

The SARS epidemic in Hong Kong

S H Lee

J Epidemiol Community Health 2003;**57**:652–654

The unprecedented epidemic of severe acute respiratory syndrome (SARS) struck Hong Kong in March to May 2003. From 11 March to 20 May 2003, a total of 1718 SARS cases had been identified (fig 1).¹ During the same period, 253 people had died of the disease. The average death rate was estimated to be about 15%. Before the occurrence of the disease in Hong Kong, an intense outbreak of the disease with acute respiratory syndrome later termed as atypical pneumonia was reported in the nearby Guangdong Province in mainland China. The outbreak in Guangdong was centred in the provincial capital of Guangzhou and its nearby Pearl River Delta area. The outbreak started in November 2002 and reached its peak in March 2003. Up to 17 May 2003, Guangdong recorded a total of 1514 cases and 56 deaths.²

EPIDEMIOLOGY

At the beginning of March 2003, a professor from Guangzhou who had been treating atypical pneumonia cases in a Guangzhou Hospital visited Hong Kong and stayed at a hotel in the Kowloon District in Hong Kong. He was admitted to a local hospital with symptoms of acute respiratory disease. He later died of the disease. Arising from this index case, seven other people who stayed in the same floor of the hotel were affected with SARS. These included three visitors from Singapore, one visitor from Vietnam, two visitors from Canada, and one local person. All of them developed SARS and two people died of the disease.³

The local infected person later was admitted into another public hospital known as the Prince of Wales Hospital at Shatin. This person was responsible for the spread of the disease at Prince of Wales Hospital resulting in over 100 medical and nursing personnel coming down with the disease.⁴

The epidemic in Hong Kong reached its peak at the end of March 2003. This was the result of the spread of the disease

into the community. One severe outbreak occurred in a housing estate known as Amoy Gardens in Kowloon towards the end of March 2003.

The index patient (first case of the outbreak) was a 33 year old man who lived in Shenzhen and visited his brother in Amoy Gardens regularly. He had chronic renal disease, which was being treated at the Prince of Wales Hospital. He developed SARS symptoms on 14 March 2003. On 14 March and 19 March, he visited his brother who owned a flat in block E of Amoy Gardens. He had diarrhoea at that time and he used the toilet there. His brother, his sister in law, and two nurses who attended to him at Prince of Wales Hospital subsequently developed SARS.

As of 15 April 2003, there were a total of 321 SARS cases in Amoy Gardens. There was an obvious concentration of cases in block E, accounting for 41% of the cumulative total.

A thorough investigation into the cause of the outbreak was carried out by the Department of Health in collaboration with eight other government agencies. The investigation revealed that environmental factors played an important part in this outbreak. The defect was found in the sewage system at Amoy Gardens.⁵

Each block at Amoy Gardens has eight vertical soil stacks each collecting effluent from the same unit of all floors. The soil stack is connected with the water closets, the basins, the bath tubs, and the bathroom floor drains. Each of these sanitary fixtures is fitted with a U shaped water trap (U trap) to prevent foul smell and insects in the soil stack from entering the toilets. For this preventive mechanism to function properly, the water traps must be sufficiently filled with water. However, as most households had the habit of cleaning the bathroom floor by mopping instead of flushing it with water, the U traps connected to most floor drains would probably have been dry and would not have been functioning properly (fig 2).

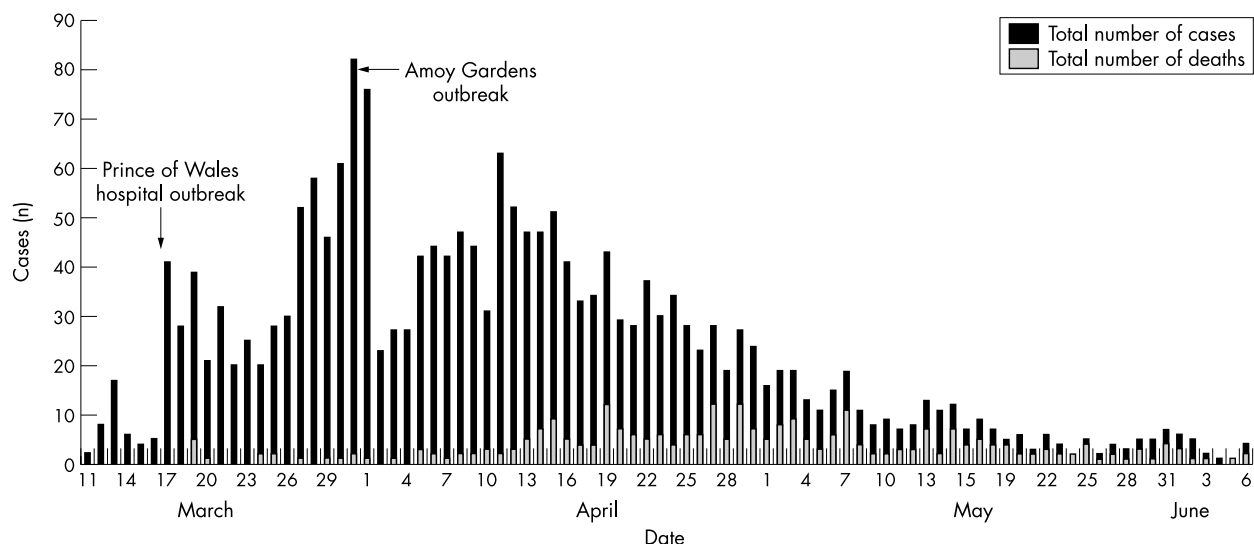


Figure 1 Data on severe acute respiratory syndrome in Hong Kong, March–June 2003.

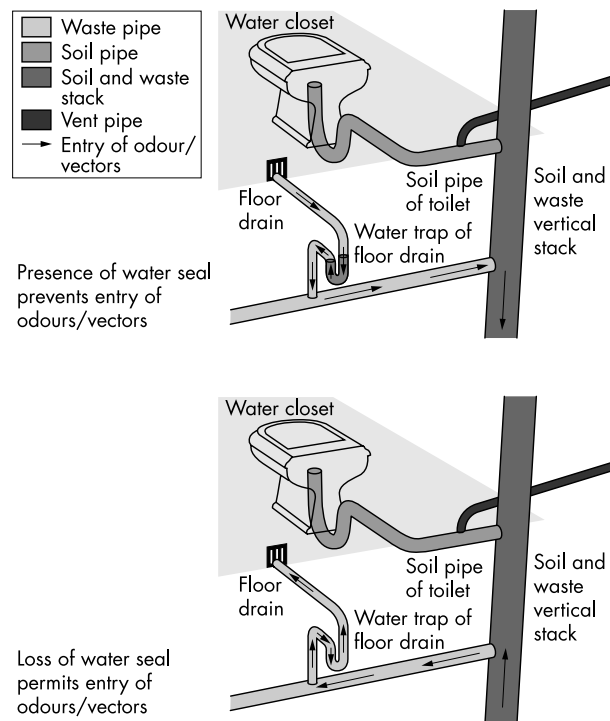


Figure 2 Floor drains at Amoy Gardens.

Laboratory studies have shown that many patients with SARS excrete coronavirus in their stools, where it could survive for longer periods than on ordinary surfaces. As many as two thirds of the patients in this Amoy Gardens SARS outbreak had diarrhoea, contributing to a significant virus load being discharged in the sewerage in block E.

It is probable that the index patient initially infected a comparatively small group of residents within block E and subsequently to the rest of the residents in that block through the sewage system, person to person contact and the use of shared communal facilities such as lifts and staircases. These residents subsequently transmitted the disease to others both within and outside block E through person to person contact and environmental contamination.

The bathroom floor drains with dried up U traps provided a pathway through which residents came into contact with small droplets containing viruses from the contaminated sewage. These droplets entered the bathroom floor drain through negative pressure generated by exhaust fans when the bathroom was being used with the door closed. Water vapour generated during a shower and the moist conditions of the bathroom could also have facilitated the formation of water droplets. The chance of exposure was increased given that the bathrooms in apartment units of Amoy Gardens were generally small in size (about 3.5 square metres). Contaminated droplets could then have deposited virus on various surfaces, such as floor mats, towels, toiletries, and other bathroom equipment.

Transmission of the disease by airborne, waterborne route, and infected dust aerosols have been examined but these were not supported by the epidemiological picture and laboratory results.

A team of experts on environment from the WHO were later invited to visit the Amoy Gardens and to study the result of the investigation. The WHO experts were in agreement with the findings of the investigation report. The experts further added that despite the outbreak, adequate cleansing/disinfection operations had been carried out and the Amoy Gardens were safe for habitation.

PUBLIC HEALTH MEASURES

The preventive and control measures undertaken in Hong Kong include (1) preventive education and publicity, (2) tracing the source of infection, (3) introducing five important control measures including (a) compulsory isolation and surveillance of contacts (b) stopping school and university education sessions (c) exchange of epidemiological information between Hong Kong and Mainland China (d) temperature checking of travellers at points of entry and exit (e) mounting district wide cleansing campaigns,⁶ (4) strengthening collaboration and communication with mainland China and the World Health Organisation and (5) developing quick diagnostic test for SARS.

From a historical perspective, the public health measures against the SARS epidemic were basically following the same principles of control of previous major outbreaks or epidemics of the old infectious diseases in the 19th and 20th centuries. The principles included early detection, notification, isolation, treatment, investigation, and control. All these measures were covered by the Hong Kong Quarantine and Prevention of Disease Ordinance Chapter 141 and the Prevention of Spread of Infectious Diseases Regulation.⁷

As a first step, when the first few cases of SARS were identified, the Department of Health of the Hong Kong Special Administrative Region government passed the legislation to include SARS as a notifiable infectious disease and thus the provisions in the Ordinance and Regulations were applicable in respect of SARS. Thus SARS patients were isolated in the hospitals and family or close contacts were kept under surveillance initially at home, but later on were transferred to isolation centres for observation for 10 days.

The public health workers undertook the investigations of the source of infection and the tracing of contacts, and the application of control measures including personal protection through the wearing of masks, strict adherence of personal hygiene, disinfection and cleansing of affected households and housing estates. Strict port health measures were introduced to screen incoming or outgoing travellers with fever exceeding 38°C, and to complete health declaration forms. All these measures were generally effective in that they raised the awareness of the public about the high infectivity of SARS, and to take prompt preventive measures. There were, however, problems in the enforcement of these measures that were not observed in previous epidemics.

Unlike the previous epidemics, the SARS outbreak reached epidemic proportions in such a short time and in such an explosive manner, the health and hospital authorities were in a way not fully alerted and well prepared to face the epidemic. There was initially an acute shortage of masks and protective clothing for the medical and health personnels who were hard hit by the disease. The inadequate epidemiological information about the disease hampered the prompt application of effective control measures. Inadequate communication with the public also generated a panic situation in the community and weakened the cooperation and support from the public. Some contacts did not come forward to the call of the Department of Health for surveillance and quarantine. There were problems in designating hospitals for the isolation and treatment of SARS patients because Hong Kong has no specific infectious disease hospital as such. As the wards of these general hospitals were not designed for infectious disease patients, infection of healthcare staff in these hospitals became a serious problem. As at 20 May 2003, a total of 379 medical, nursing and other healthcare workers in the hospitals developed SARS and three of them including one doctor, one nurse and one healthcare attendant died of the disease. Some hospital wards had to be closed for the time being and general patients were transferred to other medical institutions to make way for the SARS patients. Unlike the early days in the 1960s, there was no specific isolation centre in Hong Kong for

the quarantine of contacts of infectious disease. As an emergency measure, holiday and recreation centres outside the city areas were temporarily used as quarantine centres for the contacts. The environment was less satisfactory as these places were not designed for isolation purposes. It was noticed that there was a great sign of anxiety among the frontline healthcare workers and members of the public, many of whom had complaints and symptoms of anxiety, depression, and fear.

In the middle of May 2003 when the epidemic started to slow down, the government announced further measures to tackle the problem resulting from the epidemic. Three committees headed by top senior government officials were immediately established. One committee was responsible for the overall cleansing campaigns and environmental improvements of the housing estates in the city. The second committee was responsible for drawing up plans and programmes to revitalise the economy of the city including tourism, trade, and employment. The third committee undertake to draw up strategies and plans to promote community involvement and partnership in improving the physical, social, and economic environments of the city. Additional funds were approved to support research on treatment, vaccine development, and the clinical and diagnostic aspects of SARS. A Centre for Disease Control and Prevention would be developed to strengthen surveillance, research, training and collaboration with other health authorities regionally and internationally.

DISCUSSION

The SARS Epidemic in Hong Kong not only severely affected the health of the people but also produced many related social, economic, and humanitarian problems particularly tourism, international travel and trade, social and business activity, educational programmes in schools and tertiary institutions, and the international image of Hong Kong.

There are several features of the SARS epidemic that rendered the application of control measures difficult in Hong Kong. Firstly, protection of the healthcare workers in hospitals—the medical and nursing personnel being the front line workers were particularly affected. Secondly, there might be more than one causative agent such as chlamydia.⁸ Thirdly, a quick and accurate diagnostic test is still being developed. Fourthly, there is still no recognised standard treatment for the disease. Different approaches were used and lastly, the exact mode of transmission was not fully established, thus making the application of effective control measures difficult.

CONCLUSION

A good lesson has been learned from this epidemic in that Hong Kong will have to continue to face the challenges of infectious disease because of the increasing problems of environmental pollution, movement of population, influx of refugees and immigrants, the emergence of new infections, and

the changing lifestyle and behaviour of the population. There is a great need to set up a Centre for Diseases Control and Prevention in Hong Kong so as to strengthen surveillance and exchange of epidemiological information with other health authorities, to undertake research, development of new vaccine, and training of medical and scientific personnel on various aspects of prevention, treatment and control of infectious diseases. The epidemic, however, has created a strong sense of unity that has not been experienced before, among all sectors of the population, the government and NGOs, and the medical and nursing personnels in the joint efforts to fight against the epidemic.

Various funding foundations were set up by NGOs and public spirited citizens to provide financial support to victims of SARS and their family members and to the medical and healthcare personnel who have been affected with SARS. The devotion and dedication of the medical and healthcare staff who were sacrificed themselves and ran the risk of contracting the infection earned a great praise and appreciation from all walks of life. This spirit of sacrifice and service to the community and the care to the SARS patients as exhibited by the healthcare profession made the city even stronger and more united to face the challenges of infectious diseases in future. In a way, Hong Kong has turned the “risk” of the SARS epidemic into “opportunity”.

Author's affiliations

S H Lee, Centre for Health Education and Health Promotion, The Chinese University of Hong Kong, Flat 2D Union Court, 18 Fu Kin Street, Tai Wai, Shatin, Hong Kong, China

Correspondence to: Professor S H Lee; shlee@cuhk.edu.hk

Accepted for publication 23 June 2003

REFERENCES

- 1 **Department of Health**, Hong Kong. Severe acute respiratory syndrome (SARS) statistics, Mar–May 2003. <http://www.info.gov.hk/dh/>
- 2 **Severe acute respiratory syndrome (SARS) statistics. Mainland China, up to 17 May 2003.** <http://www.chinacdc.net.cn/default.asp>
- 3 **CDC update.** Outbreak of severe acute respiratory syndrome – worldwide, 2003. *Commun Dis Rep CDR Wkly* 2003;**52**:241–8.
- 4 **Tomlinson B**, Cockram C. SARS: experience at Prince of Wales Hospital, Hong Kong. *Lancet* 2003;**361**:1486–7.
- 5 **Department of Health**, Hong Kong. Outbreak of severe acute respiratory syndrome (SARS) at Amoy Gardens, Kowloon Bay, Hong Kong. Main findings of the investigation, 17 Apr 2003. http://www.info.gov.hk/info/ap/pdf/amoy_e.pdf
- 6 **Donnelly CA**, Grani AC, Leung GM, *et al.* Epidemiological determinants of spread of causal agent of severe acute respiratory syndrome in Hong Kong. *Lancet* 2003;**361**:1761–6.
- 7 **Lee SH.** *Prevention and control of communicable diseases in Hong Kong.* Hong Kong: Government Printer, 1994.
- 8 **Peiris M**, Lai ST, Poon LM, *et al.* Coronavirus as a possible cause of severe acute respiratory syndrome. *Lancet* 2003;**361**:1319–25.