Between February and September 2003 Health Canada reported 438 probable or suspect cases of severe acute respiratory syndrome (SARS) resulting in 43 deaths primarily in the Greater Toronto Area (GTA). The basic reproductive number of 2–4 suggested a primary mode of transmission through contact of mucous membrane with infectious respiratory droplets or fomites, although airborne transmission was also suggested. In Toronto, there were several “superspreading” events, instances when a few individuals were responsible for infecting a large number of others. At least 1 of these events occurred in an emergency department, where overcrowding, open observation “wards” for patients with respiratory complaints, aerosol treatments, poor compliance with hand-washing procedures among health care workers and largely unrestricted access by visitors may have contributed to disease transmission.

We outline the process successfully followed by 4 Toronto emergency departments (at Mount Sinai Hospital, North York General Hospital, Sunnybrook and Women’s College Health Sciences Centre and the Hospital for Sick Children) involved in the assessment and treatment of 276 suspect and probable SARS cases between Mar. 13 and June 13, 2003, with no transmission to emergency department staff.

**Modifications in operations**

During the SARS outbreak the 3 emergency departments with respiratory isolation rooms initially assessed patients within existing facilities, and the 1 without such rooms triaged suspect cases to negative air pressure wards until a temporary isolation room in the emergency department was completed. One site subsequently constructed a large outdoor SARS assessment unit. Advance notification of the arrival of suspect cases allowed efficient use of isolation facilities.

**Fig. 1: Emergency department triage for SARS during an outbreak**

### All patients and visitors placed in N95 mask by security guards at entrance to emergency department

- Names, date and time of visit recorded; no visitors allowed during outbreak

### Patients screened by triage nurse using full precautions (Box 1)

- Standardized screening tool (modified daily as required)

### Respiratory isolation before further assessment

- If no airborne isolation room available, patient placed in private room with door closed
- Some patients given scheduled appointment for further assessment (Sunnybrook & Women’s College Health Sciences Centre) or asked to wait in driveway until isolation room available

### Standardized SARS diagnostic assessment

- CBC + differential, PTT, INR, chemistry (BUN, creatine, AST, ALT, ALP, GGT, amylase, LD, calcium, magnesium, phosphate, albumin), blood cultures × 2, chest radiograph

### SARS considered likely: admit

- Infection control and public health offices notified
- Rapid admission to SARS unit facilitated
- Further diagnostics (e.g., NP swabs, serology) performed
- Full precautions maintained

### SARS considered unlikely: discharge

- Patients counselled, instructions given for when to return
- Public health notified for contact tracing
- Fever/respiratory infection information sheet provided
- Note to employer (72-hour absence) provided

Note: CBC = complete blood count, PTT = partial thromboplastin time, INR = international normalized ratio, BUN = blood urea nitrogen, AST = aspartate transaminase, ALT = alanine transaminase, ALP = alkaline phosphatase, GGT = gamma-glutamyltransferase, LD = lactate dehydrogenase, NP = nasopharyngeal
General procedures for triage and management of patients in the emergency department during the SARS outbreak are outlined in Fig. 1 and Box 1. Patients who failed SARS screening were placed in respiratory isolation before any further assessment, including assessment of remaining vital signs. Suspect SARS cases sent to hospital by infection control were processed and often sent to the SARS ward immediately with no further interventions.

Modifications to daily operations were updated daily and notices posted by email and on bulletin boards. Procedure lists and protocols for donning and removing protective gear (Boxes 2 and 3) were posted, and equipment and garbage containers were arranged to facilitate compliance with SARS precautions. Non-essential equipment and furniture were removed from rooms to minimize contamination. Stethoscopes and other frequently used equipment were provided by the hospital and left in the rooms, whereas charts, pens and wireless phones were prohibited in rooms. Any equipment removed from rooms was disinfected using a hospital-approved disinfectant, and special policies were developed for cleaning patient rooms (Box 4).

Guards at entrances to the emergency departments restricted access to staff and emergency department patients only (no visitors or family), ensured compliance with protective measures and recorded names for contact tracing. A standardized hospital SARS classification governing patient transfers between institutions was developed by the SARS Provincial Operations Centre (www.oma.org/phealth/SARSCategories.htm) and significantly affected patient flow. Individual emergency departments were at times strained by large and unpredictable changes in patient volume when neighbouring institutions were closed because of uncontrolled exposure to or spread of SARS.

To accommodate increasing numbers of patients under investigation, some sites adjusted ventilation systems to create negative air pressure rooms (checked daily). All hallway stretchers were removed, and only 1 stretcher was permitted per room that had had multiple stretchers, which resulted in reduced emergency department capacity. As the outbreak came under control, a protocol was developed governing which patients could be separated only by a drape (i.e., those who were afebrile, passed SARS screening, were compliant with wearing approved masks and could be kept at least 1 m apart from each other). Protocols were developed to control patient movement (e.g., to radiology, wards, bathrooms), dispose of human waste and minimize the risk of SARS transmission associated with respiratory droplet aerosolization (e.g., through intubation with powered air-purifying respirator hoods, use of

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**Box 1: Procedures for all personnel working in the emergency department to prevent accidental transmission or contamination with SARS**

- Wear an approved mask (N95 or equivalent) at all times while in the emergency department.
- Bearded personnel are instructed to remove facial hair.
- Change into a clean isolation gown when entering the department.
- Remove the gown upon leaving the department.
- Wash hands every hour as well as before and after each patient contact.
- Nonsterile gloves are to be used as an additional barrier method, not as a substitute for good hand-washing practice.
- Wash hands before putting on or taking off an N95 mask.
- Avoid touching the face, especially the eyes, nose, mouth and mask.
- Wear eye and face protection for all patient contacts.
- Use hospital-grade germicide wipes to clean stethoscopes and other medical equipment after each patient contact.

*Necessary to ensure that mask is sealed properly.
† Security guards, posted at entrances to the department, enforced this rule.
‡ Unless hands were visibly soiled, it was considered acceptable to use an alcohol-based (waterless gel) hand wash.

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**Box 2: Protective gear required for entering an airborne isolation room**

- 2 sets of gowns
- 2 sets of gloves
- Hair cap
- N95 mask plus disposable mask
- Face shield placed over masks

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**Box 3: Stepwise procedure for removing protective equipment in order to minimize contamination**

1. Remove outer gloves
2. Remove outer faceshield
3. Remove outer gown
4. Remove inner gloves
5. Wash hands
6. Leave anteroom or patient room
7. Remove inner gown
8. Wash hands
9. Remove mask by holding it in place, pulling elastics forward and over head, and pulling mask forward and away from face. Discard mask
10. Wash hands before touching anything else
11. Apply clean N95 mask
12. Apply clean gown
aerosolized therapies and pulmonary function testing) (Box 5).

Although some emergency departments in SARS-affected areas modified operations even more dramatically than the measures we describe,1 our experience suggests that the extra measures may not be required. The procedures we followed were protective against spread by respiratory droplets and fomites and were effective during several intubations and high-risk procedures.

Despite precautions, there were no emergency department cases of SARS transmission in health care settings in Toronto,1 and these prompted control measures such as detailed guidelines for the management of high-risk airway procedures (www.health.gov.on.ca/english/providers/program/pubhealth/sars/sars_mn.html#1). The impact of these measures on emergency department practice is difficult to evaluate, and some measures remain controversial.

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