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Responding to the Severe Acute Respiratory Syndrome (SARS) Outbreak: Lessons Learned in a Toronto Emergency Department

Authors: Carolyn Farquharson, RN, MN, ENCC, and Karen Baguley, RN, MScN, Toronto, Ontario, Canada

Carolyn Farquharson, RN, MN, ENCC, is Nurse Clinician, and Karen Baguley, RN, MScN, is Clinical Care Manager, Emergency Department, Mount Sinai Hospital, Toronto, Ontario, Canada.

For reprints, write: Carolyn Farquharson, RN, MN, ENCC, or Karen Baguley, RN, MScN, Mount Sinai Hospital, Emergency Department, 600 University Ave, Toronto, Ontario M5G 1X5; E-mail: cfarquharson@mtsinai.on.ca or kbaguley@mtsinai.on.ca.

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In March 2003, an infection called severe acute respiratory syndrome (SARS) made its way to the Greater Toronto Area (GTA) and Simcoe County. This infection has had a profound effect on nursing practice and patient care in the GTA. The impact of SARS is analogous to the effect of HIV in the early 1980s. The causative agent is not well understood, a diagnostic test has not yet been developed, the mode of transmission is not well understood, no treatment regimen has been established, no immunization exists, and patients are dying. Hospitals have used the one and only tool available to control this outbreak: strict isolation procedures to eliminate transmission.

The Toronto outbreak of SARS has presented significant issues for ED care and work life. It has challenged our hospital to question how to deliver patient care safely, eliminate the spread of disease, and protect health care providers and members of the community. The intent of this article is to highlight some of the challenges faced by our emergency department as we managed this frightening new illness and the strategies that have helped us care for patients and control the outbreak.

SARS: The context

SARS is an atypical pneumonia characterized by a fever of 100.4°F (38°C) or higher, myalgia, headache, malaise, chills, a dry, nonproductive cough, and shortness of breath or difficulty breathing.¹ The time from exposure to the onset of symptoms is 2 to 11 days.² The cause of SARS is thought to be related to the coronavirus, the virus responsible for the common cold.³ Epidemiologic evidence indicates that transmission of the illness occurs with close person-to-person contact (to household members, health care workers,

or nearby patients who were not protected by contact or respiratory isolation precautions) and through droplet secretions.⁴ Because coronaviruses can survive for several hours on inanimate objects, direct contact with contaminated objects potentially represents another mode of transmission. Airborne transmission is thought to potentially play a role in some settings, accounting for spread that has occurred in some apartment buildings in Asia.^{3,4}

The first person who was diagnosed with SARS in Toronto had recently traveled to Hong Kong. The unfortunate woman died from the infection, and several of her family members developed the illness through household contact. In turn, these infected family members transmitted the infection to ED health care workers and patients before the implementation of isolation precautions. While the disease has been transmitted in the community, most of those infected are health care workers who were infected in patient care settings.⁵ The first patient died on March 5, 2003. On March 13, Mount Sinai Hospital received its first patient with the illness. On April 10, 19 patients with suspected or probable cases of SARS had been treated, and 11 of those patients were health care providers.⁶ To date, 51% of SARS cases in the GTA are nurses and physicians, and 77% of the total cases of SARS are the result of exposure within the hospital setting.⁵

Controlling the spread in the emergency department

In an effort to deal with the transmission and onset of illness within health care and community settings, the province of Ontario designated a Provincial Operations Centre (POC), which was responsible for issuing directives to hospitals about patient care and infection control practices. These directives included when and how to close hospitals, necessary isolation/quarantine precautions for staff, patients, and visitors, admission and transfer criteria, and discharge protocols. All Greater Toronto hospitals instituted their "Code Orange" emergency disaster plans as a means of ensuring that appropriate staff were available to support new types of patient care activities. The focus was to ensure the safety of hospital staff and patients.

We needed to address many issues in a short period of time within acute care settings to prevent the spread of the illness. We created staff, patient, and visitor screening, isolation procedures, linkages with infectious diseases, and

assessment protocols to guide practice. This involved the development and daily adjustment of new procedures, protocols, documentation processes, and practices as we learned about the nature and course of the illness.

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Depending on the stage of the infection, the symptoms of SARS can resemble many nonspecific viral illnesses. It is difficult to identify infected individuals because there are no hallmark clinical symptoms for SARS and no diagnostic test to identify the virus. At the start of the outbreak, we had few patients with suspected SARS presenting to our emergency department, and the epidemiologic links were clear. As the extent of the outbreak grew, the epidemiologic links became vague. SARS is classified as "Suspect and Probable." Many patients we admitted to the hospital were diagnosed as "Suspect SARS." They were clinically and hemodynamically stable. Some had normal chest radiography with no infiltrates demonstrated (yet) but had symptoms of fever, headache, myalgia, and malaise, and 1 of 3 distinct exposures: they had either traveled to Vietnam, China, Hong Kong, Singapore, or Taiwan; they had been exposed to a person with SARS; or they had been a health care worker, patient, or visitor in a hospital in the GTA where there had been recorded cases of SARS transmission. The diagnosis of "Probable SARS" is distinguished by the above, plus severe progression of respiratory illness (cough, shortness of breath, tachypnea, desaturation) and demonstrated radiographic findings.⁵

We developed a triage screening tool to elicit information about exposure, symptoms, and an epidemiologic link to SARS. If patients had a positive response to any of the questions in the screening tool, exhibited symptoms, or had

TABLE 1
Screening questions* for all patients and staff entering the hospital

Have you had any unprotected contact with a person with SARS in the last 10 days?
Have you been in a hospital closed due to SARS in the last 10 days?
Are you in quarantine or have you been contacted by Toronto Public Health and put on home isolation?
Have you been to China, Hong Kong, Vietnam, Singapore, or Taiwan in the last 10 days?
Are you experiencing any of the following?
• Myalgia (muscle aches)
• Malaise (severe fatigue or unwell)
• Severe headache (worse than usual)
• Cough (onset within 7 days)
• Shortness of breath (worse than what is normal for you?)
• Feeling feverish, or have you had a temperature in the last 24 hours?
Record temperature now.
Have you been a patient or a visitor in another hospital or long-term care facility in the last 10 days? If so where?

*All questions provided by the Ontario Ministry of Health and Long Term Care.

a positive epidemiologic link to the illness, it meant that we would initiate the SARS protocol. An N95 mask was applied, and the patient was triaged to the negative pressure airflow isolation room in the emergency department.

By the second week of the outbreak, patients with the infection were not as easily identified. More GTA hospital workers had inadvertent, unprotected exposure to SARS cases, and the infection made its way into the community. Patients had difficulty identifying the person or place where they might have been exposed. More than a month into the outbreak, patient information related to the epidemiologic link became vague and, as a result, we became more stringent in our epidemiologic and clinical assessment at triage. The screening tool was revised several times to include the new list of possible exposures and symptoms. Hospitals in the GTA with exposures to the illness were added to the list of possible exposures. Toronto Public Health kept us informed of persons who were to be considered "high risk" for the illness due to exposures with persons who had

developed the illness at community events (funerals, religious retreats).

Today, the SARS triage screening tool is a permanent part of all patients' chart records. It includes the patients' responses to all screening questions about potential exposure, symptoms, and their temperature at triage. (See Table 1 for the questions that are included.) Now, regardless of whether patients have **any** symptoms of SARS, they wear an N95 mask. If they answer "yes" to any of the questions on the screening tool or have any symptoms of viral illness, shortness of breath, or cough, they are triaged to a negative pressure (reverse airflow) isolation room. Even patients with minor lacerations or complaints of abdominal pain who come to the emergency department are triaged to negative pressure isolation rooms if they have any of the symptoms of or possible contacts with the illness.

Controlling traffic

In an effort to prevent exposure and transmission of SARS, we have virtually eliminated visitors to the hospital. Visiting policies in the GTA were changed to restrict visitors early in the outbreak. Visitors are limited to families of the critically ill, dying, or birthing patients, or pediatric patients. Volunteers, nursing students, and non-essential staff were sent home at the onset of the outbreak and have been slowly reintroduced into the hospital based on provincial directives.

The number of entrances to our hospital building has also been limited. There is now only one possible entrance to the emergency department with a security guard posted there, around the clock, to manage traffic, inform visitors of the new policy, provide patients with an N95 mask, have them apply a disinfecting hand wash, and direct them to the triage nurse. Triage takes place with the patient wearing an N95 mask. We obtain the triage history and complete the SARS patient screening tool (including temperature assessment). We determine the patient's disposition based on the presenting complaint or a positive response to the SARS screening tool. All visitors who are permitted entry to the emergency department and all paramedics accompanying ambulance patients also require screening. The SARS screening process has increased the amount of time it takes to triage patients, so that sometimes triage requires 2 nurses.

The impact on ED space

Mount Sinai Emergency Department, an urban academic facility, has experienced an increase in its annual volume of ED patients over the past 3 years, with an average of 37,000 visits annually. We have outgrown the physical capacity of the department such that every square foot of the department, including hallway locations, is used for patient care. Our philosophy has been that sick patients are safer being cared for in a hallway space than in the waiting room. Before SARS, we had 26 stretcher bays and could add 7 more hallway stretchers if volumes were high. With the advent of SARS, this practice has changed. In order to prevent the potential transmission of SARS, all hallway spaces have been eliminated. Several of our stretcher bays were only divided by a curtain and these have also been closed. Our resuscitation room had 2 divided rooms, each with 2 stretchers; this has been reduced to 1 stretcher in each room, leaving us with only 16 spaces in the department.

The emergency department is equipped with one permanent, reverse/negative air isolation room with an anteroom. As the number of patients with positive epidemiologic links or symptoms of SARS increased, we had to create additional negative pressure isolation rooms. Engineering and building services were pressed into service to help control the spread of infection with airflow and pressure adaptations. They created 6 additional negative pressure rooms in our emergency department, giving us a total of 7 negative pressure isolation rooms. We are currently considering further renovations, including replacing curtains with wall barriers between stretcher bays and creating additional reverse isolation and anterooms.

ED isolation procedures

The emergency department has been categorized as a SARS unit because all hospital admissions with suspect or probable SARS originate via the emergency department. All of our staff (even the people at the coffee kiosk) have been wearing N95 masks since late March. As of this writing—April 28—we are only wearing them in clinical areas. Initially, there was a shortage of the N95 masks, but to date we have enough. There are not enough of the duck-billed masks, the kind we prefer. Our staff (nursing, clerical, administrative, and support staff) are also required to wear

hospital-provided scrubs. We remove all scrubs at the end of the shift and the hospital launders them. N95 masks are applied upon entry to the unit once staff screening for the illness has been completed. Isolation gowns are worn within patient care areas. If a patient is not considered to be at risk of SARS, care is conducted with a single set of gloves and protective eyewear. If a patient does not have SARS, staff do not have to change gowns after taking care of them. The isolation gown is only replaced if soiled or wet. Handwashing remains the number one aspect of infection control. This must be done hourly and before and after every patient encounter.

Early studies have found that the hallmark diagnostic indicators of SARS are: leukopenia, lymphopenia, thrombocytopenia, elevated creatinine kinase, lactic dehydrogenase, alanine aminotransferase, and aspartate aminotransferase.

When we take care of patients being investigated for SARS, we wear double isolation gowns, a hair cap, an N95 mask, a face shield, and 2 pairs of gloves. Protective isolation gear is removed and replaced upon exiting the patient room. Special handling procedures for garbage, linen, bedpans, and urinals are in place, and terminal cleaning of patient rooms is done when the patient leaves the emergency department. Bedpans and urinals are contained, soaked in a disinfectant cleaner, and removed from the department with as little handling as possible. Equipment such as stethoscopes, thermometers, blood pressure cuffs, EKG machines, and capillary blood glucose monitors must remain in the patient's room and require terminal cleaning after use.

Our support service assistants have a combined role of housekeeping and patient transport. Their role is now largely dedicated to the cleaning and disinfection of patient care areas and equipment, and the safe disposal of laundry and garbage. They have been provided with in-service training about procedures for cleaning and linen and garbage disposal. Additional staffing has been required to manage this increased workload appropriately.

Our hospital established an isolation team as a means of ensuring that staff follow appropriate infection control precautions. This group has allocated isolation carts in the emergency department and throughout the organization, determined the appropriate supplies that the carts require for safe patient care to occur, set up a restocking schedule, and provided clear signage for infection control practices. Routinely, the carts are checked and restocked by our dispatch department.

The SARS screening process has increased the amount of time it takes to triage patients, so that sometimes triage requires 2 nurses.

Confusion of SARS symptoms with those of other illnesses

The symptoms of SARS resemble many illnesses, contributing to some confusion around the recognition and diagnosis of the illness. In particular, those patients with community-acquired pneumonia have been extremely difficult to differentiate from those with SARS. Patients who historically would have been triaged to a non-acute area with "viral illness" are now triaged to a negative pressure isolation room. Our inability to clinically rule out SARS has led to an extensive diagnostic assessment and workup of many patients. The most reliable diagnostic indicator for SARS is chest radiography (posteroanterior and lateral) to assess for infiltrates. Early in the outbreak, we discovered that portable x-rays were limited in their ability to identify early pulmonary infiltrates. A written protocol, including appropriate patient dress (N95 mask, gloves, and isolation gown), was developed for transportation and imaging in our emergency department's x-ray suite. Laboratory investigation includes a complete blood count, electrolytes, calcium, magnesium, phosphate, creatinine, lactic dehydrogenase, liver function tests, and 2 sets of blood cultures. We collect several tubes of blood for serology and cytokine studies for future research of the illness. Throat swabs are collected for viral studies. Early studies have found that the hallmark diagnostic indicators of SARS are: leukopenia, lymphopenia, thrombocytopenia, elevated creatinine kinase, lactic dehydrogenase, alanine aminotransferase, and aspartate aminotransferase.⁴ As more cases of the illness were identified,

additional abnormalities were noted, including low calcium, phosphate, magnesium, and potassium levels and an elevated creatinine kinase on admission.⁵ However, the specificity of these laboratory tests is unknown. A SARS clinical decision-making tool is in the process of being developed to assist clinicians in the screening, diagnosis, and management of the illness.

Changing ED equipment

In the early stages of the SARS outbreak, many health care workers were inadvertently exposed to the infection before full isolation precautions were initiated. The causal exposures of health care workers have been largely related to respiratory procedures and interventions including endotracheal intubation, airway suctioning, and bronchoscopy.^{3,7} As a result of these exposures, we have altered patient management guidelines and treatment protocols. The triage screening tool was drafted at least 5 times, the diagnostic tests were drafted again, the process for infectious disease consults became more inclusive, and the POC issued new directives daily (regarding isolation procedures, human resource issues, etc.). A policy is currently being drafted for intubation and code blue procedures for non-SARS and suspect SARS cases. Powered air purifying respirator hoods (PAPR; 3M, St Paul, Minn) have been added to the arsenal of essential equipment required for patient intubation, and the number of staff involved in such procedures is limited. Since the beginning of the outbreak, all treatments with noninvasive ventilation, nebulized medications, and humidified gases have been suspended. All bag valve masks are now single-patient use only, and filters have been added. Filtered rebreather masks delivering 80% oxygen have been introduced for SARS patients who require high flow oxygen. Single-patient use disposable oxygen saturation probes have also been introduced as a means of reducing potential transmission of the illness.

ED staff have been trained to assess and respond to A = airway, B = breathing, and C = circulation emergencies. With the outbreak of SARS, the "A" now stands for "Are," as in "Are we all protected?" Our emergency department has implemented a role for monitoring and reminding each other about infection control safety. The danger of an undiagnosed patient with compromised airway, breathing, or circulation infecting the entire team is no longer acceptable.

The need to be constantly vigilant so that our colleagues adhere to strict isolation precautions is, and will continue to be, the most important practice shift. No one is allowed in the critically ill patient area without all the required isolation gear. Each nurse has been charged with the responsibility of ensuring colleagues are wearing protective gear before approaching the patient.

We had to create additional negative pressure isolation rooms. Engineering and building services were pressed into service.

We have had to change the way we dispose of waste. All waste material from potential SARS patients is placed in a yellow biohazard bag, tied to seal, and then placed in cardboard boxes labeled "medical waste." The cardboard boxes are then sealed with packing tape and disposed of as medical waste. Special garbage boxes are located in the anteroom or outside the negative pressure rooms that do not have anterooms. There is an entire process for closing the bag, sealing the box, and transporting it to disposal. Linen hampers are in the room.

Interfacility patient activity

Due to the potential risk of transmission between staff and patients with unknown or undiagnosed illness, all patients (regardless of their mode of transportation) who require transfer to an external facility must receive prior approval through a "transfer application" process. This system was designed to eliminate the spread of infection between health care institutions. The POC requires all sending facilities to communicate and document clearance from the infection control practitioners at both the sending and receiving facility. Every hospital in the GTA has been given a SARS category rating from 0 (no known SARS cases) to 3 (unprotected SARS exposure with transmission to staff and/or patients). The category of both facilities is documented and taken into account in a decision-making algorithm. The triage patient-screening process becomes a vital component of the application process. A patient transfer authorization form is completed and faxed to the POC office. Approval or denial from the physician at the POC is faxed to the sending

facility. Patients transferred to the emergency department from long-term care facilities go through this process, unless their condition is unstable or life threatening.

The lived experience of SARS

Working 12-hour shifts with an N95 mask has indeed been a challenge to our ED staff. Finding a vein and taking blood with double gloves and a face shield are challenging. The only part of the nurse the patient can see is his or her eyes. We could write a paper on the challenges this presents to developing a therapeutic relationship. The goal of preventing the spread of the illness has resulted in many changes in day-to-day work life. Meal breaks are the only time that staff are permitted to remove their masks. Breaks have to be taken either alone or in small groups with a distance of 3 ft between one another. Only one person is able to have his or her mask removed at one time in an enclosed room. Once staff are done eating and drinking, the masks must be put back on. As a means of supporting staff under the current circumstances, the hospital has been supplying staff on all units with bottled water and bagged snacks.

GTA health care workers who became ill were young and healthy, much like the staff taking care of them.

Within the GTA, hospital staff were advised to stop social gatherings outside of work. Professional gatherings such as staff orientation and training sessions were canceled. Staff who worked in more than one facility were restricted. Several of our staff have part-time or agency positions in other hospitals. This additional work had to be documented and, in many cases, decisions were made to limit staff movement between facilities to stop potential spread of infection.

In our emergency department, 21 staff members were sent home on 4 days of quarantine after exposure to a hospital employee who was suspected of having the infection. To date, no ED staff, including those who were on quarantine, have developed the infection. The stress of being on home isolation, coupled with the fear of transmitting the illness to family members, was significant. There was a good deal of realistic fear. GTA health care workers who became

ill were young and healthy, much like the staff taking care of them, and we all knew that others had died of this disease. Many of the staff also struggle with their conflicting roles. They are professionals, but they are also family members who need to protect their own family and friends. Many nurses have had personal appointments, such as those for routine dental care, canceled by providers because of the concern that the disease might be spread. Many of our family members and friends were reluctant to socialize with us over Easter and Passover. When the media reported that health care workers represented a threat in the community, it made us all feel socially isolated.

As anxiety mounted, it was recognized that staff needed more than just the equipment and directives to manage SARS; we needed emotional support. A drop-in center staffed by psychiatrists and mental health clinicians was established. We could drop by on an informal basis to relate our experiences, debrief, and cry if that was needed. Also, an employee support phone line was set up within the inpatient psychiatric unit.

On April 25, the Premier of the Province of Ontario and the Minister of Health publicly described the efforts and conditions to which health care workers in the GTA were subject. This turned media and the community's attention to praising and supporting health care workers. The positive impact of this on morale was amazing!

Within Mount Sinai Hospital, the Chief Executive Officer, Vice President of Nursing, and the Chief Information Officer (also a nurse) issued daily Internet updates on the status of the outbreak, new directives, and actions. We needed to hear positive words and encouragement to keep up our morale. Leadership staff have also increased their hours of work and adopted shift hours (including evenings, nights, and weekends) as a means of being visible and ensuring adequate support for staff. This has meant some 18-hour days and 14-day stretches. The Infection Control and Infectious Diseases Departments have been our guide and practice leaders. The number of personnel in nonclinical departments who were redeployed from their roles to front-line roles in order to control infection was one demonstration of the incredible effort and team work in managing the crisis within the organization.

Conclusion

As of this writing, at the end of April, no staff member in our emergency department has developed SARS. We owe that to our hospital's recognition of the illness and to the isolation procedures that were introduced, across the organization, early in the outbreak. The challenge of remaining safe and controlling the transmission of SARS has truly tested the endurance of our staff and organization. ED nurses and their medical and administrative colleagues in the GTA are to be commended for their diligence, commitment, stamina, and courage to control this outbreak.

SARS remains a potential risk to staff and patients in health care settings everywhere. Proactive initiatives are essential to controlling its spread. The exchange of information, vigilance in detection procedures, and the support of staff in these stressful environments are crucial.

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