

## Toronto Emergency Medical Services and SARS

**To the Editor:** The first appearance of severe acute respiratory syndrome (SARS) in China in November 2002 led to a worldwide epidemic by March 2003. On February 21, 2003, an index case of SARS, which led to 224 cases and 38 deaths, was diagnosed in Toronto. On March 14, four cases of atypical pneumonia in Toronto were epidemiologically linked to the SARS outbreak in China. On March 26, the Ontario Ministry of Health declared a provincewide medical state of emergency, which was lifted on May 17 when the SARS outbreak was thought to be over. However, 7 days later, several more cases of SARS were discovered in four Toronto hospitals, which caused a resurgence of the intensive precautionary measures throughout the healthcare sector. When the state of emergency was lifted on July 2, 2003, a total of 224 people in Toronto had been officially diagnosed with SARS, and 38 had died.

The SARS outbreak strained Toronto Emergency Medical Services (EMS), which worked 40 stations evenly divided among the city's four quadrants. Annually, Toronto EMS transports >140,000 patients to 17 acute-care hospitals, which makes it the largest and busiest municipal EMS in Canada. During the outbreak, Toronto EMS's 850 paramedics had 1,166 potential SARS exposures; 436 were placed in a 10-day home quarantine, which meant being isolated from those persons within the home, continuously wearing an N95 respirator, and taking their temperature twice a day. SARS-like illnesses developed in 62 paramedics, and suspected or probable SARS requiring hospitalization developed in 4 others. On March 26, almost all of the frontline staff of the city's northeast quadrant were sent

home because of possible SARS exposure at a Toronto hospital (1). On May 22, when the outbreak's second phase began, >200 paramedics had contact with patients with SARS and were quarantined. These events seriously affected EMS and their staff.

Even before the SARS emergency was declared in Ontario, Toronto EMS was aware of a serious respiratory disease in the community. Because of an increase in "atypical pneumonia" cases, an advisory had been sent to all paramedics warning them to wear respirators, gowns, gloves, and goggles with all respiratory patients. The advisory was recalled in favor of the Provincial Directive; the Provincial Directive was also changed when SARS reemerged in May. While properly fitting and supplying 850 paramedics with respirators took several months, no paramedics became ill with SARS after these requirements were initiated, even without fit-testing all the respirators.

Although cleaning the emergency vehicles was a potential concern, the only important change was substituting the usual disinfectant of 3% hydrogen peroxide with virucidal effect in 10 minutes to a disinfectant of 7% activated hydrogen peroxide with virucidal effect in 5 minutes. Otherwise, normal procedures were followed and emergency vehicles were cleaned on their regular rotational basis.

During the outbreak, the EMS Healthcare Divisional Operations Centre became the emergency operations center for Toronto EMS. It had been designed to coordinate Toronto's operational response with other municipal and provincial health services. During this time, the province also created its own emergency operations center, to which representatives from both health services reported.

Within days of the provincial emergency, Toronto EMS, in conjunction with Toronto police and fire services, created the medical support unit

that operated as an internal public health department for all paramedics and was responsible for their direction, education, support, and screening. If needed, paramedics were placed under work or home quarantine or precautionary symptom surveillance on the basis of their exposure history, symptoms, and treatment in an emergency department or SARS clinic if needed. The medical support unit used protocols developed by a base hospital medical director who, together with EMS staff, reviewed each paramedic's chart daily to make appropriate follow-up decisions. The medical support unit was a vital component in protecting the paramedics' health and welfare.

To sustain the optimal functioning of Toronto EMS, its headquarters was closed to frontline staff for the duration of the outbreak. All personnel had to be screened for SARS-like symptoms before entering, and all paramedics had to check themselves for signs and symptoms of a SARS-like illness before reporting for duty. Anyone with SARS-like symptoms had to report to the medical support unit and stop working in an EMS capacity.

To control the spread of SARS, the provincial government placed all interfacility transfers under the control of Toronto EMS through the creation of the Provincial Transfer Authorization Centre on March 29. Since then, the Provincial Transfer Authorization Centre has been responsible for ensuring that all non-emergency transfers are medically cleared to prevent patients with contagious diseases from being taken to a facility that is unprepared to receive them. The Provincial Transfer Authorization Centre now processes >1,200 requests daily and was an important factor in containing SARS.

Several lessons were learned from the SARS outbreak. First, an emergency plan must be in place before an outbreak occurs. Second, the ability to

communicate quickly and easily with provincial and municipal health authorities was needed to ensure that the most up-to-date information concerning the outbreak was available. The intergovernmental relationships necessary for such rapid communication should be established in advance. Third, accurate and timely communication with frontline staff members is the best way to minimize their fears. Finally, personal protective equipment procedures should be maintained until assurance that the exposure risk is negligible. The SARS outbreak is unlikely an isolated occurrence; therefore, sound advance planning on the basis of experience will increase the ability to protect both EMS staff and the public in the future.

#### Acknowledgments

We thank the Toronto Emergency Medical Services staff who helped manage the outbreak and Paula Chabanais for editing this manuscript.

**Alexis Silverman,\*<sup>1</sup> Andrew Simor,†<sup>1</sup> and Mona R. Loutfy,‡<sup>1</sup>§<sup>1</sup>**

\*Toronto Emergency Medical Services, Toronto, Ontario, Canada; †Sunnybrook and Women's College Health Sciences Centre, Toronto, Ontario, Canada; ‡McGill University, Montreal, Quebec, Canada; and §North York General Hospital, Toronto, Ontario, Canada

#### Reference

1. Varia M, Wilson S, Sarwal S, et al. Hospital Outbreak Investigation Team. Investigation of a nosocomial outbreak of severe acute respiratory syndrome (SARS) in Toronto, Canada. *CMAJ*. 2003;169:285–92.

Address for correspondence: Alexis Silverman, Toronto Emergency Medical Services, 4330 Dufferin Street, Toronto, Ontario, Canada M3H 5R9; fax: 416-392-2149; email: asilver@toronto.ca

<sup>1</sup>All authors contributed equally to developing, drafting, and revising this letter.

## SARS during Pregnancy, United States

**To the Editor:** Two of eight persons with laboratory-confirmed severe acute respiratory syndrome—associated coronavirus (SARS-CoV) infection in the United States during 2003 were pregnant women. Robertson et al. (1) reported data describing one pregnant patient who recovered and delivered a healthy infant. We report data concerning the second patient, with follow-up 1 month after the child's birth.

The patient, a healthy, 38-year-old woman in the 7th week of pregnancy, traveled with her husband to Hong Kong. From March 1 to March 6, 2003, they stayed at the Hong Kong hotel where it is believed a physician from China spread SARS-CoV to several guests. These guests were the index case-patients for subsequent outbreaks in Hong Kong, Vietnam, Singapore, and Toronto, Canada (2). The woman and her husband returned to the United States on March 6; the husband had onset of SARS illness on March 13. On March 19, the patient had onset of an illness with fever (temperature 37.8–40°C), muscle aches, chills, headache, runny nose, productive cough, wheezing, and shortness of breath. A chest radiograph showed a diffuse infiltrate in the left lung. The patient was hospitalized for 9 days and given broad-spectrum antimicrobial drugs. She recovered from her illness, and enzyme immunoassay and immunofluorescent assays conducted on serum samples on days 28 and 64 after illness onset were positive for antibodies to SARS-CoV.

The patient had an uneventful pregnancy until the last trimester, when her blood glucose levels were elevated. Early spontaneous rupture of membranes initiated preterm labor, and a cesarean section was performed at 36 weeks' gestation because of fetal distress. A 5-pound, 7-ounce, healthy

boy was delivered without complications. Apgar scores were 7 at 1 minute and 8 at 5 minutes. The newborn had no illness, abnormalities, or congenital malformations. Serum samples from the patient at delivery were positive for antibodies to SARS-CoV, but cord blood and placenta samples were negative. Breast milk samples on postpartum days 12 and 30 were also negative for SARS-CoV antibodies. Blood, stool, and nasopharyngeal swab samples from the patient and cord-blood samples showed no viral RNA by reverse transcription–polymerase chain reaction. Stool samples from the newborn, collected on days 12 and 30 after delivery, were also negative for viral RNA.

Although other countries have reported cases of severe illness and poor outcome associated with SARS-CoV infection during pregnancy (3–5), neither of the two pregnant SARS case-patients in the United States had serious adverse outcomes. The presence of antibodies to SARS-CoV in breast milk might be influenced by the time of infection in relation to gestation. Robertson et al. (1) reported that antibodies to SARS-CoV were detected in the breast milk of a patient who was infected at 19 weeks' gestation; however, the patient in this case was infected at 7 weeks' gestation, and antibodies to the virus were not detected in her breast milk. No reports have indicated vertical transmission of SARS-CoV, a finding that is supported by our data. However, too few cases have been studied to clearly define the risks and provide guidance for treating pregnant women infected with SARS CoV.

**Lauren J. Stockman,\* Sara A. Lowther,\* Karen Coy,† Jenny Saw,‡ and Umesh D. Parashar\***

\*Centers for Disease Control and Prevention, Atlanta, Georgia, USA; †Santa Clara County Department of Public Health, San Jose, California, USA; and ‡Private pediatric practice, San Jose, California, USA