



Emergency Response System Under Duress: The Public Health Fight to Contain SARS in Toronto (A)

Introduction

On February 23, 2003, the Severe Acute Respiratory Syndrome (SARS) virus slipped, undetected, into Toronto's Pearson International Airport aboard a commercial flight from Hong Kong. At the time, the illness was so new that it had not even been named—was known only as a mysterious and virulent pneumonia¹ spreading in Mainland China's Guangdong Province. The person who unwittingly brought the disease to Toronto—setting off an outbreak that would infect 375² and kill 44—was a 78-year-old Toronto grandmother, Kwan Sui-chu, returning home from a 10-day trip to Hong Kong with her husband.³ Two days after their return, Kwan began to feel sick. On February 28, she went to a doctor. But public health officials did not learn that the mystery pneumonia had entered their city until March 13. By that time, five other members of Kwan's family were visibly sick. Unbeknownst to public health or hospital staff, the virus had also spread

¹ Pneumonia is not a single disease but a category of diseases. These diseases share symptoms—inflammation of the lungs and the collection of fluid in air passages—but these symptoms have a variety of causes.

² Because there was no definitive test to diagnose SARS, public health physicians labeled cases as “probable” SARS or “suspect” SARS (and in Ontario, there was a third category: “persons under investigation”) based on clinical, laboratory, and epidemiological evidence. The convention, internationally, was to count only the “probable” cases for official record-keeping purposes. Thus, there were 375 “probable” SARS cases in the Toronto area between February and June 2003. Within the Toronto city limits, there were 199 probable SARS cases and 38 deaths.

³ Official government documents about the SARS outbreak keep the names of all SARS patients and their relatives confidential. Local reporters were able to find some of the names, however. In this case study, names are used, for the sake of clarity, if they have already been made public by the press.

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to a group of patients and health care workers at one of Toronto's community hospitals. By the time this group fell sick, the virus had moved on, silently infecting a new set of victims.

[At the end of this case, see Exhibit 1, Timeline of the Toronto SARS Outbreak; Exhibit 2, Acronyms; Exhibit 3, People Named in this Case Study.]

The Emergence of SARS

SARS made its quiet arrival in Toronto—Canada's largest city and its thriving, cosmopolitan economic center—three weeks before the WHO had officially identified the disease as something new and distinct from other known types of pneumonia. Before that, it seemed just as likely that the virulent disease spreading in China was the resurgence of a previously identified illness. Public health experts later observed that it was Toronto's bad luck to be part of the first small cluster of SARS cases exported from China. While SARS would travel, via passenger jets, to many cities around the world in the course of the outbreak, its arrival came days or weeks later to most of these places, which gave them time to prepare. By contrast, SARS had killed two people and—though no one knew it at the time—infected between 12 and 20⁴ others in Toronto before the WHO issued its first global alert about the disease on March 12.

The Chinese-Canadian Community. This is not to say that no one in Canada had been aware of the mystery illness before the WHO's March 12 alert. As early as January 2003, Chinese enclaves in Vancouver and Toronto had been hearing about the deadly new disease from panicky relatives in Mainland China.⁵ That month, surgical masks began disappearing from local pharmacy shelves in Vancouver as Chinese patrons bought them up to send back to China. In a prescient early February news story, Toronto's *Sing Tao Daily*, a Chinese language newspaper, anxiously predicted that an infected person from Asia might bring the disease to Canada. After all, tens of thousands of people traveled from Asia to Toronto's Pearson airport every month. But Health Canada, the country's massive federal health agency, assured *Sing Tao* that the agency was on top of the situation and was "closely monitoring the spread of pneumonia" diseases globally.⁶

The WHO, for its part, had been receiving unofficial reports of the virulent disease for a number of weeks. One e-mail message from an undisclosed source, which the WHO received February 10, 2003, said that more than 100 people had died of the illness in Guangdong Province

⁴ Figures assume that SARS patients who had become symptomatic by March 16 or March 17 had been infected March 12 or earlier. The incubation period for the virus ranged from 1 to 12 days in Toronto, but the statistical average was 4.7 days. Jim Young, Ontario's public safety commissioner and, later, the co-chair of the province's emergency response to SARS, suspects the number of people infected by March 12 was greater than 20, but there is no way to know for certain.

⁵ The first known case of SARS—thought to have crossed the species line from an animal—occurred in Guangdong province in November of 2002. Most of the world's new infectious diseases originated in this part of China.

⁶ The information in this paragraph was drawn from "SARS: Behind the mask," CBS News Online, November 19, 2003.

in a single week, that panic was widespread, and that there was a run on pharmacies as people bought up “any medicine they think may protect them.” Until this point, the Chinese Ministry of Health had refused to acknowledge the existence of the mystery disease. But on February 11, 2003, the Ministry did notify the WHO that an acute respiratory syndrome of unknown origin had struck Guangdong Province. The official statistics were far less dire than the rumors, however. The disease had killed five people, according to the Ministry, and infected another 300. Later, Chinese authorities would acknowledge that these figures represented a significant undercount.

SARS Enters the Hospital System

By their nature, stories about the early spread of SARS are personal and—in retrospect—full of odd and tragic happenstance. Perhaps the most frequently repeated of these stories is how SARS traveled, in rapid succession, from Guangdong Province to Hong Kong, and from Hong Kong to Toronto, Singapore, and Hanoi.

The tale began on February 21, the day Dr. Liu Jianlun, a 64-year-old semi-retired respiratory specialist, who had been treating severely ill pneumonia patients in Guangdong Province, flew to Hong Kong with his wife to attend his nephew’s wedding. The pair checked into Room “911” at the Metropole Hotel.⁷ Liu had been bothered by respiratory symptoms for five days before his trip to Hong Kong, but paid them little heed. He did not want to miss the wedding, for one thing, and, for another, he hoped to get the chance to talk to colleagues at the University of Hong Kong about the devastating pneumonia that was spreading through his hospital in Guangzhou. That evening, however, his condition took a dramatic turn for the worse and the following day, he checked himself into a nearby hospital. He died 10 days later, on March 4. But during his few hours in the Metropole, Liu infected nine other hotel guests. According to one account, he exposed most of them when—formally dressed for a wedding party—he was seized with a bout of sneezing and coughing in a hotel elevator lobby.⁸

On February 25, two days after Kwan and her husband returned to the Toronto apartment they shared with their two grown sons, daughter-in-law, and five-year-old grandson, Kwan developed a fever, sore throat, cough, and aches. On February 28, she went to see her primary care physician, who diagnosed flu, prescribed antibiotics, and sent her home. On March 2, she began to have trouble breathing, and three days later, on March 5, Kwan died at home, tended by family. Because she had a history of heart disease, the local coroner identified her cause of death as a heart attack.

On March 7, two days after her mother’s death, Kwan’s 38-year-old daughter, Cora, who was feeling unwell herself, became urgently concerned about the deteriorating health of her 43-

⁷ After-the-fact, the Metropole reportedly renumbered the ninth floor rooms so as to eliminate number “911.”

⁸ *The Globe & Mail*, March 29, 2003.

year-old brother, Tse Chi Kwai, who had been Kwan's primary caretaker during her illness. For several days, Tse had struggled with fever, cough, and respiratory symptoms. By this point, he had gone twice to see a doctor and was taking antibiotics, but was getting rapidly worse. Tse's sister persuaded him to go, immediately, to seek medical care at a nearby community hospital, Scarborough-Grace.

The young triage nurse at the Scarborough-Grace Emergency Department took one look at Tse—feverish, shaky, gasping for breath, and frightened—and immediately escorted him into the Emergency Room, which was, per usual, overwhelmed and understaffed.⁹ The ER doctor recommended that Tse be hospitalized, but there were, at the moment, no beds available in the inpatient hospital wards—also a commonplace circumstance. In the meantime, the ER staff moved Tse to the “observation unit” of the Emergency Department, where he spent the night on a gurney a few feet from those of other patients, some of them elderly. The gurneys were separated from one another by sliding cloth curtains. To ease his difficulty breathing, the ER staff placed a noninvasive BiPAP (Bi-level Positive Airway Pressure) ventilator over Tse's face. The BiPAP's forced air helped Tse to breathe, but also probably aerosolized his virus-laden respiratory droplets, thereby dispersing them across a wider area.

Emergency Room Infection Controls. Later, these actions would face scrutiny. Even if no one on the ER staff suspected that Tse had acquired a deadly infectious disease never before seen in Toronto, why had *any* seriously ill pneumonia patient been placed so close to other patients? critics asked. “What on earth was this patient, who had trouble breathing, doing next to an elderly man?” demanded Natalie Mehra, director of the Ontario Health Coalition, a public health advocacy group. “Why was anybody left lying in emergency for 12 hours?”¹⁰ And among respiratory specialists came the question—why had BiPAP been used on an infectious patient while he was lying chock-a-block with other patients in a confined area?

But the way the Scarborough-Grace ER handled Tse's case was characteristic of ER practices citywide, according to a number of hospital-based physicians. In many a hospital, the ER had become the densely populated “holding area” for patients who were awaiting an available hospital bed. In some hospitals, at busy times, a patient might have to spend as many as three or four days on a gurney in the ER hallway before a bed was available. There was generally very little space in the ER for isolating infectious patients. What's more, hospitals did not, as a rule, isolate pneumonia patients. Pneumonia was extremely common and, for the most part, easily treated and not terribly contagious. Hospital workers were therefore not required to use special precautions or “barrier” infection controls (masks, goggles, gowns, gloves) when treating pneumonia patients. Putting on and taking off such items was time-consuming. Wearing them was thought to be alienating to patients and, for staff, cumbersome and uncomfortable. Masks, in

⁹ *Time Magazine*, May 5, 2003

¹⁰ *Toronto Star*, June 24, 2003.

particular, caused breathing difficulties, dizziness, and rashes for many wearers. Even the most basic precautions against spreading infection, such as frequent hand washing, tended to be a low priority in the hectic ER atmosphere.

Dr. Brian Schwartz, director of pre-hospital care at Toronto's Sunnybrook & Women's College Health Sciences Centre, who would later play a key role in the response to the SARS outbreak, believes doctors, nurses, and other health care workers should always wear masks when delivering care to patients with febrile respiratory illness. He argues that in contemporary times, medical workers have grown dangerously blasé about infection control in general—an attitude that may date to the eradication of small pox in the Western hemisphere in 1971.¹¹ After that, infectious diseases suddenly seemed an old fashioned concern. In fact, in 1970, US Surgeon General William Stewart famously told the US Congress that the nation was “ready to close the book on infectious disease as a major health threat.”¹² In the new era, a doctor's coat spattered with blood and gore began to carry a certain cachet, as the mark of the unflappable veteran, Schwartz says, and anyone who seemed overly concerned about infection control risked eye-rolling from colleagues. In the case of blood, that attitude changed with the advent of AIDS in the 1980s, but “I think as an international medical community, we became very complacent with respect to respiratory illnesses, except in pockets where you might have TB (tuberculosis),” he says. “We [developed] an air of invincibility that is unwarranted.”

The ramifications of this new attitude have been far-reaching, according to infection control experts. For one, a generation of hospital emergency departments was designed and maintained with little regard for infection control. Allison McGeer, director of infection control at Toronto's Mt. Sinai Hospital, told a reporter that this state of affairs gave the SARS virus its first real opening in Toronto. “We could have gotten away without the full outbreak,” she said. “If we had emergency departments that had higher air speeds of ventilation and negative air pressure¹³, if we had single rooms in our [ER] observation areas, if we had adequate hand washing facilities and training—and *time* for people to wash their hands—that transmission might not have happened.”¹⁴

Public Health in Toronto and Ontario

Toronto Public Health. Across Canada, the primary responsibility for controlling infectious diseases belonged to local government and, in Ontario, that meant 37 local public health units, each governed by a medical officer of health¹⁵ and local health board. Toronto Public Health

¹¹ Credited to the vaccination campaign of the World Health Organization, begun in 1956.

¹² SARS and Public Health in Ontario, Interim Report, 2004.

¹³ Negative air pressure refers to a system by which the air in a room is sucked out—and fresh air pumped in—at a rapid rate.

¹⁴ *Toronto Observer*, October 22, 2003.

¹⁵ In the United States, the administrators who lead local, state or federal public health agencies typically have a masters-level professional degree, but need not be medical doctors. In Canada, by contrast, public health—like neurology or

(TPH) was Canada's largest public health unit and was known across the country for its strong advocacy, community participation, and wide array of programs. As in the public health field, generally, the mission of TPH had broadened over time. Communicable disease control—once the centerpiece—had now moved over to make room for health promotion, health protection, and the prevention of chronic diseases.

TPH's Communicable Disease Control division employed 300 of TPH's 1700 employees, and was still the agency's largest single division. It received 40,000 communicable disease reports each year and oversaw 300 minor disease outbreaks annually, each generally controlled in two or three days. But the division did not have the legal responsibility, the legal authority, or the staff resources to promote compliance with Ontario's minimum mandatory infection control requirements in institutional settings such as hospitals, long-term care facilities, nursing homes, and day care centers, according to Dr. Barbara Yaffe, then-director of the TPH Communicable Disease Control.¹⁶ Provincial law did require TPH to assign a staff member to each hospital's internal infection control committee, which TPH did. In addition, TPH oversaw the handling of any cases of "reportable" diseases within the hospitals. (Reportable diseases were those communicable diseases identified under law as posing a potential threat to public health.) But because TPH did not oversee infection control, broadly, within the hospitals, there had historically been few well-developed relationships between the TPH and the hospitals' infection control staffs. This had just begun to change in late 2002, when TPH established a Pandemic Influenza Steering Committee that included representatives from the hospital infection control field. These burgeoning new relationships, in fact, would prove valuable during the SARS outbreak, according to Yaffe.

Ontario Public Health Department. Even in theory, it was not clear what role the Ontario Public Health Department—a division of the provincial Ministry for Health and Long-term Care—was supposed to play in the event of a communicable disease emergency. Some public health experts were under the impression that if an outbreak overwhelmed the resources of the local public health unit or if it spread beyond the boundaries of a single local jurisdiction, the provincial Public Health Department was supposed to step in and take charge. But in reality, Ontario Public Health was small (TPH was 15 times larger) and was, by reputation, weak—in terms of its statutory authority, its resources, and the skill-level of its staff. The province's chief medical officer of health, who directed Ontario Public Health, rarely reversed the decisions of local medical officers of health. Provincial law did give the chief medical officer the authority to do so in certain circumstances, but local medical officers were "not ordinarily subject to the review or influence, of the chief medical officer of health," according to a provincially-sponsored report written after the SARS outbreak. The report also described the "machinery... under which the province might

pediatrics—is a medical specialty. Thus, the leaders of Canada's public health agencies at all levels of government are generally public health doctors.

¹⁶ In fact, Toronto's largest teaching hospitals were relatively well resourced and had more infection control expertise than TPH, itself, did.

ultimately bring to heel a rogue board of health” as “cumbersome.” This lack of centralized authority had terrible implications for emergency management, the report continued. For example, two adjacent communities might have inconsistent quarantine policies or inconsistent diagnostic practices.

Not everyone in the Ontario public health field agreed with this assessment. Some argued that provincial law did, in fact, provide the chief medical officer of health sufficient discretion to override local authorities, but that the provincial government had not traditionally made use of this discretion. Whether a product of limited authority, limited resources, or limited leadership skill over some 15 to 20 years, Ontario Public Health was not widely viewed as a helpful or galvanizing force in Ontario by the local medical officers of health, nor was it held in high esteem outside Ontario in the public health field. Several of Ontario’s medical officers of health later reported that they had long found the agency resistant to sharing information with the field and to approaching issues in an open, collegial fashion. As a result, relations between Ontario Public Health and the public health units were generally wary and strained at the point that Tse walked into the Scarborough-Grace Emergency Department on that fateful Friday, March 7.

Tuberculosis?

On Saturday March 8, after 12 hours on an emergency room gurney, Tse’s condition was visibly declining and he was placed in the Scarborough-Grace Intensive Care Unit. ICU Director Sandy Finkelstein examined the patient later that day, noting that Tse was dangerously ill and that his mother, who had also been sick with respiratory symptoms, had just died. Finkelstein was puzzled by Tse’s condition, but his first instinct was to check for the possibility of tuberculosis, an illness common in Tse’s Toronto neighborhood of Scarborough, home to many immigrants. The doctor ordered TB tests and immediately moved Tse to an isolation room in the Intensive Care Unit.¹⁷

By this point, Kwan’s husband, Tse’s wife, and Tse’s two siblings all had a fever, cough and, labored breathing.¹⁸ Finkelstein ordered x-rays for the four, checking for tuberculosis. As a matter of protocol, the Scarborough-Grace Hospital notified Toronto Public Health of a possible TB cluster within a family on March 9, a Sunday. This raised no special alarm, as some 400 TB cases were reported in Toronto each year. TPH referred the case to its TB unit for investigation and follow-up—the usual procedure.

Afterward, infectious disease experts would note that, even though Finkelstein’s TB concern proved wrong, it had been a lucky instinct to pursue it. Even a remote chance of

¹⁷ *Toronto Star*, September 22, 2003.

¹⁸ Not everyone in the extended family was sick, however. Tse’s brother-in-law and the three children in the family—aged 5 months, 9 years, and 17 years—were free of symptoms.

tuberculosis—unlike pneumonia—required the isolation of the patient and the use of special infection control precautions by health care workers and visitors. As a result, hospital staff, other patients, and visitors were all much better protected from SARS once Finkelstein made his tentative diagnosis and moved Tse into an isolated room. Meanwhile, members of the TPH staff asked the rest of Tse’s extended family to stay home until the tentative TB diagnosis was either confirmed or ruled out, to avoid spreading it to others.

Or is it ... Bird Flu?

On Monday, March 10, Agnes Wong, a nurse and patient care manager in the Scarborough-Grace ICU, returned to work after an off-duty weekend. During her days off, she had enjoyed a favorite pastime—reading Chinese language newspapers. One story, in particular, had haunted her—the story of a young family in Hong Kong. The 33-year-old father had traveled with his nine-year-old son and eight-year-old daughter to Fujian Province on Mainland China in January 2003. While there, the girl had died of unknown causes. Back in Hong Kong, the father died on February 17, and his son—also sick—was hospitalized. On February 19, father and son were diagnosed with bird flu. (Bird, or “avian,” flu, once a disease found only in chickens and ducks, was diagnosed in 18 human subjects in Hong Kong in 1997, but the outbreak was quickly halted. Between the 1997 outbreak and the two cases diagnosed in February 2003, no other cases of bird flu had been reported.) In late February, the TPH had learned of the bird flu cases in Hong Kong and had sent an alert about bird flu to infectious disease specialists, hospital emergency rooms and infection control practitioners in Toronto.

When Wong returned to work at the ICU on March 10, she learned about the worrisome new patient, Tse, who was extremely sick, with a tentative diagnosis of tuberculosis. His story was a compelling one. He had just lost his mother—perhaps also to tuberculosis. And he had recently married a 24-year-old woman from China. The couple now had a five-month-old baby boy. “Somehow I connected this event with the other event I’d read about in Hong Kong,” Wong later told a *Toronto Sun* reporter. “He was such a young man—in his forties—he shouldn’t be so sick. I asked the nurse to check their traveling history.” When Wong learned that Tse’s mother had, in fact, recently returned from Hong Kong, she became more and more persuaded that Tse’s illness might be bird flu. “I said, ‘Something very unusual is going on. Two members of a family getting so sick? And one already dying?’ Somehow I knew something was wrong.” Wong took her hunch to Finkelstein and the hospital’s infection control division. “I didn’t have any proof except what I read in the Chinese newspaper—but they took it very seriously,” she later told the *Toronto Sun*.¹⁹

As Tse’s condition worsened, Finkelstein considered what other disease he and his family might have contracted. Bird flu was a possibility. Certainly from a clinical perspective, Tse’s illness appeared to be progressing far too quickly to be TB. What’s more, the Vancouver Public

¹⁹ Quotations and information from the *Toronto Sun*, December 21, 2003.

Health department was now reporting a mysterious respiratory case, too. Vancouver's patient had also stayed at the Metropole Hotel in Hong Kong. He had then traveled on to Bali, where he developed fever and respiratory symptoms. He was sick enough by the time of his return flight to Vancouver on March 7 that local city authorities were notified, and met the patient at the plane with an ambulance. He was quickly taken to an isolation room at the Vancouver General Hospital.²⁰

The WHO Alert

On Wednesday, March 12, the WHO issued a global alert about outbreaks of "atypical pneumonia"²¹ in Viet Nam, Hong Kong and Guangdong Province. Very little was known about the disease at this point. It appeared that the same disease had broken out in all three locations, but even this much was uncertain. Only sketchy information was available from public health authorities in Mainland China, but in Hanoi and Hong Kong, there had been significant outbreaks of the respiratory syndrome among health care workers in hospitals treating patients with the disease. In Hanoi, 20 hospital staff had become sick, and in Hong Kong, 26 had developed fever and respiratory symptoms. It had still not been determined whether this new disease was bird flu or something else.

ProMED. There were several ways that local physicians generally learned that the WHO had issued an alert. The most traditional was the chain of communication through the government. That is, the WHO would notify the federal government, which would notify state or provincial governments, which would notify local governments, which would notify local hospitals and doctors. In addition, some local officials and doctors might see word of the WHO alert on television or in the newspaper. But some Toronto doctors say they first learned of the WHO alert from "ProMED (Programs for Monitoring Emerging Diseases)," an Internet service sponsored by the International Society for Infectious Diseases. Indeed, this was a harbinger of the critical role ProMED was to play throughout the SARS outbreak.

ProMED had been designed as a clearing house, receiving infectious disease information from experts around the world and disseminating it within hours to an international network of subscribers. The ProMED subscribers received word of the WHO alert the evening of March 12. This was faster than the traditional news media could manage, and much faster than the traditional government chain of communication. All across the world, doctors and other health experts on the front lines of the SARS battle would come to rely on ProMED to learn the most current information about the disease and the outbreak. "This outbreak was to ProMED what the

²⁰ The patient recovered, and the disease did not spread to anyone else.

²¹ Atypical pneumonia refers to a subset of pneumonia diseases marked by particularly rapid onset and severity of symptoms.

first Gulf War was to CNN,” observes Dr. Donald Low, microbiologist-in-chief at Toronto’s Mt. Sinai Hospital. “It put ProMED on the map.”

Toronto Goes Public

On Thursday March 13, the day after the WHO’s alert, Tse died at Scarborough-Grace of respiratory failure. When Tse’s younger brother and sister arrived to view his body, hospital staff members were appalled at how sick they both appeared, and sent them directly to the Scarborough-Grace Emergency Department. An Emergency Department physician placed a call to Andrew Simor, microbiologist-in-chief at Sunnybrook and Women’s College Health Sciences Centre, and asked whether Sunnybrook had an isolation room free and could take one of the Tse siblings. Simor agreed, and—mindful of the WHO alert—stipulated that the patient go straight into an isolation room upon arrival rather than entering via the emergency department.²²

Meantime, Finkelstein’s tuberculosis tests for Tse and his family came back—as predicted—negative. At this point, Finkelstein phoned McGeer, Mt. Sinai’s infection control director. Mt. Sinai’s Infectious Disease Department was the largest in the area, and its laboratory served 11 area hospitals. In addition, the department had forged a cooperative relationship with many local hospitals: the hospitals cooperated in Mt. Sinai research projects, and Mt. Sinai served as a resource for the hospitals’ trickiest infectious disease cases. McGeer agreed to admit Tse’s sister, as well as his young widow and baby²³, to Mt. Sinai. Kwan’s husband, too, was sick by this point, and he was soon admitted to Mt. Sinai as well.

Late Thursday afternoon, Simor, McGeer and Irving Salit, director of the Infectious Disease Division of the University Health Network, held a teleconference to discuss treatment for the new patients. The first two Toronto residents to contract this virulent pneumonia had both died. Now there were four more cases, three of them critical. They decided on an aggressive course of treatment—a complement of three broad-spectrum antibiotics and two anti-virals.

After a teleconference with McGeer Thursday night, the Toronto and Ontario public health departments decided to hold a press conference on Friday night, March 14, to inform the public about the cluster of cases, and to urge anyone who had been in contact with the family or had suspicious symptoms to call a Toronto Public Health hotline, which TPH hastily established Saturday morning. McGeer also notified Health Canada, the Centers for Disease Control in the United States, and the WHO of the cluster of cases. “So by Thursday night, everything was buzzing,” recalls Low, who was out of town until the following day, but was keeping abreast of events through e-mails from McGeer. McGeer told a reporter, “I knew we were dealing with

²² *Globe & Mail*, March 29, 2003.

²³ The baby was not sick, which created a dilemma: what to do with the child, since there were, at the moment, no healthy adults in the family to take care of him. As a stopgap measure, Mt. Sinai admitted the child “for observation.”

something that was very serious,” but even so, she added, “I never, in my wildest dreams, could have imagined what we were in for.”²⁴

The Race to Understand SARS

In Hong Kong, meanwhile, medical laboratories had run tests to determine whether the new outbreak of atypical pneumonia was actually an incarnation of the old bird flu virus, and those tests had come back negative. Tests for several other recognized types of atypical pneumonia came back negative as well. That meant the disease was new, and its cause, unknown. Health officials knew it was crucial to identify it as quickly as possible. Without knowing the cause, it was not possible to make a definitive diagnosis, to develop vaccines to fend off the disease, or to design better medicines to treat it.

The WHO moved quickly on several fronts. On Saturday, March 15, the organization named the new disease SARS—for Severe Acute Respiratory Syndrome—and declared it “a worldwide threat.” The WHO also announced criteria for identifying a “probable” or “suspect” SARS case, and sent them to the federal health agency of every country.²⁵ In addition, over the course of the next three days, the WHO set up a network of 11 leading laboratories in nine countries to expedite discovery of the SARS causative agent and, if possible, to develop an accurate diagnostic test. In parallel, an international network was set up to pool clinical knowledge of the symptoms, diagnosis, and management of SARS. And a third network was established to study SARS epidemiology—empirical data about how the disease was being spread.

In Toronto, Mt. Sinai’s Low—who had just arrived home from his trip—made it his personal mission to make sure Tse was given an autopsy and then to gather and send as many disease specimens as possible from the autopsy and from Tse’s ill relatives to the Ontario provincial laboratory, the National Microbiology Laboratory in Winnipeg, and the Centers for Disease Control laboratory in the United States. Mt. Sinai’s infectious disease research group collected detailed clinical information about the signs and symptoms of the disease in Toronto’s six cases. On Sunday night, March 16, Mt. Sinai sent this clinical data to ProMED and sent a copy to the CDC in the United States. “So as of Sunday night, we had the feeling we were doing a pretty good job,” says Low. “We had gotten all this information. We were sharing it around. Things were going along tickety-boo.”

²⁴ *Toronto Star*, May 25, 2003.

²⁵ If the WHO was to keep track of a disease worldwide, it was important that everyone use the same definitions. While the WHO did not have the authority to require other countries to use the WHO definitions, most countries used the WHO definition, or a close variation.

The Lull Before the Storm

As of Saturday, March 15, there was still no discussion within Toronto's infectious disease and public health circles that SARS might sweep through Toronto's hospital workers, the way it was sweeping through hospital workers in Hong Kong and Hanoi. Through the infectious disease grapevine, Low had learned a little about one of the largest outbreaks, at Hong Kong's Prince of Wales Hospital, where a local man had been diagnosed with pneumonia and hospitalized on March 4. (Later, when it was clear that he had SARS, epidemiologists pieced together the information that he had been infected by Dr. Liu at the Metropole Hotel.) Over the next week, this patient transmitted SARS to 47 health care workers, including 16 medical students. Hearing the story from afar, Low was sure there had been an egregious breach of safety precautions at the Prince of Wales. "I'm thinking, 'Obviously, they're screwing up somehow,'" Low recalls. "They're letting their health care workers get sick. It must just be *terrible* infection control, for gosh sakes. It's not going to happen to us."

Over the next few days, this confident mood mostly held steady, but there were a few worrisome developments. First, a primary care physician who had seen Tse and his wife for about 15 minutes in an outpatient clinic was now home sick with pneumonia. She was quickly diagnosed with SARS and hospitalized. "So she was the first example that this had gone outside the family –and after a relatively minor degree [of contact]," says Low.

On the evening of Sunday, March 16, there was a second worrisome development. Joseph Pollack, 76, came to the Scarborough-Grace Hospital Emergency Room for the third time in 10 days. On March 7, he had come to the ER with heart arrhythmia. A few days later, he returned with a fever and pneumonia, but was not deemed sick enough for hospitalization and was sent home. On March 16, he arrived by ambulance, very sick and gasping for breath. This time, he was immediately placed in an isolation room in the Intensive Care Unit. The ER staff checked his recent history and ascertained that on March 7, Pollack had spent 12 hours in the ER Observation Room, lying on a gurney next to Tse. "So now we've got another case that's outside the family, and evidence of transmission in the hospital setting, which is a bit more disconcerting," says Low. After all, he adds, "We were trying to wrap this thing *up*."

In Retrospect, a Crucial Juncture

After-the-fact, some critics remarked that if the Scarborough-Grace Hospital had temporarily isolated itself at this point—that is, if the hospital had halted all transfers of patients to other hospitals; if it had closed its doors to new patients, outpatients, and visitors—the magnitude of the SARS outbreak in Toronto would have been vastly reduced. Richard Schabas, chief of staff at York Central Hospital and Ontario's former chief medical officer of health, put it this way:

One of the things you would think you would do in a situation like that—where you’ve got an outbreak of a new infectious disease about which you know little or nothing, in a hospital—is you would put a wall around that hospital. At the very least, you’d stop transferring patients from that hospital to other hospitals.

A sharply critical *Toronto Star* article, written several months after the SARS outbreak, echoed this sentiment, noting that in a similar situation, a hospital in Hanoi had, in fact, closed immediately. Hanoi’s outbreak was limited to 63 cases and five deaths, compared to the Toronto area’s 375 cases and 44 dead.²⁶

Hindsight is always 20/20, counter the decision-makers who were on the scene at the time but did not advocate closing Scarborough-Grace to new in-patients and day-patients—at least not for a few more days. All that had apparently happened at Scarborough-Grace, by that point, was that SARS had passed, in the ER, from Tse to an elderly and susceptible man lying right next to him. It wasn’t a good thing, but it didn’t indicate a virus running amok, either. “I was out at Scarborough-Grace in the middle of this thing, and nobody was thinking about closing the hospital on March 18 and 19. Nobody had even a clue about it,” says Low.

To close a hospital was tantamount to declaring that the hospital was too overwhelmed to continue its normal functions. “You’re basically saying something is out of control, and you have to go into shut-down mode,” says Ontario Health Minister Tony Clement. In addition to the stigma, it was very expensive for a hospital to curtail its revenues in this way, and Ontario hospitals, as a group, were already running significantly in the red.²⁷ A hospital shutdown also cut off an avenue of medical care to many patients. Emergency patients would have to go to another hospital. Patients already in the hospital could no longer enjoy the visits of family members and friends. Patients who required specialized care could no longer be transferred to the appropriate facility. And, already, outpatients complained that they had to wait far too long to receive many kinds of treatment. In other words, a hospital shutdown was disruptive and inconvenient to staff, doctors, patients, and family. “To close any hospital—the consequences are tremendous. It’s not something that you do lightly,” says Low.

Health Care Workers in Trouble

By Thursday, March 20, things took an abrupt turn for the worse, however. One by one, Scarborough-Grace nurses and hospital workers began to straggle into the Scarborough-Grace Emergency Department complaining of high fevers. The following day, March 21, Pollack died—the city’s third SARS fatality. With Scarborough-Grace workers continuing to turn up at the

²⁶ *Toronto Star*, October 5, 2003.

²⁷ *Toronto Star*, June 21, 2003.

hospital ER, there was an active discussion in Toronto about whether Scarborough-Grace should close. The hospital management resisted closing completely but did shut down its Emergency Department and Intensive Care Unit to new patients. By evening, hospital staff began appearing at the emergency rooms of other Toronto hospitals and in the hospitals of neighboring York, Durham, Peel, and Simcoe jurisdictions, where many health care workers lived. By Sunday, March 23, 12 members of the Scarborough-Grace staff had been diagnosed with probable-SARS.

That Sunday, under growing pressure from the Ontario Health Ministry, Scarborough-Grace closed altogether. At the same time, Toronto Medical Officer of Health Sheela Basrur and her executive team decided they needed to take a rather drastic step: They issued a public appeal to all hospital staff and all other persons who had visited Scarborough-Grace Hospital, for any reason whatever, on or after March 16 to (1) contact the TPH and (2) put themselves in self-quarantine for a period of 10 days from the date of their most recent exposure to the hospital. “We recognized that that was a pretty broad sweep, a big extension of quarantine—that it might affect thousands of people,” says Basrur. “But I think at the outset, given the tremendous number of unknowns we were facing, it was the only reasonable thing to do.”

Meanwhile, within Toronto’s hospitals, another worry was building. Citywide, there were very few hospital isolation rooms available; in general, Toronto’s hospitals ran very close to full capacity, which allowed for almost no “surge capacity” in an emergency, and the need for isolation rooms made the problem that much harder. No one knew what the magnitude of the SARS outbreak would be at its peak. Hospital-based infectious disease doctors McGeer and Simor began to discuss the dramatic possibility of calling in the military to set up a mobile hospital where all the SARS patients in the city could be treated. On Sunday, a rehabilitation and long-term care facility called West Park, in northwest Toronto, offered at least a temporary solution: it would revive its 25-bed tuberculosis hospital, long shut down, to create a SARS facility. With help from staff at Scarborough-Grace and Mt. Sinai hospitals, West Park readied the facility in fewer than six hours—a feat likened to a miracle.

But there was a catch. Collective bargaining agreements precluded hospital workers from being transferred to the facility against their will. By this time, doctors, nurses, and other hospital workers were very frightened of catching SARS and West Park was able to find staff enough to care for only 14 patients. Mt. Sinai’s Low himself volunteered to serve as the doctor-in-charge of the facility.

‘Could we have seen this coming ... ?’ In retrospect, physicians realized that there had been some intimations of coming trouble earlier in the week, but no one had picked up on them. Low, for instance, recalls that on Tuesday, March 18, while at Scarborough-Grace to collect clinical samples to send to laboratories for assessment, a nurse remarked to him that Pollack’s 73-year-old wife, Rose, was running a fever. “I remember thinking ‘Well, that’s not good,’” Low says, but, on the other hand, many many things could explain a fever. Rose Pollack was not suffering any

respiratory symptoms—the sine qua non of the SARS illness. The following day, back at Scarborough again, Low recalls a nurse casually remarking that she herself, who rarely fell sick, had run a fever the night before—but it had broken, and now she felt fine. This remark, too, made him vaguely uneasy—but, after all, hadn't the nurse said she was fine? "These things just didn't gel at that time. It was still early," he says, then adds, "In outbreaks, there's quite a denial component. The psychology is really to try to minimize it. You're trying to say, 'We've got this under control.'"

Resurrecting an Age-Old Strategy: Quarantine

Before the illness that had killed Kwan and Tse had been identified as probable-SARS, the Toronto Public Health agency had informally tried to halt the spread of the disease—whatever it might be—by asking family members to stay home and avoid exposing others. But once the disease was tentatively identified as SARS, TPH and, in particular, its Communicable Disease Control division, had to face an uncomfortable fact. For the first time in decades, Toronto was confronting a disease of unknown biological cause—potentially fatal and perhaps highly contagious—against which there was no immunization available, and for which there was no cure. This meant that contemporary approaches to preventing the spread of contagious illness—immunizing against the flu, for example, or, in the case of AIDS, providing condoms, clean needles, and public education—would not be sufficient. Instead, TPH leaders, in line with recommendations from the WHO, decided they must resort to the old fashioned techniques of isolating those with probable- or suspect-SARS in the hospital (as the hospitals were already doing) and quarantining those who had been exposed to the disease.

It was daunting to think about cranking up the machinery of quarantine, which had not been used in Toronto in at least 50 years—that is, not in the working life of anyone presently working for TPH. The TPH leadership had to come up to speed quickly on how to run a quarantine program, train staff, and educate the public about why quarantine was necessary and what it entailed.

What Quarantine Entailed. The idea behind quarantine was deceptively simple. When a person was diagnosed as a possible SARS case, the first task for the TPH was to determine how long the person had been infectious, and then to review this infectious period with the patient (and sometimes with close family or friends)²⁸. The goal was to get the patient to remember every place he or she had gone while infectious and every person with whom he or she had had sufficient

²⁸ In the case of most infectious respiratory diseases, a person was infectious as soon as he or she felt the onset of symptoms. The assumption was that this was true of SARS, although in some diseases a person could be infectious before feeling sick.

contact to transmit the disease.²⁹ Then each of these exposed persons was contacted and placed under quarantine for the “incubation” period of the disease—the length of time between infection and the first sign of symptoms. The incubation period was thought to last between two and ten days for SARS. If no symptoms appeared after 10 days, the person was considered safe from contracting the disease at that point. If SARS symptoms did appear, the person was hospitalized in an isolation room. If indeterminate symptoms appeared—just a cough, for instance—the person remained in quarantine until the symptoms expanded to meet the criteria of SARS, disappeared, or took the shape of a recognizably different ailment. While under quarantine, the person had to remain home and avoid all contact with other household members. That meant abiding by such unpopular requirements as eating alone and sleeping alone. If contact was unavoidable, the person was to wear a surgical mask. The person was also to closely monitor his or her health and, in particular, to check for fever every day. TPH’s job was to call each person under quarantine daily to check on his or her health status, and to ensure that the person was complying with quarantine rules. Hospital workers who were considered contacts—but not “close” contacts—of a SARS patient were to be placed on “work quarantine.” This meant that they observed quarantine procedures at home, traveled alone to and from work, and followed full infection control procedures at work.

A Snowballing Crisis

Between Sunday, March 23 and Wednesday morning, March 26, the number of SARS cases rose, though not dramatically, from 12 to 18. Between morning and evening on March 26, however, the number suddenly shot up—from 18 to 49. By Wednesday evening, every isolation room in the city was occupied, 10 Scarborough-Grace staff members were awaiting hospital admission, and other sick hospital workers were at home, waiting to be seen.

That same day, Mt. Sinai Hospital doctors concluded that one of their Intensive Care patients, a liver transplant recipient who had been transferred a day and a half earlier from Scarborough-Grace, almost certainly had SARS as well. For 31 hours, he had been treated at Mt. Sinai without infection control precautions. As a consequence, Mt. Sinai announced that it would transfer the patient to Toronto General, and close its Emergency Department and Intensive Care Unit for 10 days. All hospital workers who had been exposed to the patient were instructed to quarantine themselves. During Mt. Sinai’s shutdown, the patient’s doctor, seven health care workers from the Mt. Sinai ICU, and six members of the patient’s own family would develop SARS symptoms.

²⁹ It was not clear what level of contact was, in fact, sufficient. Overall, the disease behaved like a droplet-spread illness that needed quite close contact to spread, but in some anecdotal situations, it seemed to have spread with more remote contact, and scientists were not sure why.

The Mt. Sinai experience was a blow in the Toronto medical community, given its leading role in infectious disease work, and given the desperate need in the city for SARS hospital beds. Sunnybrook stepped into the breach, and announced that it would convert 40 standard hospital rooms to isolation rooms over the next 48 hours.

By this point, says Low, no one was denying that Toronto was in trouble. “It was sort of the realization that we had lost control of this thing,” he says. In fact, he and others now feared that SARS was not only a virulent disease, but also a highly contagious one. “I thought that it was only going to be a matter of time before it would spread out into the community in Toronto. Then it would be Ottawa, Hamilton—other communities. Because you couldn’t contain everybody,” he says. “I thought that at the end of the day, we’d be recognized as the epicenter for SARS in North America.”

Exhibit 1

Timeline of the 2003 Toronto SARS Outbreak

- February 21 __Kwan Sui-chu is infected with the SARS virus in Kong Kong's Metropole Hotel.
- February 23 __Kwan returns home to Toronto.
- February 25 __Kwan begins to feel ill.
- February 28 __Kwan goes to see her primary care physician and is prescribed antibiotics.
- March 5 ____Kwan dies at home.
- March 7 ____Kwan's son, Tse Chi Kwai, goes to the Scarborough-Grace Hospital Emergency Department with a severe case of pneumonia.
A Vancouver citizen, who had also stayed at the Metropole Hotel, returns home from Bali very sick and is rushed directly from the plane to isolated care at Vancouver General Hospital.
- March 8 ____Tse is tentatively diagnosed with tuberculosis and placed in an isolated room in the Intensive Care Unit.
- March 9 ____Scarborough-Grace Hospital notifies Toronto Public Health of a possible cluster of tuberculosis cases in an extended Scarborough family.
- March 10 ____Scarborough-Grace Patient Care Manager Agnes Wong raises the possibility that Tse might have bird flu—at the time, considered a possible cause of the “mystery pneumonia” in China's Guangdong Province.
- March 12 ____The World Health Organization issues a global alert about outbreaks of atypical pneumonia in Viet Nam, Hong Kong, and Guangdong Province.
- March 13 ____Tse dies at Scarborough-Grace Hospital.
- March 14 ____Toronto and Ontario public health officials hold a joint press conference to alert the public to the fact that two members of a Toronto family have died and another four are sick as a result of contracting a mysterious, virulent pneumonia—perhaps the same one circulating in China and Viet Nam.
- March 15 ____The WHO names the new disease SARS, for Severe Acute Respiratory Syndrome, declares it a “worldwide threat,” and releases diagnostic criteria for it.
Primary care physician who saw Tse and his wife in her outpatient clinic is diagnosed with SARS.
- March 16 ____Joseph Pollack, 76, cardiac patient who spent 12 hours on a gurney next to Tse's in the Scarborough-Grace Emergency Department on March 7, is rushed to the Scarborough-Grace Emergency Department and swiftly diagnosed with SARS.
- March 20 ____Scarborough-Grace health care workers begin to appear at the hospital's Emergency Department with high fevers.
- March 21 ____Pollack dies at Scarborough-Grace.
Scarborough-Grace shuts down its Emergency Department and Intensive Care Unit.
- March 23 ____Scarborough-Grace closes to all new hospital admissions, places sharp restrictions on day patients & visitors.
- March 25 ____Ontario Health Minister Tony Clement declares SARS a “reportable” disease under provincial law.
- March 26 ____SARS caseload in greater Toronto rises from 18 to 49 during this single day.
Mt. Sinai Hospital discovers that an undetected SARS patient spent 31 hours in its Intensive Care Unit without being isolated. Hospital closes its Emergency Department and Intensive Care Unit for 10 days & orders all exposed hospital workers to quarantine themselves.

Exhibit 2
Acronyms

BiPAP	Bi-level Positive Airway Pressure
BLD	Bukas-Loob Sa Diyos Covenant Community
CDC	Centers for Disease Control
ER	Emergency Room
GTA	Greater Toronto Area
ICU	Intensive Care Unit
iPHIS	Integrated Public Health Information System
MAG	Ministry Action Group
ProMED	Programs for Monitoring Emerging Diseases
POC	Provincial Operations Centre
PUI	Persons Under Investigation
SAC	Science Advisory Committee
SARS	Severe Acute Respiratory Syndrome
TB	Tuberculosis
TPH	Toronto Public Health
WHO	World Health Organization

Exhibit 3

People Named in this Case Study

Public Officials in Spring 2003

- Sheela Basrur, MD, Toronto Medical Officer of Health
- Tony Clement, Ontario Minister of Health and Long-term Care
- Ernie Eves, Ontario Premier
- Barbara Yaffe, MD, TPH Communicable Disease Control Director

Medical Experts

- Sandy Finkelstein, MD, Scarborough-Grace Intensive Care Unit Director
- Donald Low, MD, Mt. Sinai Microbiologist-in-Chief
- Allison McGeer, MD, Mt. Sinai Infection Control Director
- Irving Salit, MD, University Health Network Infectious Disease Division Director
- Richard Schabas, MD, former Ontario Chief Medical Officer of Health & York Central Hospital Chief of Staff
- Brian Schwartz, MD, Sunnybrook Pre-Care Director
- Andrew Simor, MD, Sunnybrook Microbiologist-in-Chief
- Agnes Wong, Scarborough-Grace Intensive Care Unit Patient Care Manager

SARS Patients

- | | |
|-----------------------|-----------------------|
| • Kwan Sui-chu, 78 | • Eulialo Samson, 82 |
| • Liu Jian Lun, 64 | • Nestor Yanga, 54 |
| • Tse Chi Kwai, 43 | • Maurice Buckner, 57 |
| • Joseph Pollack, 76 | • Kitty Chan, 66 |
| • Rose Pollack, 73 | • Hubert Chan, 44 |
| • James Dougherty, 77 | • Lewis Huppert, 99 |
| • Adela Catalon, 46 | |

Others

- Natalie Mehra, Ontario Health Coalition Director