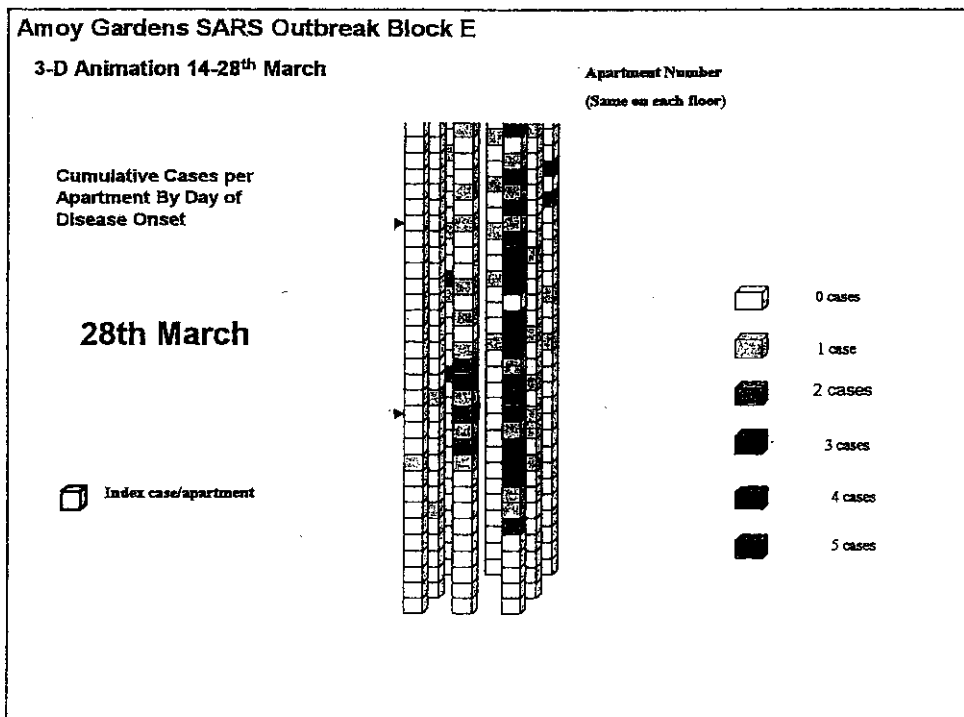
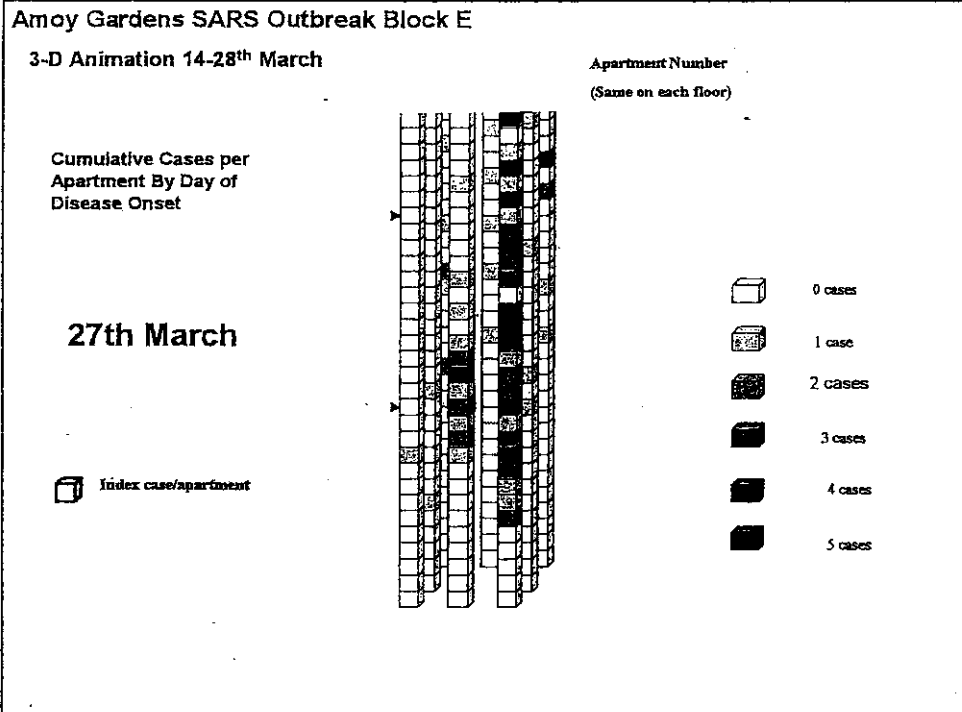
**22<sup>nd</sup> March**

 Index case/apartment









Re-entrant



### Case-control study Block E, Amoy Gardens



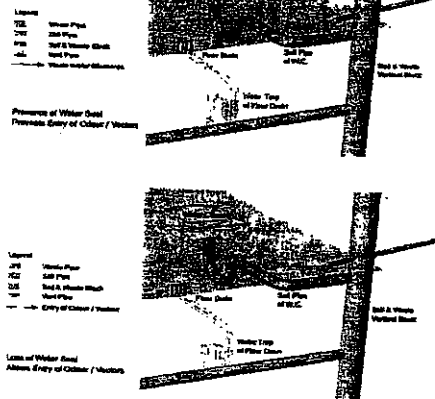
- Switching on bathroom fan was the only significant factor associated with developing SARS
  - 41/45 (91%) case households
  - 26/40 (65%) control households
  - OR = 5.5 , 95% CI=1.5, 22.8
  - P= 0.003

## Environmental samples



Water samples	Negative
Air samples	Negative
Rodent droppings, TS Cockroach surface, gut Cats/dogs TS, anal swab	Coronavirus (passive carrier)
Swabs in household bathroom	Coronavirus in toilet rim

Figure 3C



Floor Drains at Amoy Gardens

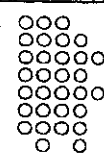
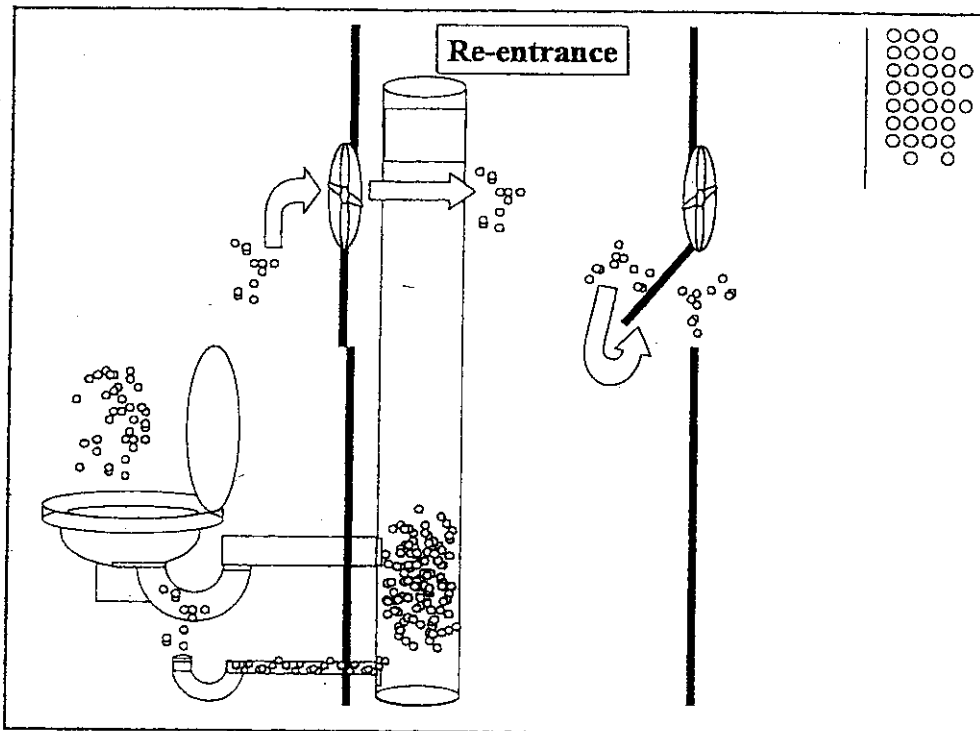


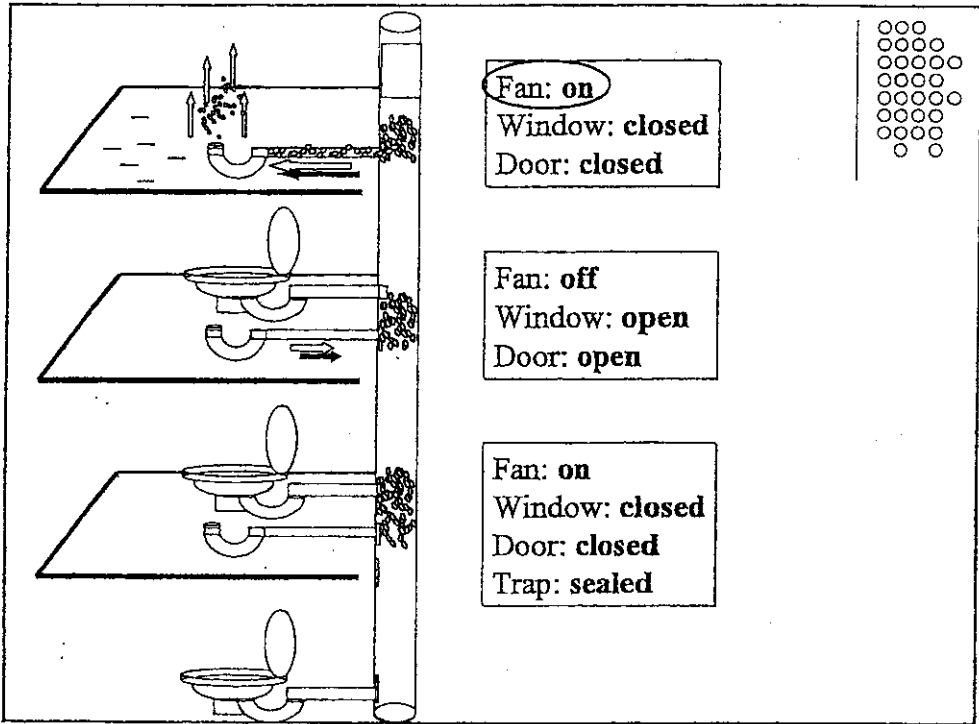
## Stability of SARS CoV on surfaces

(J Tam et al, CUHK)



	In TC Medium	In Stool
Glass	72h	96h
Formica	36h	72h
Stainless steel	36h	36h
Cotton cloth	12h	24h
Paper file Cover	24h	36h



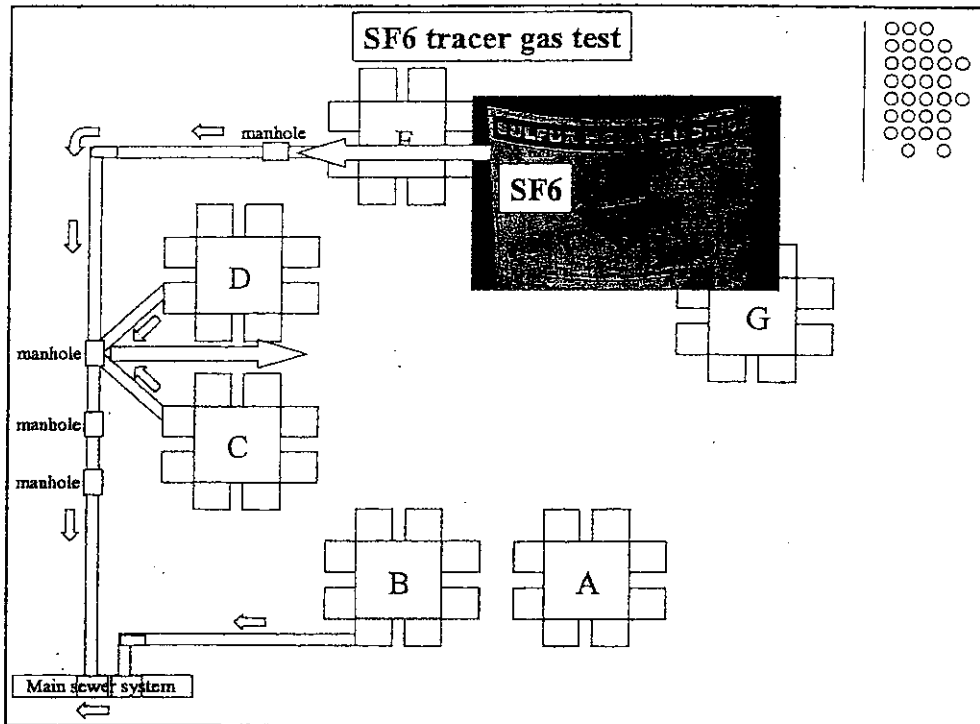


## Secondary modes of transmission to other blocks

- People movement
- Vectors as mechanical carriers

A grid of circles is located on the right side of this section.





## Government actions

- Cleansing and disinfection
- Publish guide to public on household disinfection
- Advise public to fill U-trap with water
- Proper maintenance of sewer piping system

## Government actions



- Pest control & environmental hygiene improvement
- Publish buildings where there were SARS cases
- Multi-disciplinary response team

## Conclusions



- Rare sequence of events leading to outbreak
- SARS patients excreting coronavirus in soil stack
- Dried-up U-traps
- Interruption of flushing water supply
- Powerful exhaust fans
- Updraft in light well facilitated droplet spread

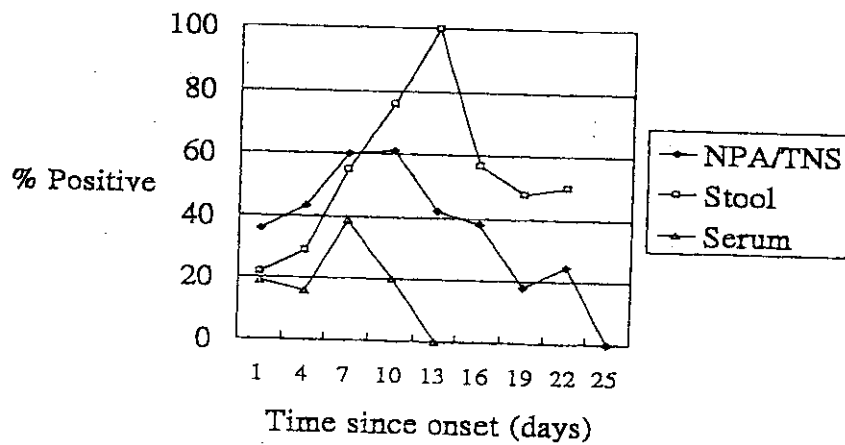
## Virus Carriage Studies (2) (Government Virus Unit, DH)



Quantitation of viral excretion in stool

<u>Days after onset</u>	<u>GM(Copies)/ul</u>
3-4	69
6-8	3311
10-15	13183
16-19	933
21-23	120
28-37	37

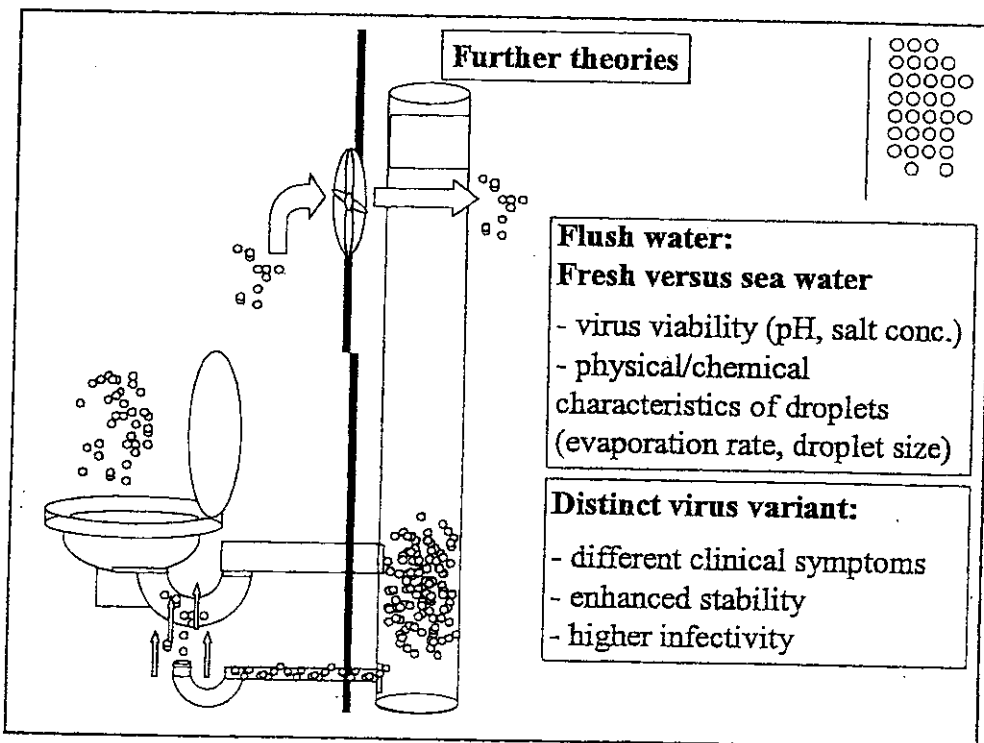
## Virus Excretion (W Lim, DH)



## Substantiating evidence



- SARS patients known to excrete coronavirus: positive toilet rim swab
- Index case had diarrhea and passed stools in the toilet of Room [redacted], Block E
- Cluster of cases in Block E between Room [redacted] and [redacted], above and below index case flat
- Spatial clustering of cases in Room 7 and 8 of Block E parallel to sewer pipes
- Higher incidence of sewage pipe problems at Block E



## Index case



- Lived in Shenzhen
- Chronic renal failure on hemodialysis, follow up at PWH
- Onset 14/03/03, seen at PWH
- Slept in brother's flat in Block E on 14/03/03 and 19/03/03
  - Had diarrhea, used toilet
  - Stool test +ve coronavirus PCR
- Brother, sister-in-law and healthcare workers who attended him came down with SARS

