

SARS outbreak in the Greater Toronto Area: the emergency department experience

β See related articles pages 1349, 1353

Between February and September 2003 Health Canada reported 438 probable or suspect cases of severe acute respiratory syndrome (SARS) resulting in 43 deaths¹ 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,^{2–4} although airborne transmission was also suggested.⁵ In Toronto, there were several “super-spreading” 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,⁶ 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.

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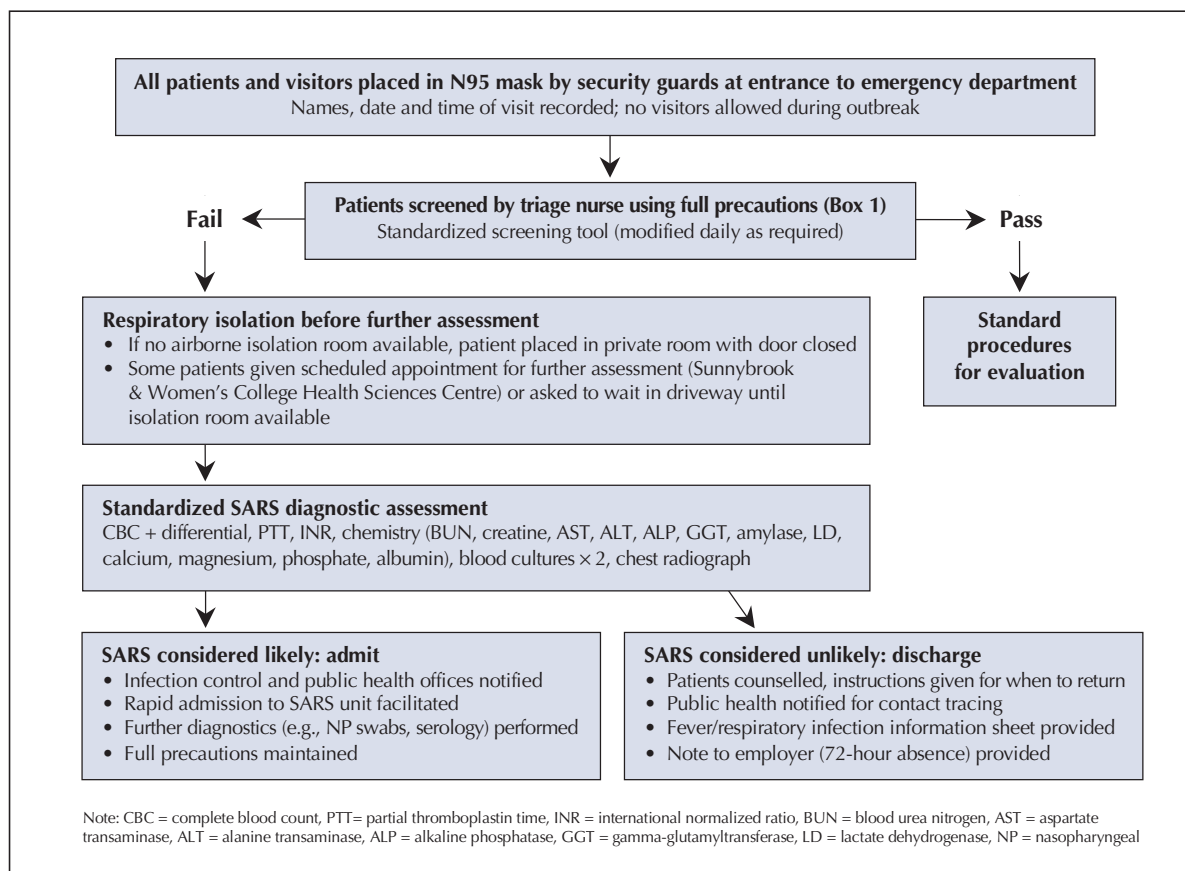


Fig. 1: Emergency department triage for SARS during an outbreak

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

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.

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

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,⁷ 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 nonemergency department cases of SARS transmission in health care settings in Toronto,⁸ 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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References

1. Canadian SARS numbers. Ottawa: Health Canada; 2003 Sept 3. Available: www.hc-sc.gc.ca/pphb-dgspsp/sars-sras/cn-cc/20030903_e.html (accessed 2004 Oct 18).
2. Lipsitch M, Cohen T, Cooper B, Robins JM, Ma S, James L, et al. Transmission dynamics and control of severe acute respiratory syndrome. *Science* 2003;300:1966-70.
3. Peiris JS, Yuen KY, Osterhaus AD, Stohr K. The severe acute respiratory syndrome. *N Engl J Med* 2003;349(25):2431-41.
4. Department of Communicable Disease Surveillance and Response. Consensus document on the epidemiology of severe acute respiratory syndrome (SARS). Geneva: World Health Organization; 2003. Available: www.who.int/csr/sars/en/WHOconsensus.pdf (accessed 2004 Oct 18).
5. Yu ITS, Li Y, Wong TW, Tam W, Chan AT, Lee JHW, et al. Evidence of airborne transmission of the severe acute respiratory syndrome virus. *N Engl J Med* 2004;350(17):1731-9.
6. Varia M, Wilson S, Sarwal S, McGeer A, Gourmis E, Galanis E, et al. Investigation of a nosocomial outbreak of severe acute respiratory syndrome (SARS) in Toronto, Canada. *CMAJ* 2003;169(4):285-92.
7. Chien LC, Yeh WB, Chang HT. Lessons from Taiwan [letter]. *CMAJ* 2003;169(4):277.
8. Loeb M, McGeer AJ, Henry B, Ofner M, Rose D, Hlywka T, et al. SARS among critical care nurses, Toronto. *Emerg Infect Dis* 2004;10(2):251-5.

Box 4: Hospital cleaning policies during SARS outbreak

- All cleaners to wear approved personal protective equipment (mask, gloves, isolation gown, eye protection) and change it after every room cleaned
- Checklists specifying each surface to be cleaned (and cleaning frequency) both inside and outside of patient rooms to be posted by the door of each room and signed and dated by cleaners
- Disposable cloths, mops and buckets to be used and changed after each room or area has been cleaned. Rooms to be cleaned with VIROX Accelerated 5 Concentrated Hydrogen Peroxide Surface Cleaner and Disinfectant, diluted 1/16, or 250 mL in 4 L of cold water
- Patient rooms to be fully cleaned twice (surfaces left wet for a minimum of 10 minutes for second cleaning) before new patient admission
- Specific instructions provided for emptying waste containers (e.g., do not squeeze or compress garbage bags while tying, to minimize potential aerosolization of particles)

Box 5: Additional precautions to prevent SARS transmission associated with respiratory procedures

- Aerosol treatments prohibited*
- Bilevel positive airway pressure (BiPAP) therapy prohibited
- Oxygen to be administered without humidification (but with frequent mouth care) or by using HiOx mask with exhaust filter
- Powered air-urifying respirator (PAPR) hood mandatory for intubation and bronchoscopy of SARS patients
- Intubation of patients with suspect SARS requiring airway support to be performed by the most experienced personnel available using rapid sequence protocol
- Patients requiring airway support, including patients with suspect SARS, to be managed in an area of the resuscitation room most distant from other patients, using a minimal complement of emergency department personnel

* Patients with asthma were treated instead with metered dose inhalers and aerochamber devices