SEVERE ACUTE RESPIRATORY SYNDROME (SARS): A SUMMARY OF THE 2003 GLOBAL OUTBREAK AND LOCAL IMPACT

Severe acute respiratory syndrome (SARS) was the first highly virulent, readily transmissible respiratory infectious disease to impact our modern global society. While the advent of a new infectious disease was not surprising, what was alarming was how rapidly it spread—over the course of just a few months in the spring of 2003, cases were identified in more than two dozen countries across several continents with the majority of cases occurring in Asia. The first human cases were identified in November 2002 in Guandong, a southern province of mainland China, and once containment of was declared 8 months later, over 8,000 cases were reported worldwide—of these, 774 died. Fortunately, the US escaped both widespread illness and community transmission; only 8 cases with laboratory confirmed SARS infection were reported in the US, all had traveled to other parts of the world.[1]

SARS is a viral respiratory illness caused by a novel coronavirus, SARS-associated coronavirus (SARS-CoV), and is spread through close person-to-person contact via infectious respiratory droplet secretions. Typical symptoms begin with fever (often greater than 100.4° F) progressing to malaise, body aches, and then lower respiratory illness (e.g., shortness of breath, dry cough). A small percentage of cases also develop gastrointestinal illness (e.g., diarrhea). Many cases progress to pneumonia. During the global outbreak of 2003, CDC categorized the identification of potential SARS cases in the US into two types: suspected versus probable cases. Suspected cases presented with basic SARS symptoms (e.g., fever and signs of lower respiratory illness) plus at least one SARS-exposure risk factor (e.g., travel to an area with known community transmission or close contact with a potential SARS case). Probable cases had the same symptoms and risk factors as suspected cases, but also had radiographic evidence of pneumonia or acute respiratory distress syndrome (ARDS). Since the primary SARS risk factor for US cases was travel to a SARS-associated area, which changed frequently over the course of the outbreak, the basis for SARS case identification was constantly in flux and was terminated when incident cases were no longer identified abroad.[2]

In retrospect, the World Health Organization (WHO) developed the following core conclusions regarding the transmission of SARS infection:[3]

- SARS is primarily not an airborne disease. The principal method of SARS transmission has been through direct contact (i.e., to eyes, nose, mouth, etc.) with infectious respiratory secretions. Some studies suggest that airborne (aerosolized) transmission and fecal-oral transmission can occur,[4] this may partially explain some unusual occurrences of SARS transmission such as the outbreak at the Amoy Gardens apartment in Hong Kong; however, these are rare and atypical events—droplet transmission is the predominant method of SARS transmission. As such, the proper use of personal protective equipment and simple infection control techniques, such as frequent hand washing, are especially effective methods of preventing illness.
- Risk of transmission is greatest around day 10 of illness. Since viral titers peak around day 10 of illness and then decline, when symptomatic cases are effectively isolated within 5 days of onset of illness, few secondary cases occur.
- There is no risk of transmission 10 days following resolution of fever. This finding further supports the infection control recommendations to isolate cases, even suspected cases, until 10 days following resolution of fever as well as to enact flight restrictions and other containment measures which center on screening individuals for fever.
- Healthcare workers were at increased risk for infection. Since healthcare workers are more likely to be exposed to SARS cases during their peak of infectivity and because they have a higher potential of coming in contact with infectious respiratory secretions, healthcare workers—especially those

1 CDC. Revised U.S. surveillance case definition for severe acute respiratory syndrome (SARS) and update on SARS cases—United States and worldwide, December 2003. MMWR 2003; 52(49):1202–1206. Available at: www.cdc.gov/mmwr/preview/mmwrhtml/mm5249a2.htm

2 WHO. Update 92—Chronology of travel recommendations, areas with local transmission. Available at: www.who.int/csr/don/2003_07_01/en

3 WHO. Consensus document on the epidemiology of severe acute respiratory syndrome (SARS). Department of Communicable Disease and Response. Available at: www.who.int/csr/sars/en/WHOconsensus.pdf

4 Tong TR, Liang C. Evidence of airborne transmission of SARS. NEJM 2004; 351(6):609-611.

responsible for aerosol generating procedures such as intubating a patient—are at high risk for infection. While the SARS outbreak was eventually contained, the threat of SARS remains and likelihood of new infections and global spread continues. As such, it is critical that healthcare facilities maintain effective infection control procedures and be diligent in the identification of possible cases.

- Children are rarely affected by SARS. As of publication of their recommendations (May 2003), WHO reports only two cases of SARS transmission from children to adults and no evidence of any child-to-child transmission or transmission in schools. The manifestation of SARS in children is controversial and further investigation is needed to determine whether children may have asymptomatic or mild SARS infections.

SUMMARY OF LOS ANGELES COUNTY SARS CASES

Over the course of nearly 6 months (from late March when the first potential LAC SARS case was identified until case identification was terminated by the CDC in mid-August), a total of 22 cases were investigated for possible SARS infection in LAC—none of these cases had a specimen positive for SARS Co-V (Table 1). More than half of the investigated cases (68%, n=15) were classified as a suspect SARS case since their illness did not progress to pneumonia and they showed no signs of respiratory distress syndrome. Many (32%, n=7) were foreign cases, not local residents, who were visiting our county or identified when traveling through the Los Angeles International airport. The SARS exposure risk factor for all but one of the cases (a child of another LAC suspect case) was travel to a SARS-associated location, all from various areas in Asia (e.g., China, Taiwan). None of the potential cases held sensitive occupations or were healthcare employees.

Table 1: Summary of LAC SARS Cases*

	Probable SARS (n=7)	Suspect SARS (n=15)	Total SARS Cases (n=22)
Classification completed	**7**	**6**	**13**
Other diagnosis	1	0	1
Negative SARS Co-V convalescent Ab	6	6	12
Classification unable to be completed	**0**	**9**	**9**
Foreign resident; final tests unavailable	0	7	7
Testing incomplete; refused convalescent testing	0	2	2
Classification pending final tests	**0**	**0**	**0**
Confirmed positive SARS Co-V	**0**	**0**	**0**

* Includes case investigations only as of 8/13/2003.

LESSONS LEARNED

While none of the locally investigated cases was diagnosed with SARS, the response required of public health was substantial; tremendous effort was necessary for both public and professional outreach and numerous materials were developed including extensive education materials and clinical guidelines and protocols. Many of these materials are available on the ACDC website (www.lapublichealth.org/acd/SARS.htm). The planning and materials have served as valuable resources for other infectious diseases (including pandemic influenza) and will be critical should global transmission of SARS recur.

Many important lessons were learned as a result of our SARS investigations. The following are a few of the key considerations and issues that were addressed:

- Public health partnerships with hospitals and community healthcare organizations are critical. This was an important lesson learned worldwide as well as in LAC. Accordingly, Acute Communicable Disease Control has established the Hospital Outreach Unit (HOU) and assigned liaison public health nurses (LPHN) to interface with all hospitals in our county. The LPHN are responsible for improving overall disease reporting and preparedness for emerging infectious diseases in their assigned hospitals. This new program also facilitates the communication between our health department and the hospitals and improves relationships.
- Early detection of disease is paramount. Physicians and hospital staff were, and continue to be, on the front lines of SARS. They will be the first to identify new cases should SARS recur. Similarly, if their detection and infection control procedures are flawed, it is hospital staff and their close contacts (i.e., their families and other patients) that are most likely to be affected. Systems of monitoring rates of respiratory illness among hospital staff are currently being considered as a method of early SARS and other disease outbreak detection.
- Infection control is an ongoing responsibility. As mentioned previously, standard infection control practices proved critical in ending the SARS epidemic. However, now that the fear and saliency of SARS has subsided, it is easy to neglect consistent infection control practices. Healthcare facilities need to implement periodic evaluations of their infection control practices and their ability to identify both potential SARS cases as well as other individuals with unique infectious diseases (e.g., pandemic influenza cases). ACDC has conducted and continues to provide hospitals with extensive education in infection control including methods for proper hand hygiene, respiratory hygiene, and the use of personal protective equipment.
- Physicians should consider and test for differential diagnoses. CDC guidance permits reclassification of potential SARS cases if another diagnosis is obtained which can fully explain the patients' condition. While all medical professionals should be alert for and suspicious of potential SARS cases, during the 2003 pandemic, only 8 confirmed SARS cases were identified in the US; the overwhelming majority of suspected SARS cases were actually ill with more common respiratory pathogens (e.g., influenza, Mycoplasma pneumoniae, Chlamydia spp., parainfluenza, respiratory syncytial virus, adenovirus, etc.). For example, in California molecular testing decreased suspicion for SARS in nearly half of the suspected SARS cases (45%, n=23) and nearly half of the probable SARS cases (47%, n=9).5 Thus to limit both the anxiety and the special resources that occur in the diagnosis of potential SARS case, healthcare facilities should be well stocked with the supplies to obtain a more likely differential diagnosis and physicians should be well versed in their ability to test for and obtain such an alternative diagnosis.
- Surge capacity needs to be addressed. In an epidemic event, health facilities need to be aware of their available resources (e.g., isolation rooms, intensive care unit beds, ventilators, staffing, supplies, etc.). A specific issue that occurred in our county involved the housing of foreign cases. Many of the investigated potential LAC cases during 2003 were foreign visitors, not local residents. And in light of the high proportion of travelers into our county, coupled with the fact that should SARS recur it will most likely again begin in another country (again most likely in Asia), there is a great need to have special housing available for foreign cases and their family to be able to quarantine and monitor these individuals during the 10 day infective period.
- Rapid dissemination of information helps to control panic. Methods of communication should be set up before the event occurs. Information technology needs to be up-to-date. Media plays an important role. Call centers and hotlines should be available continuously (24 hours, 7days a week) and accessible in multiple languages.
- Planning and preparedness needs to be an ongoing process. ACDC continues to develop and adapt to the constantly changing SARS situation as well as for other potential major public health events (e.g., pandemic and avian influenza). This includes developing preparedness plans and testing these plans through a variety of training exercises (e.g., SARS table top exercises).

5 Louie JK, Hacker JK, Mark J, et al. SARS and common viral infections. EID 2004; 10(6). Available at: www.cdc.gov/ncidod/EID/vol10no6/03-0863.htm

LAC and the US escaped widespread transmission of SARS, but other locations (such as Toronto) were not as lucky. And again, in light of the high prevalence of international travelers in our county, the likelihood of the introduction of a novel deadly disease is great. Even if SARS does not recur, other diseases (e.g., avian influenza or pandemic influenza) are imminent and the SARS outbreak of 2003 can serve as a valuable lesson for future preparation and prevention.