SARS — One Year Later
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It was just over a year ago, in November 2002, that the first case of what was to become known as the severe acute respiratory syndrome (SARS) was identified in Foshan, Guangdong Province, China. The dramatic spread of SARS in the late winter and spring of 2003 appeared at first to herald the onset of a new infectious disease that would become endemic worldwide. However, almost as quickly as it spread, it was brought under control. As evidenced in this issue of the Journal in a report by Olsen et al. (pages 2416–2422) and a review article by Peiris et al. (pages 2431–2441), much has been learned in the intervening months about SARS and its causative agent, SARS-associated coronavirus (SARS-CoV).

A number of features distinguish the illness caused in humans by SARS-CoV from the respiratory illnesses caused by other viruses. SARS-CoV has a long incubation period for a respiratory virus: typically 4 to 7 days and occasionally as long as 14 days. The illness has a relatively insidious onset, upper respiratory tract symptoms are uncommon, and lower respiratory tract symptoms worsen slowly but steadily during the first 10 to 15 days. For reasons that are not yet understood, the disease is milder in children than in adults, and the viral load and the degree of infectivity in children also appear to be lower. In adults, the viral load is initially low, reaches a peak during the second week of illness, and appears to be higher in patients with more severe disease. This finding probably explains why no transmission has been identified from patients in whom symptoms have not yet developed and why in most cases transmission has occurred in hospitals.

Less well understood, but critical to the prompt control of future outbreaks, is the heterogeneity of the risk of transmission that is illustrated by the airplane flights described by Olsen et al. Infection in a single passenger on one flight resulted in illness in 22 of the 119 other passengers, whereas no known disease was transmitted by 4 symptomatic persons on another similar flight. In all the outbreaks, a minority of patients were associated with the majority of the transmitted cases, including cases that were transmitted despite the implementation of infection-control precautions.

As the history of the Toronto outbreak illustrates, it is not difficult to control the disease once it has been recognized, but it is challenging to recognize cases even in the midst of an outbreak (see Figure). If SARS returns, the greatest challenge will remain the early recognition of outbreaks.

Health authorities are preparing for the possible return of SARS this winter. The likelihood that it will return and the geographic location of new outbreaks will depend on the reservoir for SARS-CoV, which may include humans, laboratories, and animals. It is unlikely that a human reservoir currently exists. Outside of special settings such as hospitals, SARS-CoV has not spread from person to person at a rate that would allow its persistence in the general population, even in the absence of control measures. Some have speculated that during the summer months, the transmission of SARS-CoV may have been ongoing in previously affected areas but unrecognized because the disease was mild or asymptomatic. However, as Peiris and colleagues note, most patients with SARS have moderate-to-severe, symptomatic disease, and asymptomatic patients are unlikely to transmit the disease to others. There is no evidence that the disease is infectious more than 10 days after the resolution of fever or that patients with SARS have chronic or relapsing infection that might result in the transmission of the virus to other people. In this light, the absence of cases for more than five months is persuasive evidence that no human reservoir exists.

Laboratories that continue to work with SARS-CoV serve as a potential source of infection: one case of SARS in Singapore was the result of a laboratory accident. Clearly, it is vital when one is working with SARS-CoV to adhere to the biosafety guidelines established by the World Health Organization. Fortunately, the laboratory worker who acquired SARS had mild disease and did not transmit it to other people.

Thus, animals represent the most important potential reservoir for disease. SARS-CoV–like viruses have been isolated from Himalayan palm civets found in a live-animal market in Guangdong Province. Evidence of infection with similar viruses was also detected in other animals and in humans working at the same market. Results from other studies are consistent with the hypothesis that an animal reservoir exists for SARS-CoV or antigenically relat-
ed viruses; however, the findings to date are not sufficient to permit the identification of either the natural reservoir for SARS-CoV or the animals responsible for cross-species transmission to humans. Such cross-species transmission of a virulent and transmissible virus should be a rare event; however, its frequency cannot be predicted without much more information. Ongoing surveillance, research, and cooperation both within China and internationally will be critical for understanding the risk, recognizing the reintroduction of SARS if it occurs, and controlling human-to-human transmission.

The improbability of new outbreaks of SARS does not mean that we are wrong to be vigilant. The transmission that occurred at a hotel in Hong Kong on the night of February 21, 2003, and a small number of super-spreading events in each of the outbreaks suggest that it may be easy to transport this virus from a wild animal sold in a market in one country to humans in another country. The experience with SARS this year is a reminder that new infectious diseases will continue to emerge and that we need a collaborative, powerful, and effective international public health community to protect us when they do.

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