SEMP Biot #302: Emergency Departments and Epidemics: The 2003 Toronto SARS Experience
November 27, 2005

Almost three years ago, on February 23, 2003, a then novel infectious viral pathogen entered undetected into Toronto, Ontario, Canada aboard a commercial flight from Hong Kong in the person of a 78-year-old diabetic immigrant grandmother named Kwan Sui-chu, who was infected on February 21, 2003 in Hong Kong's Metropole Hotel. (1) For the next four and one-half months, the ensuing health epidemic disaster highly stressed the medical and public health systems, exposing hidden weaknesses, which were related to medical, economic and political practices, often interlinked and cascading. This Biot is a description of the medical unfolding of the novel infectious disease.

Scarborough-Grace Campus of Scarborough Hospital, Scarborough, Ontario, Canada.
Source: http://www.omsdoc.com/sggh.htm; accessed November 27, 2005.

The Metropole Hotel in Hong Kong.
Source: http://www.eglobe-hotels.com/hong_kong/metropole_hotel.htm; accessed November 27, 2005.

One of Toronto's emergency departments, the Scarborough-Grace emergency department, played an important role in unknowingly propagating the epidemic. Emergency departments are the area of a licensed general acute care hospital for provision of unscheduled outpatient services to patients whose conditions require immediate care. They are staffed 24 hours a day. Canadian emergency departments are very similar to their US counterparts and are highly regarded for the quality of care they provide.

Advanced airway and breathing medical procedures, such as the use of positive airway pressure devices (e.g., BiPAP) and endotracheal intubation to improve ventilation, are common in busy emergency departments. The threat of the transmission of infectious diseases via these procedures is well known for well known diseases such as tuberculosis. The challenge is to suspect such diseases all the time in spite of the vast majority of respiratory pathogens, which pose little threat to medical care professionals.

Toronto, Canada's largest city, boasts a population of 5,200,000 people who live in the Greater Toronto Area, which includes Scarborough, a suburb city whose 2005 population is 655,050 persons. Scarborough-Grace emergency department is central to the story of the epidemic. Scarborough-Grace and Scarborough General are the two campuses of Toronto Scarborough Hospital (TSH) System.

Toronto is well known for its multiculturalism. Scarborough's population is two-thirds minority residents, divided as follows: 40% Chinese and South Asian residents, 19% African-Canadian residents, 5% Filipino Canadian residents, and 2% other minority groups. Chinese Kwan Sui-chu, the index SARS case in Canada, and her husband shared their Toronto apartment with their two grown sons, daughter-in-law, and a five-year-old grandson.

How the Epidemic Entered the Toronto Medical System

Kwan Sui-chu visited her primary care physician on February 28, 2003 after feeling ill for three days. Her physician prescribed antibiotics, but Kwan developed breathing problems on March 2 and died at home on March 5, 2003. (She infected her physician, which started an outpatient epidemic arm involving numerous family practice physicians and their patients. This aspect of the epidemic will not be covered here.) Kwan never went to the hospital for evaluation and care during her short illness.

Kwan's grown son, 43 year-old Tse Chi Kwai, was the primary caretaker for his mother during her short illness. Two days after his mother died, he was prostrate with fever, coughing and shortness of breath in spite of antibiotics prescribed by a primary care doctor whom he visited twice. His 38-year-old sister, Cora, who was feeling ill herself, persuaded Tse Chi Kwai, to go to the nearby hospital emergency department for care on March 7, 2003 (Friday). The hospital was Scarborough-Grace, and Tse Chi Kwai's visit to its emergency department is when the novel virus entered Toronto's hospital system.

Emergency Department Care of Tse Chi Kwai

The triage nurse at the Scarborough-Grace emergency department noted that Tse Chi Kwai was "feverish, shaky, gasping for breath, and frightened." (See Varley, p. 4.) She took him into the care area immediately, which was "per usual, overwhelmed and understaffed." (Varley, p. 4) The emergency department staff began treatment for Tse Chi, which included strapping on a facemask to provide BiPAP (Bi-level Positive Airway Pressure) ventilatory assistance, and moved him to the emergency department's observation unit because no beds were available in the inpatient hospital wards. There he spent twelve hours on a gurney separated by sliding cloth curtains from other patients just a few feet away. The crowding in a confined space, BiPAP aerosolization of the virus, and the infectiousness of the virus were important factors in the looming epidemic.

Dr. Sandy Finkelstein, ICU physician, Scarborough-Grace Hospital. Source: http://www.cbc.ca/news/background/sars/gfx2/finkelstein.jpg; accessed November 27, 2005.

Nurse Agnes Wong, ICU, Scarborough-Grace Hospital. Source: http://www.cbc.ca/news/background/sars/behindthemask.html; accessed November 27, 2005.

On March 8, 2003 (Saturday), Tse Chi Kwai's condition worsened and he was finally moved from the emergency department observation unit to the hospital's intensive care unit (ICU). The ICU physician obtained the important history that Tse Chi Kwai's mother had just died and Kwan's husband, Tse's wife and Tse's brother and sister had a respiratory illness similar to their mother's. The physician immediately suspected tuberculosis, "an illness common in Tse Chi Kwai's Toronto neighborhood," (Varley, p. 7), and moved Tse to an isolation room in the ICU while initiating work-ups (e.g., chest x-rays) on the rest of the family. In retrospect, the ICU physician's identification of a family cluster of illness that appeared to be contagious and might be tuberculosis, and isolation of the Tse, were the first public health interventions performed to contain the looming epidemic.

On March 9, 2003 (Sunday), Grace-Scarborough Hospital sent a report to the city public health agency to report a possible TB family cluster (6 individuals). In epidemiology, a cluster is an aggregation of illness cases in a given area over a particular time period without regard to whether the number of cases is more than is expected for that time period in that area. Indeed, the public health agency staff were not alarmed to receive notification of a possible cluster of TB cases because some 400 TB cases were reported each year in Toronto. The report was referred to the agency's TB unit for investigation and follow-up.

An ICU nurse, who reported to work on March 10, 2003 (Monday) after having the weekend off to read Chinese newspapers, raised the possibility to the ICU physician that Tse Chi Kwai might have bird flu. The ICU physician agreed that tuberculosis appeared unlikely because Kwai's disease was progressing too quickly.

On March 12, 2003 (Wednesday), the World Health Organization issued a global alert about outbreaks of "atypical pneumonia" in Viet Nam, Hong Kong and Guangdong Province, China.

Tse Chi Kwai Dies

On March 13, 2003 (Thursday), Tse Chi Kwai died at Scarborough-Grace ICU of respiratory failure. When Tse's younger brother and sister Cora came to view his body, hospital staff, struck by how sick the brother and sister appeared, sent them to (where else?) the Scarborough-Grace emergency department. Isolation rooms were not available in the hospital, so other arrangements needed to be made for the care of the two relatives.

An emergency physician at Scarborough-Grace called a colleague at another Toronto hospital (Sunnybrook and Women's College Health Sciences Centre) who admitted one patient directly (bypassing the emergency department) to an inpatient hospital isolation room. The ICU physician at Scarborough-Grace called a colleague at a second Toronto hospital (Mt. Sinai), which agreed to admit Cora, Tse's wife, and Tse's five-month-old son. The paucity of isolation rooms in the city resulted in many transfers of sick, infected patients to reach hospitals with available isolation beds.

On March 14, 2003 (Friday night) the city (Toronto) and province (Ontario) public health agencies held a press conference to inform the public (and the US Centers for Disease Control and Prevention) about a cluster of cases of respiratory illness, not yet calling it an epidemic. In epidemiology, an epidemic is the occurrence of more cases of disease than is expected in a given area or among a specific group of people over a particular period of time. The number of cases indicating the presence of an epidemic varies according to the agent, size, and type of population. Surveillance systems, such as the one that resulted in notifying the public health agency of a possible cluster of TB cases, serve to identify epidemics early to facilitate deployment of investigative and control measures.

Canada, at the time of the 2003 Toronto epidemic, did not have a nation-wide public health authority like the Centers for Disease Control and Prevention in the US. It now does.

Over the weekend (March 15-16), Tse's autopsy was performed, specimens were sent to Winnipeg and CDC for processing, and medical and public health practitioners were confident. They were not thinking ahead that the six family cases—the cluster—might be the beginning of an epidemic.

Joseph Pollack Dies

But then something happened on the night of March 16, 2003 (Sunday) that was very worrisome. A 76 year-old man named Joseph Pollack with a heart arrhythmia condition, who was unrelated to the family cluster under investigation, arrived to the Scarborough-Grace emergency department gravely ill with fever and pneumonia. The emergency department staff determined that he had spent the night of March 7, 2003 in the observation room on the gurney next to Tse Chi Kwai who, recall, was undergoing treatment at that time with BiPAP. Mr. Pollack died on March 21, 2003 (the city's third SARS fatality).

March 17 and March 18 (Monday and Tuesday) were a critical opportunity to contain the looming epidemic by closing Scarborough-Grace Hospital to new incoming patients and any outgoing transfers to other hospitals. The opportunity,

however, was missed by the medical and public health professionals in Toronto. One physician close to the action said, “I was [at] Scarborough-Grace in the middle of this thing, and nobody was thinking about closing the hospital on March 18 or March 19 [Tuesday and Wednesday]. Nobody had even a clue about it.” (Varley, p. 13)

A similar situation had occurred in a hospital in Hanoi, Vietnam, which reacted by closing the hospital immediately, according to Varley. Hanoi’s outbreak was limited to 63 cases and six deaths, compared with Greater Toronto’s 375 cases and 44 dead. The 2004 population of Hanoi was estimated at 4,100,000. (2)

Scarborough-Grace Hospital Closes ED and ICU

On March 20, 2003 (Thursday), many Scarborough-Grace staff began showing up at the Scarborough-Grace emergency department with fever and respiratory symptoms. It was at this point that the Scarborough-Grace Hospital administrators decided to shut down the hospital’s emergency department and ICU to new patients. Sick Scarborough-Grace Hospital staff, left with no alternative, started going to other hospital emergency departments throughout Greater Toronto for care. By Sunday March 23, 2003, 12 Scarborough-Grace staff members were diagnosed with probable SARS.

Scarborough-Grace Hospital Closes to Incoming New Patients but Continues to Transfer Patients Out

Scarborough-Grace Hospital administrators, under pressure from the provincial public health agency, closed altogether on March 23, 2003 (Sunday) to new patients, 10 days after Tse Chi Kwai died and two days after Joseph Pollack died. However, Scarborough-Grace Hospital continued to transfer its patients to other hospitals (see below).

Closing the emergency department and ICU at Scarborough-Grace Hospital on March 23, 2003 was too late to have an effect on containing the epidemic. Mr. Pollack’s wife Rose had been infected by her husband (recall that he was infected by BiPAPped Tse Chi Kwai in the emergency department observation unit of Scarborough-Grace Hospital on March 7, 2003). On March 16, 2003 (Sunday night), Rose was waiting in the Scarborough-Grace Hospital emergency department waiting room for two and one-half hours while her husband Joseph was receiving care. During that time, she spread the virus to 24 other people, including three ward clerks, a security guard, three nurses, a housekeeper, and five people waiting in the emergency department, including the patriarch of the Bukas-Loob Sa Diyos Covenant Community, a mostly-Filipino religious group, who was waiting his turn to have his injured knee evaluated. The patriarch was discharged from the emergency department and spread the virus among his congregation, which is another arm of the epidemic story that won’t be discussed here.

James Dougherty Dies

On that same March 16, 2003 Sunday, Scarborough-Grace Hospital staff transferred a 77-year-old man named James Dougherty who had survived a heart attack, to a second hospital (York Central Hospital) for dialysis treatment. He had a fever and breathing problems when he was transferred. He died of SARS on March 23, 2003 at York Central. On review of his records, public health and medical authorities learned that Mr. Dougherty had spent the night of March 7, 2003 in the Scarborough-Grace Hospital emergency department observation unit on a gurney (he was being treated for congestive heart failure) opposite Joseph Pollack and—you guessed it—Tse Chi Kwai with his BiPAP strapped to his face. James Dougherty spent two days in the CCU at Scarborough-Grace Hospital and 12 days at York Central Hospital without infection precautions!

Coronary care unit staff at Scarborough-Grace Hospital unfortunately missed James Dougherty as a possible case of SARS. Evidently they attributed his low-grade fever and breathing problems to his heart attack. At Scarborough-Grace Hospital, he spread SARS to an estimated 21 health care workers, patients, and visitors, including a liver transplant recipient who was transferred from Scarborough-Grace to Mt. Sinai on March 25, 2003, which is another arm of the epidemic that won’t be discussed here. Note that even though Scarborough-Grace had been closed to new patients on March 23, 2003 under pressure from the provincial public health authorities, it continued to transfer out patients to other hospitals. At Mt. Sinai, James Dougherty infected an estimated 15 people with SARS.

High Risk Medical Procedures and Treatment Areas

Emergency department staff save many lives by employing technologies, such as advanced airway management procedures. These procedures invariably aerosolize respiratory tract microorganisms, which is not a problem most of the time because the microorganisms are not particularly infectious (communicable) or virulent (can be treated successfully with antibiotics or antivirals); staff have properly protected themselves by using masks, gloves, and gowns; and staff have protected their other patients from exposure by using good infection control practices, which includes proper patient placement (e.g., sufficient space between gurneys, placement in isolation rooms, posting of precautions, such as respiratory droplet precautions). Emergency departments handle high volumes of patients, including some of the sickest who require immediate medical interventions, often in tight quarters, and continuing care because inhospital beds are not available. This is a chronic problem in Canada and the US. This is what happened in the care of Tse Chi Kwai.

Managed Care and Hospital Bed Surge Capacity

Managed care during the 1990s pared back hospital bed supply because it was deemed too expensive for the public to maintain. As a result, surge capacity has been removed from the health care system, both in the US and Canada. Tse Chi Kwai inoculated two patients, at least, next to him in the observation unit on March 7, 2003, which facilitated the Toronto SARS epidemic, because inpatient beds were unavailable.

Hospital Administration Decision Making

Hospital administrators at Scarborough-Grace Hospital delayed closing the hospital, according to Varley, because of the stigma of being unable to cope, eliminating a steady stream of revenues, and removing a facility from providing care to patients who needed care. Varley quoted a Toronto physician active during the outbreak who said, “To close any hospital—the consequences are tremendous. It’s not something you do lightly.” (p. 13)

Public Health Authorities Response

The provincial (Ontario) public health authorities were tardy in requiring closure of Scarborough-Grace Hospital. Although they possessed the authority, they lacked planning, organization, information, manpower, and credibility, and were dealing with an unknown agent whose route of transmission was also unknown.

Summary

Hospital emergency departments are understandably a point of entry of novel or existing infectious diseases into any hospital system. The nature of emergency departments as high risk, high volume, and problem-prone areas of care is well known. Structural constraints to safe care, ignorance of infection control measures, denial that an infectious disease threat exists, and delays in implementation of aggressive containment strategies because of medical, economic, or political machinations or ignorance will cost the community, state or province, and country dearly in the long run.

Sources:

1. Pamela Varley: “Emergency Response System Under Duress: The Public Health Fight to Contain SARS in Toronto (A)”, John F. Kennedy School of Government Case Program, Harvard University, p. 1. This 20-page case (part A) is available for a modest charge at: http://www.ksgcase.harvard.edu/.

2. CDC, Emerging Infectious Diseases: **“**Lack of SARS Transmission among Public Hospital Workers, Vietnam.” Vol. 10, No. 2, February 2004. Available online at: http://www.cdc.gov/ncidod/EID/vol10no2/03-0707.htm; accessed November 27, 2005.

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