

WILL THE SARS EPIDEMIC RECUR?

Host and environment are key factors

A Lee

On 5 July 2003, the WHO removed Taiwan from its list of areas with recent local transmission of SARS meaning that all known chains of person to person transmission of the severe acute respiratory syndrome (SARS) virus have now been broken.¹ However, the WHO executive director for communicable diseases advised that public health should not let down its guard, as more cases could still surface somewhere in the world.¹ It is therefore an important public health issue whether the SARS epidemics will recur.

If you had a crystal ball to view the future, this question would be answered. We would make some prediction based on the epidemiological triangle (fig 1) recognising the three main factors—agent, environment, and host in the pathogenesis of disease.² If we can control any two of the main factors, we would prevent the occurrence of a communicable disease.

Coronavirus has been identified in playing an aetiological part of SARS.³ A lot of work has been done to understand the genome of the virus that would lead to development of vaccine and treatment, but time is needed for such development. To prevent the recurrence of epidemics we should look at the host and environmental factors.

The agent must be capable of infecting the host for infection to develop. This depends on whether the environment is favourable for its survival and transmission, and also the susceptibility of the host. The susceptibility of the host depends on its ability to fight off the infection, which can be a disease specific defence mechanism such as vaccine, or non-specific defence mechanism. The ability of non-defence mechanism to fight off infectious disease will depend on the host's general health status, nutritional status, age, coexisting chronic illness, etc. If you have a population that is healthy, fit, and well nourished, the chance of infection would be low.

Epidemics are an increase in the frequency of occurrence of a disease in a population above its baseline level for a specified period of time. To calculate this, estimate the basic reproductive number that is defined as the expected number of new infectious hosts that one infectious host will produce during the period of infectiousness in a population that is susceptible. It depends on number of contacts per unit time, transmission probability, and duration of infectiousness. Apart from infectivity of the agent and host suscept-

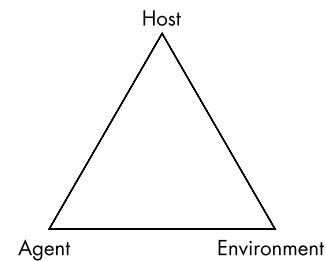


Figure 1 The epidemiological triangle.

ibility, transmission probability also depends on environmental factors. SARS is spread by droplet transmission. If the population has developed good personal hygienic practice to prevent the spread of droplet infection, and creates a clean and hygienic environment minimising the chance of survival of infectious disease agents, the transmission probability will be low. If the suspected SARS cases can be screened early and isolated, the number of contacts per unit time will be fewer and the duration of susceptible hosts exposed to suspected cases will also be short. Therefore environment improvement and good infectious disease control measures are the key factors to prevent an epidemic in the autumn of 2003.

Before a breakthrough in treatment and vaccine development, a SARS epidemic can easily recur if the population is unhealthy and has poor hygienic practices, and where there is inadequate infectious control measures and a poor living environment. The Hong Kong SAR government has taken measures to improve the environment, and also to promote community action and partnership in improving the health and hygiene. It really depends whether these initiatives can be sustained as to whether the epidemic is less likely to recur.

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Virus pathogens suggest an autumn return

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SARS is one of the deadly new emerging infectious diseases identified in the 21st century. Since its emergence in November

2002, SARS has created public panic and raised many issues among healthcare workers and policy makers around the world. Although

healthcare communities together with public vigilance around the world seem to have halted the SARS outbreak, at least for the time being, the question remains to be answered is whether the infection will reappear? I believe if SARS follows the pattern of other

Policy implications

- Greater vigilance about health and hygiene and the open sharing of medical information should be the norm in future.
- In the absence of any effective vaccine or treatment, the only way to combat SARS is to limit its spread.
- If SARS does return in autumn its epidemiology could be different.

respiratory viruses, it is probable that it will reappear next autumn during the influenza season. I have the following explanations in support of my opinion.

The causative agent of SARS is a novel coronavirus—a virus of the corona family. About one third of all common colds are caused by viruses from the same family and these show a winter and spring seasonality.¹ The emergence of SARS outbreak in China and Hong Kong during the influenza season (December–March) suggests that possible common environmental factors may influence transmission. Some human pathogens such as influenza, measles, and rotavirus follow a cyclical pattern, waxing in colder and drier months and waning when weather turns warmer,² which may also be the case for the SARS virus. While the importance of effective quarantine and preventive measures cannot be ignored, the decline in the SARS prevalence with increasingly warmer weather supports that seasonality may be a contributing factor. This may explain the limited spread of the SARS virus in the rural areas of Guangdong, which has only basic medical facilities and lower public preparedness. For instance, environmental temperature may influence the trends of SARS outbreak. Outbreaks of respiratory syncytial virus infections were associated with higher environmental temperature, lower relative humidity, and higher maximum day to day temperature variations.³ During the Amoy garden outbreak in Hong Kong, external temperature ranged between 18–22°C, which has been proposed as permissive temperature enabling transmission of the SARS coronavirus. It is unconvincing that Vietnam and Guangzhou controlled SARS by better medical facilities and hygienic standard. Anecdotal reports suggest that the changes in temperature might have limited the outbreak of SARS in Vietnam and Guangzhou earlier than Hong Kong. The wider

Key point

- If SARS follows the pattern of other respiratory viruses, it is probable that it will reappear next autumn during the influenza season.

use of heaters in Toronto and air conditioning in Hong Kong and Singapore, usually to keep the room temperature within 18–22°C, might have contributed to the long lasting outbreak in these developed cities. It would be useful to examine the relationship between temperature change and the occurrence of SARS in the future.

Consistent with other infectious diseases,² changes in atmospheric conditions, the prevalence of virulence of the pathogen and the behaviour of the host could also contribute to the recurrence of SARS. It is possible that the virus is being slowly transmitted among people who remain asymptomatic or the virus is surviving in the environment and will reappear when favourable conditions return. Although the source of the coronavirus remains to be confirmed, civet cats and other wild animals sold in food markets in southern China are believed to be the source. If confirmed the animals will be a reservoir in ready contact with humans that could initiate a second SARS epidemic.

Finally, whether or not SARS reappears, lessons learned from the recent outbreak such as greater vigilance about health and hygiene and the open sharing of medical information should be a norm in future. In the absence of any effective vaccine or treatment, the only way to combat SARS is to limit its spread. We should also be aware that if SARS does return in autumn its epidemiology could be different. In the recent outbreak, most of the SARS cases with the exception of Amoy Garden outbreak in Hong Kong were confined to the healthcare workers indicating limited community spread. Given the high case fatality rate, if the rate of transmission should increase in the community the consequences could be devastating.

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Debate