

Chapter 2

SARS IN CANADA: Anatomy of an Outbreak

Through the ages humans have relied on animals for food, labour, companionship, and entertainment. However, our interactions with animals have infected humans with numerous communicable diseases. It now appears that exotic animals in a Guangdong market—perhaps civet cats or raccoon dogs—may have given the human race yet another novel infectious disease: severe acute respiratory syndrome, or SARS.

Old diseases usually spread slowly. Smallpox, for example, was a scourge in Europe for thousands of years before it finally crossed the Atlantic with Christopher Columbus and his men. SARS, on the other hand, moved at the speed of a jet airplane. Within days of its arrival in Hong Kong, it had circled the globe.

This chapter provides a brief overview of the SARS outbreak in Canada. The SARS story is one in which thousands of front-line public health and health care workers rose brilliantly and often heroically to the occasion to contain an outbreak, despite systems that were often seriously inadequate to the task. We found, not surprisingly, that individual and organizational perspectives on the same events during the outbreak often differed sharply. Further, although new information continuously emerged, it increasingly had more to do with retrospective second-guessing of decisions by individuals than with forward-looking enhancements to the public health and health care systems. This truncated account is designed simply to remind Canadians of how the SARS outbreak unfolded, and touches on some key issues that surface from even a cursory review of four extraordinary months in the history of Canadian public health and health care.

We have minimized the use of names throughout the account for participants and interviewees. Other reviews underway, particularly the Ontario Public Health Investigation by Mr. Justice Archie Campbell, have the time and mandate to dissect specific events in detail. Most of the salient issues are adequately framed by the first wave of SARS in Canada, and the account focuses more on “SARS I”, recognizing that Mr. Justice Campbell’s mandate arose in meaningful measure from events around the second wave or “SARS II”. Nonetheless, we do track the outbreak through to containment in June 2003. Future historians will be able to describe these events with greater accuracy, a wider international perspective, and the benefit of longer hindsight.

2A. A New Disease in Guangdong (November 27, 2002 - February 22, 2003)

“Have you heard of an epidemic in Guangzhou? An acquaintance of mine from a teachers’ [Internet] chat room lives there and reports that the hospitals there have been closed and people are dying.”

—Dr. Stephen Cunnion (posted on ProMED-mail on February 10, 2003)

On February 14, 2003, the World Health Organization [WHO] reported in its weekly newsletter that an unusual acute respiratory illness had claimed five lives since the previous November in Guangdong Province, China. Three hundred more people—about one-third of them health care workers—were reported to have been infected. Six days later, the Chinese Ministry of Health informed the WHO that the cause of the illness was a common bacterium, *Chlamydia pneumoniae*.¹

¹ *Chlamydia pneumoniae* is an obligate intracellular bacterium—it depends on and lives within a host cell. Most adults will be infected by *C. pneumoniae* at some point in their lives. Infections result in respiratory illness of varying severity, and can be effectively treated with widely available antibiotics.

More than two months before, Health Canada's Global Public Health Intelligence Network [GPHIN] received a Chinese-language news report of a flu outbreak in mainland China. GPHIN is an early-warning system that continuously scans Internet media sources for reports of infectious disease outbreaks around the world. The Chinese report, published on November 27, 2002, was sent to WHO with an English header. The full report was never translated. Health Canada officials became aware of the new disease along with the rest of the world in February 2003.

Health Canada publicized the Guangdong outbreak in its next FluWatch bulletin,² which summarized influenza activity between February 9 and 15, 2003. The following week, FluWatch reported that Chinese authorities claimed the Guangdong outbreak was over.

Concurrently, officials in Hong Kong reported a case of avian influenza. On February 19, 2003, during a regular conference call with Health Canada's Pandemic Influenza Committee, federal officials recommended that all provinces be vigilant for influenza-like illnesses in returning travellers, particularly those returning from Hong Kong or China. Health Canada also issued written alerts on February 20 and 21 to the Pandemic Influenza Committee, the Council of the Chief Medical Officers of Health, the Canadian Public Health Laboratory Network, the FluWatch network (including hospital infection control practitioners), and veterinarians, warning all recipients to be alert for avian flu. Some representatives on the Pandemic Influenza Committee expressed concerns that Health Canada should not be dealing directly with hospital infection control practitioners.

Around this time, ProMED-mail, an Internet-based reporting system that, like GPHIN, provides early warnings of infectious disease outbreaks, was alerting its audience that the mysterious respiratory ailment in Guangdong might not be caused by *Chlamydia pneumoniae* after all—tests found the bacteria in only two of the deceased patients' tissue samples.

The combination of the two outbreaks—avian flu and the mystery disease—raised concern among staff at the British Columbia Centre for Disease Control, and its officials issued the first of three broadcast e-mails on February 20, informing doctors, infection control

specialists, and public health authorities to be alert for influenza-like symptoms in travellers returning from China. Toronto public health officials sent out similar information about severe 'flu' in younger adults to a list of infectious disease and emergency room physicians in Toronto on February 20, and the Provincial Public Health Branch circularized health units to the same effect on February 21.

Meanwhile, the chain of events that would bring SARS to Canada began. A 65-year-old doctor who had treated atypical pneumonia patients in Guangdong travelled to Hong Kong to attend his nephew's wedding. By the time he checked into the Metropole Hotel, he was feeling unwell. The doctor infected at least 12 other guests and visitors from several countries, including a 78-year-old woman from Canada, Mrs. K S-C.

DISCUSSION POINT

The Canadian Hospital Epidemiology Committee advised the Committee that Canada lacks a coordinated system to "notify acute care facilities of a global health alert, with attendant recommendations for surveillance and control" if persons suspected of having a new infectious disease "appear in Canadian health care facilities." Relevant information was sent out in Ontario, but the lines of accountability for alerts appear blurred, and key target groups commented that they had no prior warning of a new respiratory virus from Asia. Does Canada have an adequate system to detect emerging diseases worldwide or even within its borders? Once an outbreak is detected, what kind of communication structure would work best to get information to public health officials, infection control specialists, emergency departments and ultimately to front-line health care workers—and ensure that appropriate responses are occurring?

2B. From Kowloon to Scarborough (February 23, 2003 - March 12, 2003)

Mrs. K returned to Toronto on February 23, 2003 after a 10-day trip to Hong Kong. During her holiday, she spent three nights at the Metropole Hotel in Kowloon where she briefly encountered the Guangdong doctor. Two days after arriving in Toronto, Mrs. K developed a high fever, and by the time she visited her family doctor on

² FluWatch reports are posted on Health Canada's website weekly during the influenza season (September to April) and biweekly during the rest of the year. Prior to Internet publication, Health Canada sends the reports by e-mail or fax to provincial and territorial FluWatch representatives, the Pandemic Influenza Committee, a 250-doctor strong network of sentinel physicians, the College of Family Physicians of Canada, hospital infection control practitioners, WHO and the Pan-American Health Organization [PAHO], the CDC and several federal government departments (e.g., Department of National Defence).

February 28, she was also complaining of muscle aches and a dry cough. Mrs. K's condition continued to deteriorate, and she died at home on March 5, 2003. Family members did not want an autopsy and the coroner thought it unnecessary. On the death certificate, the coroner listed heart attack as the cause of death.

On March 7, 2003 two days after his mother's death, Mrs. K's 44-year old son, T C-K arrived at The Scarborough Hospital, Grace Division emergency department. He complained of a high fever, a severe cough, and difficulty breathing. He shared the open observation ward of a busy emergency department for 18 to 20 hours while awaiting admission. Only curtains separated him from nearby patients. By the next day, Mr. T's condition had deteriorated sufficiently that he was admitted to the Intensive Care Unit [ICU], and eventually required intubation—doctors inserted a tube through his mouth into his trachea, and attached it to a ventilator to help his breathing.

The physician who treated Mr. T was a respirologist and intensive care specialist who astutely suspected tuberculosis. He had not received any information about the mysterious respiratory illness in Guangdong. With tuberculosis a possibility, he isolated Mr. T, and asked the rest of the family to isolate themselves at home. He contacted Toronto Public Health. As per the usual protocol for tuberculosis, public health officials contacted the family, and made arrangements for chest x-rays and tuberculosis skin tests. According to Toronto Public Health officials, none of the family members reported feeling unwell.

Many patients and staff were exposed to Mr. T before he was placed in isolation, and two of the patients being treated in the Grace emergency department at the same time would also fall ill. Partly due to hospital overcrowding, Mr. T remained in the emergency department long after doctors had authorized a hospital admission. While waiting for a bed to be freed up, Mr. T received oxygen and vaporized medications (potentially capable of transforming infectious droplets into an infectious aerosol), and had numerous visitors.

DISCUSSION POINT

The SARS outbreak threw into high relief the state of Canadian emergency departments—the point of first contact for the sickest patients. As the Canadian Association of Emergency Physicians noted in its submission to the Committee, there are no national standards addressing emergency department design or operation, most departments lack adequate isolation facilities, staff may not be trained in infection control procedures, and “the current practice of housing large numbers of sick admitted patients for prolonged times in open, densely-populated emergency departments is a potential public health hazard.” These phenomena reflect not only upon the funding and organization of emergency departments, but also the continued shortfall in ambulatory care capacity, and the need for primary care reform.

The new disease spread to other countries. An American businessman who also had stayed at the Metropole Hotel flew to Hanoi, Vietnam. Feeling unwell, he visited a local hospital on February 26, 2003 where over the next few days, several nurses also became ill. The hospital called the local WHO office, and Dr. Carlo Urbani was sent to investigate. On February 28, he informed the regional WHO office of the respiratory disease cluster. On March 6, 2003, still unable to determine the cause of the Hanoi outbreak, he placed a direct call to the WHO head office in Geneva. Dr. Urbani began to experience symptoms himself on March 11, and died 18 days later. His alarm helped contain the Vietnam outbreak.

Meanwhile, in Hong Kong, several dozen health care workers at the Prince of Wales Hospital were beginning to show symptoms. Twenty-three were admitted to an isolation ward on March 11, 2003.

On March 12, 2003, WHO issued a global alert regarding the mystery illness (soon to be called the severe acute respiratory syndrome, or SARS) that was occurring primarily among health care workers in Hanoi and Hong Kong. Physicians at several hospitals in Toronto involved in the first wave of the outbreak later advised that they were not informed of the alert by any level of public health—local, provincial, or national. The next day, these physicians discovered the WHO alert through their own intelligence gathering.

2C. SARS I: The Outbreak Begins (March 13, 2003 - March 25, 2003)

Mr. T died on March 13, 2003. By this time, the tuberculosis tests results were available and negative, and several other family members were sick. Public health officials, in consultation with experts like Dr. Allison McGeer and Dr. Andrew Simor, connected the dots. There was an unusual respiratory illness in Guangdong that had apparently spread to Hong Kong. Mrs. K had recently travelled to Hong Kong. She had died at home. Soon after, her son had developed a respiratory illness that did not respond to the usual treatment. He too had died, and other family members were now developing symptoms.

The attending physicians recognized the need to prevent further transmission of a disease that was unequivocally contagious, but whose mode of transmission was unknown. They arranged transfers of Mrs. K's family members to hospitals with negative pressure isolation rooms, important in preventing transmission of airborne disease. Sunnybrook and Women's College Health Sciences Centre, Mount Sinai Hospital, and the Toronto Western site of the University Health Network all accepted family members. A granddaughter was admitted to the Hospital for Sick Children.

Mr. P, who had been treated in the emergency department bed adjacent to Mr. T on March 7, 2003 returned to The Scarborough Hospital on March 16 with respiratory symptoms, and a fever. He was admitted into the airborne isolation room in the emergency department, and managed in contact and droplet precautions before being sent to the ICU. However, his wife, who was with him in the emergency department, was not asked about illness until he was transferred to the ICU. Mr. P died on March 21; his wife and three other members of his family were infected. His wife infected seven visitors to the emergency department, six hospital staff, two patients, two paramedics, a firefighter, and a housekeeper.

The physician who intubated Mr. P in the ICU wore a mask, eye protection, gown, and gloves while performing the procedure, but he developed SARS. Anxieties about the infectivity of SARS were understandably magnified by this incident, especially when three nurses present at the intubation were also infected. Intubation procedures, a significant source of droplet production, would be a recurring cause of SARS transmission during the outbreak.

Another patient who was in the emergency department with Mr. T on March 7, 2003 became ill on March 13, and was brought back to The Scarborough Hospital by ambulance. He suffered a confirmed myocardial infarction—a heart attack. His contact with Mr. T was known, but the low level of his fever, and small infiltrate on his chest x-ray were thought at the time not to be compatible with SARS. Health care workers used only standard infection control precautions while treating the patient, and transferring him to York Central Hospital, a full-service community hospital north of Toronto. He would become the source of another SARS cluster that ultimately affected more than 50 individuals, and closed down York Central Hospital.

While Toronto fought a spreading SARS outbreak, British Columbia faced a different situation. The same day Mr. T died, before anything was known in Vancouver about the Toronto outbreak, a man who had also stayed at the Metropole Hotel in Hong Kong arrived at the Vancouver General Hospital with a flu-like illness. He lived with his wife, had not been in contact with family and friends, and went directly to the hospital when he became symptomatic. Infection control practitioners and the attending physician at the Vancouver General Hospital ensured that their index patient was masked, and quickly isolated. There were no reports of secondary transmissions from this case. In contrast, Mrs. K in Toronto was surrounded by a large family and sought only ambulatory care, and her ill son had no travel history to trigger suspicions upon his admission to hospital.

On March 13, 2003, Health Canada received notification of the Toronto cluster, and convened the first of what would become daily information-sharing teleconferences among federal, provincial, and territorial public health experts. On March 14, the Ontario Ministry of Health and Long-Term Care [OMHLTC] held a press conference with Toronto Public Health and Mount Sinai Hospital spokespersons about the cluster of atypical pneumonia cases. Media outlets began to cover the emerging story avidly.

SARS continued to spread at The Scarborough Hospital, Grace Division; patients, staff, and visitors developed symptoms consistent with the new disease. Grace closed its emergency and intensive care services on March 23, 2003, and began refusing new admissions and transfers from other hospitals. Outpatient clinics were closed, and employees were barred from working at other institutions. Anyone who had entered the hospital after March 16 was asked to adhere to a ten-day home quarantine. The hospital implemented stringent infection control policies including contact and droplet

precautions such as hand washing, wearing gowns, gloves, N95 masks³, eye protection, and the use of single or negative pressure rooms for all SARS patients.

On March 23, 2003, officials recognized that the number of available negative pressure rooms in Toronto was being exhausted. In a four-hour period on the afternoon of March 23, staff at West Park Hospital, a chronic care facility in the city, re-commissioned 25 beds in an unused building formerly used to house patients with tuberculosis. Despite the efforts of West Park physicians and nurses, and assistance from staff at the Scarborough Grace and Mount Sinai Hospitals, qualified staff could be found to care for only 14 patients.

Faced with increasing transmission, the Ontario government designated SARS as a reportable, communicable, and virulent disease under the *Health Protection and Promotion Act* on March 25, 2003. This move gave public health officials the authority to track infected people, and issue orders preventing them from engaging in activities that

might transmit the new disease. Provincial public health activated its emergency operations centre (better known as MAG for Ministry Action Group).

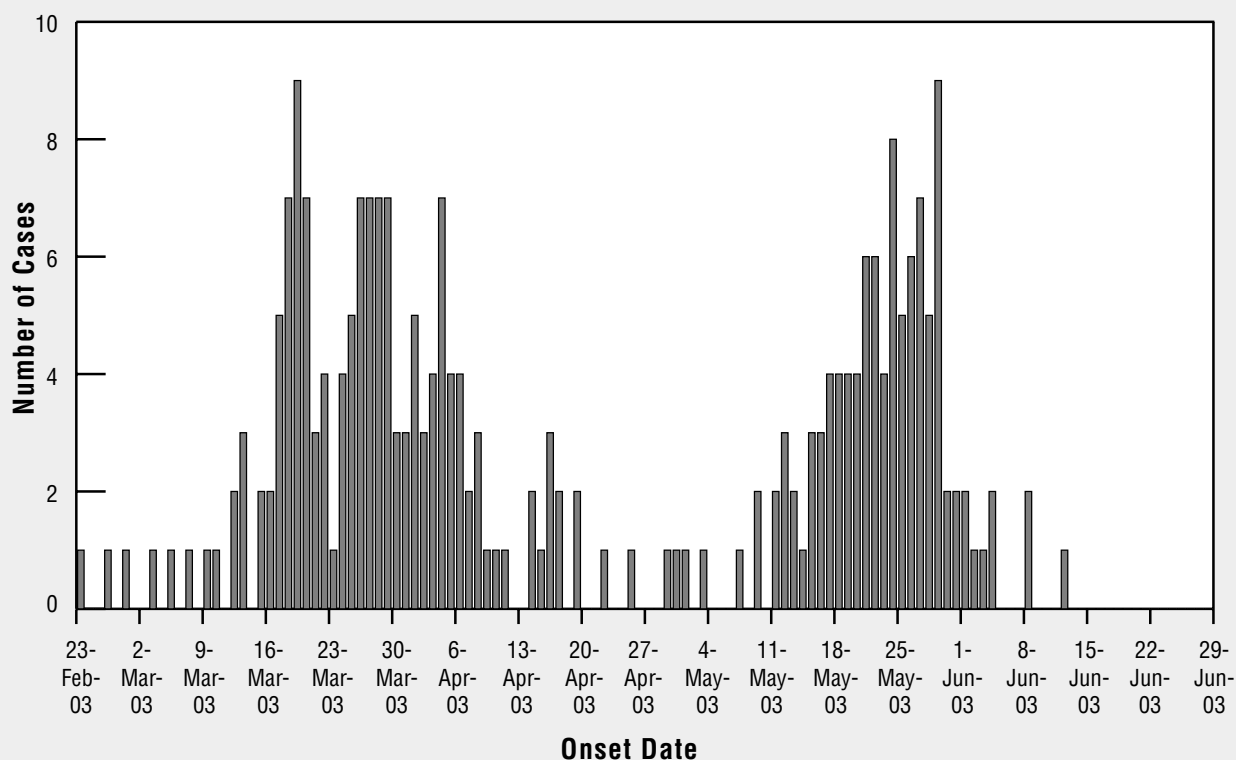
By the evening of March 26, 2003, the West Park unit and all available negative pressure rooms in Toronto hospitals were full; however, ten ill Scarborough Hospital staff needing admissions were waiting in the emergency department, and others who were ill were waiting at home to be seen. Overnight, with the declaration of a provincial emergency, the OMHLTC required all hospitals to create units to care for SARS patients. Accepting a lead role in the outbreak, Sunnybrook and Women's would, within 48 hours, put 40 negative pressure rooms into operation.

By March 25, 2003, Health Canada was reporting 19 cases of SARS in Canada—18 in Ontario and the single case in Vancouver. But 48 patients with a presumptive diagnosis of SARS had in fact been admitted to hospital by the end of that day. Many more individuals were

FIGURE 1

Number of Probable Cases of SARS in Canada, February 23 to July 2, 2003

(N=250), excludes 1 patient for whom onset date is unknown.



3 Respirators are designed to help prevent the inhalation of airborne particles by the user; the N95 mask is technically a respirator, and is designed to filter 95% of particles larger than one micron. Surgical masks trap droplets produced by the user, and help prevent the transmission of virus-containing secretions. During the SARS outbreak, many patients and visitors were asked to wear surgical masks.

starting to feel symptoms, and would subsequently be identified as SARS patients. Epidemic curves later showed that this period was the peak of the outbreak. On March 19, nine Canadians developed “probable” SARS, the highest single-day total. Taking “suspect” and “probable” cases together, the peak was March 26, and the three days, March 25 to 27 are the highest three-day period in the outbreak.

2D. The Emergency (March 26, 2003 - April 7, 2003)

Ontario Premier Ernie Eves declared SARS a provincial emergency on March 26, 2003. Under the *Emergency Management Act*, the Premier has the power to direct and control local governments and facilities to ensure that necessary services are provided. The same day, the province activated its multi-ministry Provincial Operations Centre for emergency response, situated on the 19th floor at 25 Grosvenor Street.

All hospitals in the Greater Toronto Area [GTA] and Simcoe County were ordered to activate their “Code Orange” emergency plans by the OMHLTC. “Code Orange” meant that the involved hospitals suspended non-essential services. They were also required to limit visitors, create isolation units for potential SARS patients, and implement protective clothing for exposed staff (i.e., gowns, masks, and goggles). Four days later, provincial officials extended access restrictions to all Ontario hospitals.

Later, the Committee heard mixed opinions about whether Code Orange was justified. Several interviewees noted the massive number of cancelled services, and suggested that the collateral casualties from the suspension of health care activities may never be fully measured. Other harms were more subtle, including hardship caused by restrictions on visits between families and patients hospitalized with conditions other than SARS. These informants claimed the activation of Code Orange demonstrated a “lack of understanding of the system.” They suggested that The Scarborough Hospital could have been closed and converted into a dedicated SARS hospital, with staff support from other facilities, while selected other hospitals began urgent preparations to become SARS-care centres. The remainder of the system could then operate with increased infection control precautions.

Other interviewees argued strenuously that the declaration of emergency and Code Orange were essential to galvanize infection control, and prevent unrecognized exposure by hospitals in the face of great uncertainty about the transmissibility of SARS.

DISCUSSION POINT

Ministerial leadership is needed to create system-wide outbreak management protocols, ideally of a graded nature commensurate with the severity of an outbreak. Many Ontarians experienced adverse effects from cancelled surgeries and delayed appointments. Ontario could put hospitals on “Code Orange” status (or not), but did not have a coordinated outbreak protocol for health and long-term care facilities and community-based health care providers. Do other Canadian provinces have such protocols in place? Are they harmonized with each other to permit interprovincial coordination in the event of a national outbreak? Has Health Canada taken a leadership role in creating template protocols and facilitating their adoption?

Dr. Jim Young, Ontario’s Commissioner of Public Safety and Security, co-chaired the Provincial Operations Centre Executive Committee, and led the Executive and Scientific Advisory Committee in a lengthy and intense exercise to assess the pros and cons of designating one or more facilities as “SARS hospitals.” Decision makers feared an outbreak would over-run any one or two designated SARS hospitals. The West Park experience suggested that the logistics of staffing a SARS specialty hospital would be extremely difficult. Concentrating SARS patients in a few institutions would put an enormous burden on these hospitals, and place their clinical personnel at great risk. Patients would still go to the emergency department nearest them, and language in current collective agreements constrained the ability of the system to move staff into new institutions. The team decided to build capacity for the management of SARS in multiple institutions. SARS patients were cared for at over 20 hospital sites scattered across the Greater Toronto Area.

2D.1 Information Technology and Data Sharing

On April 1, 2003, Dr. Ian Johnson, a professor and epidemiologist at the University of Toronto, was seconded to the OMHLTC to establish a SARS surveillance system. He had formerly served as associate medical officer of health for North York. Upon his arrival, Dr. Johnson immediately noted insufficient physical and human resources. Dr. Johnson later told the Committee that reporting structures were unclear, and the head office of the Public Health Branch was simply unable to provide optimal support for outbreak investigation and management. There were also frequent requests for data for the provincial government’s daily press conferences.

Dr. Johnson characterized the province's infectious disease tracking and outbreak management software as "an archaic DOS platform used in the late eighties that could not be adapted for SARS." Several other key informants echoed this sentiment. In 2000, the Ontario Public Health Branch had led a process that developed a five-year plan to upgrade information technology, but it was not approved for funding.

This outdated software platform was assessed, and rapidly rejected by Toronto Public Health as unsuitable for the SARS outbreak. Toronto Public Health developed new software tools to deal with tracking cases and contacts; other local health units eventually followed suit as the outbreak spread. However, individual files for cases and contacts were maintained on paper charts that included colour-coded Post-It notes. Dr. Sheela Basrur, the city's chief medical officer of health, later commented that Toronto was using nineteenth century tools to fight a twenty-first century disease.

Several interviewees reported that data handling protocols were variously unclear or non-existent. Developing them during the SARS outbreak proved to be time-consuming and frustrating. One interviewee described the situation as "a turf war" on multiple levels. Offers of assistance from academic clinicians were rejected; infectious disease specialists and hospital epidemiologists set up a separate data system for clinical management and institutional infection control.

Health Canada officials were concerned that the Public Health Branch of the OMHLTC was, in the words of one informant, "completely overwhelmed". The Committee later learned that the personnel and infrastructure supporting Chief Medical Officers of Health are thin in several provinces.

DISCUSSION POINT

Provincial public health authorities are the next line of defence when an outbreak spreads beyond a single municipal health unit or overwhelms its capacity. Ideally, they provide leadership and coordination for public health activities province-wide. British Columbia has taken the additional step of building a public health focus for infectious diseases in the British Columbia Centre for Disease Control. Would Ontario have benefited from a similar agency at the provincial level? How do we build a second line of defence against outbreaks on a national basis? Ontario has also devolved public health functions to municipal control; expenses are divided equally between the provincial government and municipalities. Did this weaken Ontario's capacity to manage multi-jurisdictional outbreaks in a coordinated fashion?

Dr. Colin D'Cunha is Ontario's Chief Medical Officer and Commissioner of Public Health. He co-chaired the provincial emergency team with Dr. Young. Dr. D'Cunha advised the Committee that Toronto Public Health was initially overwhelmed, and not able to generate timely data in the first two or three weeks of the outbreak. Another informant noted that Toronto has 1,800 public health employees, and wondered if the city had maintained a large enough outbreak management and infectious disease unit.

Dr. D'Cunha stated that protection of patient confidentiality constrained his ability to release data to Health Canada. Senior GTA public health physicians took the same view of their obligations to share data with the Ontario Public Health Branch. Health Canada informants in turn argued that they never wanted personal identifiers, simply more detail to meet WHO reporting requirements. Multiple informants noted that relationships among the public health officials at the three levels of government were dysfunctional.

A memorandum of understanding on data sharing was never finalized between the province and the federal government. High-level public health officials in Ontario and Health Canada have since given the Committee sharply divergent views on how well information flowed with respect to both its timeliness and adequacy. It is clear that at points during the outbreak, Dr. Arlene King of Health Canada dealt directly with Dr. Johnson and local public health officials to acquire the more detailed data necessary for discussions with WHO. Local public health units in turn faced pressure from the Ontario Public Health Branch to send on data for press conferences, for reports to Health Canada, or both.

DISCUSSION POINT

The lack of a modern database accessible to local, provincial, and federal health authorities had adverse impacts on the flow of information to the public and international agencies. The absence of appropriate and shared databases and capacity for interim analyses of data, also interfered with outbreak investigation and management, and constrained epidemiologic and clinical research into SARS. Agreements for data sharing between different levels of government, and the necessary information technology, were apparently not in place before the outbreak. Who is responsible for developing such protocols? What kind of information systems could help prevent future problems? How can officials ensure the confidentiality and security of patient data while facilitating the necessary access and analyses?

A senior public health physician, on secondment to WHO during the SARS outbreak, assessed the jurisdictional tensions bluntly after a visit to Canada in May: “The system is sick. It’s broken.”

2D.2 Scientific Advisory Committee

Another group that complained about insufficient data was the Scientific Advisory Committee [SAC], an *ad hoc* group of experts that started as a “human-cellphone conglomerate” of concerned physicians, infection control practitioners, and administrators from across the country. Made up of volunteers who essentially dropped whatever they were doing to assist in the Toronto outbreak, the committee members worked long hours, seven days a week. Several Toronto physicians were integral members, but when Dr. Allison McGeer fell ill, and five core members were forced into quarantine, Dr. Dick Zoutman, a hospital epidemiologist and medical microbiologist from Kingston, moved to Toronto and assumed the chair. “Handcuffed” by inadequate amounts of information, Dr. Zoutman later commented that his group “wanted desperately to get into the epidemiology, but had no data, capacity, or time to do so.”

The SAC was charged with developing quarantine guidelines and hospital directives covering topics such as restricted access, isolation precautions, employee screening, and patient transfers. The directives were passed to the director of the Hospitals Branch of the OMHLTC and her staff, who reworded them to facilitate implementation by administrators, or, as the team called it, “translation into ‘Hospitalse’.”

Preparing directives under intense pressure, the SAC occasionally lost track of draft versions in the early going, but soon devised the necessary protocols. The SAC also had to manage a frequently changing membership as some physicians returned to their “day jobs”. Along with offering high praise for the SAC’s chair and members, interviewees later wondered why the committee did not include representatives with expertise in anaesthesia, paediatrics, or respiratory therapy. Representation from family medicine came later in the outbreak, when it was recognized that primary care input was essential to generate directives for physicians practising in community settings.

Nuances were sometimes lost and meanings blurred as directives were processed through various channels. A specialist who participated on the SAC later stated: “At times, the directives issued to the hospitals appeared to be significantly different than directives that were agreed to by the [SAC] members and proved to be very

confusing for the hospitals.” Several clinical and administrative leaders raised concerns that early directives were not field-tested, lacked a scientific basis or were operationally impossible. Dr. Jim Young noted, however, that the situation required “decisive action, not perfection. Every hour that we wasted was more people getting infected.”

A controversial directive was the requirement that health care workers wear fit-tested N95 masks. Neither the fit-testing (a complex operation requiring a subject to try various mask designs while a bitter-tasting gas circulates underneath a hood), nor the appropriateness of the N95 standard itself had been fully discussed by the SAC. Given that SARS was being spread primarily via droplets, some informants questioned whether N95 masks were necessary. Others stressed that the disease should be treated as airborne until more information was available.

Notwithstanding the debate about the necessity of N95 masks, fit-testing was felt by almost all to be operationally impossible. The Provincial Operations Centre issued the edict that health care workers should wear fit-tested masks, but no support was provided to hospitals to ensure this would happen. Confusing matters further, unions such as the Ontario Public Service Employees Union attempted to fulfil their safety mandates by issuing their own health alerts and recommendations. The Ontario Nursing Association was alarmed by the lack of fit-testing and non-compliance with the provincial directive, and launched grievances to protect front-line nurses.

DISCUSSION POINT

The Scientific Advisory Committee [SAC] was a hastily-assembled group of tireless volunteers. With over 200 SARS patients in Toronto, infectious disease experts were spread thin—and the city had only a handful of hospital epidemiologists. Their ability to participate in SAC deliberations was limited, and when they were able to participate in person, the entire committee was at risk of being infected with the SARS virus. Should a body similar to the SAC already have been in place? The CDC has recently initiated the use of a “B [or Brains] team” to provide scientific backup and sober second thoughts in the midst of what is often a crisis atmosphere. What kind of structure should be in place in the provinces or nationally to ensure the requisite scientific support for outbreak investigation and ‘B team’ functions? Who should issue directives to health care workers and institutions, and what kind of support should be provided to facilitate compliance?

2D.3 Leadership

Various interviewees acknowledged the indefatigable leaders of the emergency response, but remarked that, as one put it, “we never knew who was in charge.” Dr. D’Cunha and Dr. Young jointly led the Provincial Operations Centre. Many interviewees noted tensions between the two physicians, as well as their differing management styles. In separate interviews, both Drs. Young and D’Cunha acknowledged that the dual leadership structure was less than ideal, and one person should have been in charge. Matters were further complicated as other branches of the OMHLTC helped to manage the interactions with hospitals, long-term care facilities, physicians, and various elements of the health service system. A number of physicians involved in caring for SARS patients began actively discussing whether and how the management of the outbreak could be handed over to a single “SARS czar”.

At the federal level, similar themes emerged. Staff at the Health Canada Regional Office in Toronto felt they could have played a greater role given their proximity to the crisis, and their ability to gather intelligence locally. A pre-existing F/P/T Pandemic Influenza planning committee became the nidus for daily SARS teleconferences organized by Health Canada, but representatives from Ontario were too busy dealing with the outbreak to join in. Several senior Health Canada personnel from Ottawa who came to help in Toronto were identified for praise by interviewees. However, fairly or not, most informants contrasted the response of Health Canada’s Population and Public Health Branch with the high standard of federal support set by the CDC in the United States. One provincial health official later commented that “Tunney’s Pasture is good for general advice, and Ottawa has a big chequebook, but the feds lack operational credibility.”

DISCUSSION POINT

Emergency situations are inherently stressful. Public health crises require clear leadership at the municipal, provincial, and ultimately national levels as their scope widens. Who should provide these differing levels of leadership? What kind of an organizational structure would work best? Some informants questioned the embedding of the response to SARS, a public health crisis, in Ontario’s general emergency management structures. Should there be a category of health emergencies distinct from the general emergency machinery at the provincial and federal levels?

2D.4 Health Canada’s Role

According to Health Canada’s internal communications, on March 14, 2003, the federal government sent “six infectious disease and epidemiology experts to help with the investigation of SARS cases,” with “an additional eight experts” sent on April 1. In contrast, a provincial official later commented that Health Canada sent three trainees from its Field Epidemiology Program to do a research project with Toronto Public Health. It appears that about a dozen Health Canada personnel of varying levels of seniority were actually on the ground in Toronto for much of the outbreak, but largely invisible. Senior federal personnel were closely involved in investigating a number of SARS clusters, kept other provinces and territories prepared for SARS, and managed the international liaison. However, federal involvement in Ontario was limited by the lack of a delineated role in an organizational structure, lack of data for outbreak investigation, and absence of business process agreements for inter-jurisdictional collaboration.

For example, a group of field epidemiologists from Health Canada first worked with Toronto Public Health, and then were moved to a OMHLTC office at 5700 Yonge Street where their duties included data entry. Their mentors in Ottawa objected to this deployment of skilled personnel, and the field epidemiologists were demoralized. Others were sent in to help on a rotation system, but this was suboptimal. A member of the SAC commented that “the on-the-ground help from Health Canada seemed to come on five-day contracts so there was no continuity.” For their part, the field epidemiologists were critical of the lack of provincial organization, and nonavailability of data. On April 30, Health Canada pulled back the field epidemiologists from the provincial office, a move that some informants deemed unsupportive and ill-advised.

The federal government convened an invitational “SARS Summit” in Toronto on April 30 and May 1, 2003, setting out the framework for a national SARS strategy. The event helped to promote a commonality of purpose in the struggle against SARS, although some front-line clinical and public health physicians who had been fighting SARS at ground level later wondered why they were not invited. Health Canada also facilitated the purchase of approximately 1.5 million N95 masks for the National Emergency Stockpile System [NESS], and sent 10,000 to Toronto health officials.

DISCUSSION POINT

In the United States, as in Canada, responsibility for outbreak management progresses through local and state public health chains of command. However, the Centers for Disease Control and Prevention [CDC] is generally 'invited early and often' to become involved with any serious outbreak. Its credibility mitigates jurisdictional tensions. The same cannot be said at present for the Population and Public Health Branch of Health Canada. How can we build federal capacity to support provincial and municipal officials in battling disease outbreaks? What collaborative hierarchy of roles and responsibilities can be devised that reflects the unique nature of Canada's federation?

2D.5 Public Communications and Media Relations

Health Canada, the OMHLTC, and Toronto Public Health all issued regular SARS updates on their websites. Televised SARS press conferences were a daily feature of national newscasts—Drs. James Young, Colin D'Cunha, and Sheela Basrur became household names. Dr. Donald Low, chief microbiologist at Mount Sinai Hospital and professor of medicine at the University of Toronto, emerged as one of the unofficial leaders of the SARS battle, and sometimes joined the official press conferences. He and other infectious disease leaders also did numerous unscripted interviews.

Many observers felt that interaction with the media became an end in itself during the outbreak. Several Committee informants felt the impression created was one of too many “talking heads” whose opinions sometimes diverged. Singapore, in contrast, held an evening press conference with a single spokesperson, the Minister of Health, leaving public health officials and infectious disease experts to focus on the outbreak. A senior physician later questioned why the media profiled the cumulative counts of probable and suspect SARS patients, rather than the relatively unimpressive daily incidence statistics (as per figure 1). There appeared, however, to be no coherent communications strategy aimed at dispelling the sense of deepening crisis.

2D.6 Research

On March 15, 2003, WHO established an international network of laboratories to find the agent responsible for SARS. The speed of the investigation was unprecedented—barely a month later, WHO announced that a previously unknown member of the coronavirus family had been conclusively identified as the most likely culprit.

DISCUSSION POINT

Communications was among the issues raised in a compelling letter to the Committee, signed by the presidents or chief executives of nine major health care groups—the Canadian Medical Association, the Canadian Public Health Association, the Canadian Nurses Association, the Canadian Healthcare Association, the Canadian Dental Association, the Association of Canadian Academic Healthcare Organizations, the Canadian Pharmacists Association, the Canadian Association of Emergency Physicians, and the Canadian Council on Health Services Accreditation. They wrote:

“During a crisis or emergency, the public will quickly begin to look for a trusted and consistent source of information. However, during the early days of the SARS crisis, in Toronto, there were occasions when several different public health officials were being quoted and had titles attributed to them that appeared to indicate they were responding in an acting capacity only and not as an “official”. This had the potential to leave an impression with the public that no one with any authority was in control. Establishing one individual with authoritative credentials as the chief spokesperson creates public confidence, and lends credibility to the messages. How the crisis or emergency is reported is just as important as how it is actually handled. It is also crucial that the public, and the media have a clear understanding of the language of the crisis so that clear, consistent messages are communicated and received. Governments across jurisdictions must develop an emergency plan to which all parties are committed regarding leadership in communications.”

The first scientific papers describing SARS were published on the *New England Journal of Medicine* website on March 31, 2003; one came from Hong Kong and the other from Canada. In the following weeks, researchers from Hong Kong flooded the medical journals with important analyses—eight major publications appeared in *The Lancet* alone. Several more were spread between the *British Medical Journal*, *Science* and the *New England Journal of Medicine*.

In the same period, Canadian researchers published two more articles in the major international journals. One was an important breakthrough, albeit quickly repeated in other jurisdictions—researchers from British Columbia and Winnipeg described the genetic sequence of the Toronto SARS virus in *Science*. Later, a team of doctors from Toronto depicted the clinical features of SARS in *JAMA - the Journal of the American Medical Association*.

While researchers in Hong Kong were busy correlating clinical and laboratory features of SARS with epidemiologic data, this did not occur in Toronto. The first clinical paper from Toronto was compiled with minimal input from public health officials; its lead author was a resident physician just two years out of medical school.

Some of Toronto's infectious disease experts were too busy taking care of patients to find time for research. Others were occupied by SAC deliberations. Multiple informants praised the work done by infectious disease and infection control specialists who supported a wide range of activities inside and outside their home institutions. They and countless health care workers rose daily to the challenge of battling SARS, placing themselves at risk to battle a new and contagious disease with a significant mortality rate. As one academic physician later ruefully commented, "It doesn't show up on my CV if I'm in the trenches battling SARS." However, even had an appropriate database been in place, the required machinery and supporting personnel may well have been insufficient to allow either appropriate outbreak investigation or the associated epidemiologic and clinical research.

On July 26, 2003, a major paper with multinational authorship was published in *The Lancet*, providing data in support of the proposition that the new SARS-associated coronavirus had met the criteria to be designated the causative agent of the new disease. Patient data were included from six countries: Hong Kong, Singapore, Vietnam, Germany, France, and the United Kingdom. No Canadians appeared among the 22 authors, and no Canadian patients were included in the study sample.

DISCUSSION POINT

Outbreak investigation and research shade together. For example, provisional analyses of data during an outbreak allow researchers to estimate incubation periods (the length of time necessary to quarantine a contact), and devise treatment protocols. Canadian researchers were hamstrung by patient care and scientific advisory responsibilities, a lack of data, infighting about data access, limited research funds, and the need to obtain ethics approvals at multiple institutions. Submissions to the Committee by the Canadian Association of Medical Microbiologists, among others, have recommended establishing a common ethics review board for outbreak situations, developing guidelines to ensure that outbreak data are made available to all interested researchers (ownership and authorship issues should not be of primary importance during an emergency), and assembling a dedicated and experienced research team early in an outbreak.

2D.7 Laboratories

Within 24 hours of receiving the initial specimens from SARS patients in early March 2003, the National Microbiology Laboratory in Winnipeg ruled out all known respiratory pathogens. The laboratory was a key member of the WHO network responding to SARS, and helped develop and refine diagnostic tests for SARS. Over the course of the first and second outbreaks, the laboratory tested several thousand specimens that included blood, sputum, stool, urine, and nasopharyngeal aspirates. At one point, the laboratory was receiving 600 specimens per day, but had sufficient surge capacity to accommodate the load.

Patient samples often arrived with no epidemiologic or clinical data—sometimes, even basic identifying data were incorrect or missing. More disconcerting was the finding that over 170 individuals who did not have SARS—at least according to restrictive case definitions—tested positive for the virus. Although some results may have been false positives (i.e., due to imperfect tests or specimen contamination), scientists were concerned that members of this group represented an opportunity for the virus to spread unchecked into the general community. The absence of a central database made finding these individuals and their contacts more difficult than it should have been—a situation that one informant called “very frustrating and dangerous.”

In contrast, the Central Provincial Public Health Laboratory in Toronto was unable to provide optimal support during the SARS outbreak. Senior physicians advised the Committee that microbiology laboratory capacity nationally has eroded in recent years; and in Ontario, the Central Laboratory was unable to keep up with the testing volumes involved in previous outbreaks of West Nile and Norwalk virus. A number of infectious disease specialists suggested that there remains an urgent need for rapid and coordinated laboratory testing for SARS and related viral diseases, especially with the fall flu season approaching.

With the provincial lab overwhelmed, some hospitals sent specimens directly to the National Microbiology Laboratory, bypassing the usual hierarchy of referral. The Hospital for Sick Children, Mount Sinai, and Sunnybrook and Women's had strong platforms in polymerase chain reaction technology—an elegant laboratory testing modality that identifies microorganisms by analyzing strands of their DNA or RNA. They became the *de facto* and unfunded referral centres for Toronto SARS testing.

DISCUSSION POINT

The Canadian Public Health Association advised the Committee that “current inabilities or unwillingness to share information within the laboratory network are aggravated by the fact that three sectors—the public, private, and voluntary sectors at three levels—the municipal, provincial, and federal levels—provide laboratory services.” Standardized testing and coordinated collection/sharing of data would help inform outbreak management. How should the hierarchy of referral and responsibility be organized for laboratory testing during outbreaks? Who should set and police standards? How can we strengthen relationships between laboratories and clinical services, public health and government regulators? How do we address the supply, recruitment and retention of medical microbiologists and virologists in public health laboratories?

2D.8 Clinical Challenges

SARS was and remains a challenging disease to diagnose and treat—it presents with nonspecific symptoms, it has no hallmark abnormality on physical exam or biochemical testing, and there is still no unequivocally effective treatment. Toronto-area hospitals and clinicians had never faced an outbreak like SARS. Clinics designed specifically to assess potential SARS cases were created at several sites in the GTA to relieve the burden on emergency departments, and to help prevent further transmission. Once identified, SARS patients were cared for at numerous hospitals across the city during the first wave of the outbreak.

Other countries used different strategies—in Singapore, for example, authorities concentrated all SARS patients in one hospital. Hong Kong tried to centralize SARS care in a single institution but its capacity was rapidly exceeded. In Beijing, officials ordered each hospital to establish a “fever clinic” that could assess patients at risk of having SARS; then, in just eight days, construction workers built a thousand-bed SARS hospital on the city’s outskirts.

In Toronto, infectious disease specialists, clinical chiefs, and intensive care specialists held daily teleconferences to discuss treatment options, and review the number of cases at each hospital. As with any new disease, treatment plans for SARS were designed and implemented with little or no evidence to back them up. Typically, a patient admitted with SARS would receive supplemental oxygen as required, antibiotics to cover a potential bacterial infection, and possibly—depending on the treating physician—ribavirin, a potent medication known to be effective against a variety of viruses. Steroids were used

for patients with worsening respiratory symptoms, a clinical scenario that apparently corresponded to an excessive and counterproductive inflammatory response in the lungs.

As the doctors in Toronto gained experience, they concluded that ribavirin was likely causing more harm than good. Many patients receiving it were developing toxic side effects like red blood cell breakdown and liver dysfunction, and many patients who did not receive the antiviral medication were recovering. This information, coupled with *in vitro* testing (i.e., in the laboratory) showing little or no effect on the SARS coronavirus, led Canadian physicians to stop prescribing ribavirin. Clinicians in other countries continued to use ribavirin, but in smaller doses that limited its side effects. Even in this era of evidence-based medicine, SARS forced physicians to trust their instincts—and their colleagues’ collective wisdom.

By the end of the first week of April 2003, 91 probable and 135 suspect SARS cases had been reported in Canada. Ten people had died.

2E. The Quest for Containment (April 8, 2003 – April 23, 2003)

2E.1 Public Health’s Fight

Public health officials in York and Toronto continued to trace and quarantine contacts with good results. The outbreak management teams and leaders of the local public health units were identified by some interviewees as those who deserve greatest credit for containing the SARS outbreak.

Nonetheless, concerns mounted that SARS was poised to spread into the community. Individuals who attended a funeral on April 3, 2003 were quarantined when some family members developed symptoms. An employee of a large information technology company defied quarantine, and returned to work while symptomatic; one co-worker contracted SARS, and nearly two hundred more were sent into isolation. A Scarborough school was closed by Toronto Public Health when one student, a nurse’s child, exhibited SARS symptoms; four other schools would be closed by local school boards as a result of SARS concerns before the outbreak ended. Routine screening picked up a fever in a nurse caring for SARS patients—a hurried search to identify her fellow commuter train passengers ensued.

Because Toronto was the only city outside Asia to be hit hard by SARS, the international media converged on the city like never before. The attention was not only unprecedented; it was unwanted. Despite the media attention, there was no evidence that the SARS epidemic was spreading through the community. The Amoy Gardens outbreak in Hong Kong, where the virus may have been transmitted through a defective sewer system, was an exception that proved the rule—the SARS virus was spread by either brief exposure to big doses of viral particles or close, prolonged contact. All but a few Canadian cases occurred in travellers, health care workers, and their immediate contacts. Using traditional surveillance, contact tracing, and quarantine, opportunities for community transmission were being identified and contained.

The number of people quarantined grew daily. Very occasionally, someone would refuse to enter isolation, and public health officials had to resort to legal means to enforce compliance. But this was the exception; Torontonians were generally remarkably compliant with highly demanding strictures. Quarantined individuals lost income, suffered from boredom and loneliness, and most importantly, were fearful that they might develop SARS or that they may have spread SARS to family and friends.

Committee informants commented that different public health units seemed to have different thresholds for the use of quarantine. A related issue is whether public health officials used quarantine too frequently. Some interviewees believed they did—one noted that while Beijing had 2,500 cases of SARS compared to Toronto with 250, both cities quarantined about 30,000 individuals. Beijing quarantined fewer people per SARS case because they focused on close contacts (e.g., household members, hospital visitors, and those who might have come in contact with bodily fluids). On the other hand, the higher caseload of probable and suspect SARS in Beijing might actually have been a result of too-limited use of quarantine.

Perhaps the greatest scare of the Toronto outbreak occurred on April 12, 2003 when a cluster of SARS cases was identified in a close-knit religious community. Remarkably, it had begun with exposure back in mid-March of several members of a large extended family at the initial epicentre—The Scarborough Hospital, Grace Division. Over the ensuing weeks, the infection spread quietly through the extended family and some close friends, health care workers who cared for them, and then into a religious group. In all, 31 cases, including three health care workers, were associated with this cluster. Public health workers employed active

surveillance and quarantine to control the spread of infection, and unchecked community transmission never materialized.

As residents of their jurisdictions became exposed through the religious group cluster, public health units in the surrounding regions of Durham and Peel joined Toronto and York in trying to stop the outbreak. The various units collaborated, but there was no overarching coordination across jurisdictions. Hospitals later complained that they were sometimes contacted separately for information about the same patient by two public health units. Hospitals were also fielding requests for information from the OMHLTC Hospital Branch, the Public Health Branch, and the Provincial Operations Centre. Understandably, it appeared to those on the clinical front lines that public health officials were not communicating with each other. Meanwhile, in Toronto, local public health workers were nearing exhaustion—all non-SARS activity in infectious diseases and many other provincially-mandated programs had been suspended, and virtually all qualified employees were working on SARS full time.

The monumental efforts of public health workers played a critical role in the containment of SARS. Toronto Public Health, for example, investigated 1,907 separate reports in addition to 220 cases of probable or suspect SARS, each of which involved several hours of investigative work, independent of contact tracing. A pair of papers later published in *Science* provided estimates of the “infectiousness” of the SARS virus. Both papers lead one toward the same conclusion: although SARS is only moderately transmissible, left unchecked it could have infected millions of people worldwide. Whether it would have done so before mutating into a more benign form is, fortunately, still unknown.

2E.2 Primary Care

Although most of the attention during the outbreak was directed toward hospitals, several instances of patients transmitting SARS to their family doctors produced apprehension. One academic family physician voiced concern as early as March 28, 2003: “Family physicians, just like hospitals, need precise and explicit directions for screening patients, and for contending with suspect or probable SARS patients who might make it past the screening system.” They also “required full protective gear in the unlikely event that a SARS patient did make it into their offices.” He suggested that family physicians could be used as sentinels—reporting cases of pneumonia to a central authority might pick up SARS clusters where there was no obvious epidemiologic link.

Guidelines for family doctors were eventually issued on April 3, 2003 via the fax and e-mail network of the Ontario Medical Association. These instructions outlined three goals: first, to keep potential SARS patients out of doctors' offices using signs, pre-recorded telephone messages and screening questionnaires; second, to safely treat any SARS patients that did enter the office; and third, to protect physicians and staff from infection. Some informants later suggested that the guidelines were difficult to implement in community-based practices.

More problematic was the lack of a system to distribute the necessary protective gear. The Ontario Medical Association proposed that the fastest strategy was for family doctors to buy their own supplies where they could, and apply for reimbursement later. A growing number of family physicians, however, were concerned by the lack of provincial support. On April 15, Drs. D'Cunha and Young convened a meeting of family doctors, hospital CEOs, and chiefs of emergency medicine at a downtown hotel. Family doctors left the meeting frustrated that the province had still not developed a plan to distribute protective equipment to physicians and their office staff. On April 21, 2003, almost four weeks after the Province of Ontario declared an emergency, the province finally used its vaccine distribution network to provide family doctors with protective equipment.

DISCUSSION POINT

During the SARS outbreak, several family physicians were infected with SARS. Because most people visit their family doctor (rather than an emergency department) when they are unwell, family doctors need protocols, protective equipment, and prompt information during infectious disease outbreaks. How can we better support community physicians during extraordinary situations? How can we improve communication between public health officials and the primary care sector? What about other community care agencies? How do they fit into the scheme of disease surveillance and outbreak response?

2E.3 Transmission of SARS to Protected Health Care Workers

On April 13, 2003, on the Sunnybrook and Women's SARS unit, a family doctor who may have been infected with the SARS virus while caring for several members of the religious group cluster began to suffer from increasing shortness of breath. He was transferred to the ICU. Once there, non-invasive devices were used to

assist his breathing. None worked, and doctors decided he required intubation. The entire ordeal (from transfer to intubation) took several hours. Many health care workers were exposed to the patient's coughed-up secretions or the aerosols generated by devices to assist his breathing. Both were rich with SARS viral particles.

By the following week, 11 health care workers present during either the transfer or the intubation became ill. On April 20, 2003, Sunnybrook and Women's closed its SARS unit and its ICU. Canada's largest trauma centre stopped accepting trauma patients. Investigators from the CDC were invited north to join a team attempting to shed light on how health care workers using all recommended precautions could have been infected. The team concluded that direct contact with the patient or a contaminated environment might have led health care workers to contaminate themselves as they removed their protective gear; alternatively, the patient's coughing or the assisted ventilation might have led to airborne spread.

The concept that minor breaches in protocol led to infection was upsetting to some professionals who saw these findings as a veiled criticism. The possibility that their own inadvertent and minor breaches in protocol could lead to infection was disturbing to some professionals who saw these observations both as further evidence of the risks of SARS care and also as an indirect criticism. However, most physicians and nurses had little recent experience with droplet precautions for a virus such as SARS. Hospitals redoubled their efforts to train health care workers covering SARS units.

Sunnybrook and Women's continued to carry the largest volume of SARS patients in the GTA, but many of its physicians with relevant expertise or experience were now ill or in quarantine. The hospital's administrators, clinical chiefs, and involved clinicians put out desperate requests for support through numerous channels. Other Toronto institutions were either struggling with their own SARS load or unwilling to help. One sister hospital eventually sent one senior resident to help with general medicine coverage, freeing up on-site staff to concentrate on SARS patients.

The military sent a critical care specialist. One physician arrived from the United Kingdom, another came from Montreal, and the chairman of medicine at the University of Ottawa offered to assemble reinforcements if necessary. Further support came only after the province retained a private placement agency to help with recruitment, but the agency's pay scales for professionals would later become a point of contention.

DISCUSSION POINT

Ontario is the only province that has not adopted regional administration of health care. The merits of regionalization in general are subject to ongoing evaluation. However, the GTA lacks any truly regional plan for clinical services or health emergencies. More generally, clinical jurisdictions across Canada do not have defined response teams for health emergencies that can move between hospitals, let alone across regions or provincial boundaries. The Canadian Medical Association has proposed a 'grid system' for personnel to support health emergencies. Should a system of health emergency response teams be created within and across regions and provinces?

Meanwhile, in British Columbia, the transmission of SARS to a nurse caring for SARS patients forced the closure of a ward at the Royal Columbian Hospital near Vancouver on April 19, 2003. This was the first case of secondary transmission in British Columbia; the other three probable SARS patients in British Columbia had contracted the disease outside the country.

2E.4 WHO Travel Advisory

As the Easter and Passover holidays approached, public health officials braced themselves for a large spike of cases emanating from the religious group cluster. Both public health officials and clergy stressed repeatedly that people under quarantine should remain home, and avoid public religious services. Catholic churches also instituted precautionary measures—communion wafers were placed in hands rather than mouths, and confessions took place outside the usual booths. At diverse religious gatherings handshakes were replaced with smiles.

The expected wave never occurred. By April 23, 2003, only one individual—a member of the religious group—had developed SARS in the previous two weeks. But just as confidence within the city began to grow, WHO issued an unprecedented advisory, recommending that visitors to Toronto postpone all but the most essential travel. The United Nations agency was concerned that “a small number of persons with SARS, now in other countries in the world, appear to have acquired the infection while in Toronto.”

Three months after WHO issued its travel advisory against Toronto, Health Canada officials remain mystified about WHO's reasoning and motivation. As one Health Canada physician told the Committee, “The travel advisory was an absolute stunner... We were of the belief, based on the epidemiologic data, that the outbreak was dwindling

rapidly.” Some informants have since speculated that WHO officials were concerned about the appearance of a double standard favouring Toronto. WHO travel advisories had already been issued for Hong Kong and Guangdong, and advice against non-essential travel to Beijing and China's Shanxi Province was given on the same day as the Toronto advisory.

Singapore had 189 probable cases on April 23, 2003 compared with 140 for Toronto, as well as transmission at a community market. Epidemic curves comparing the outbreaks in Toronto and Singapore are strikingly similar (see Chapter 11). However, Singapore's management of the outbreak, not least its communications strategy, was superbly organized and reflected a remarkable degree of social solidarity that could not have been lost on WHO. The Committee has also learned that regional WHO offices had different levels of interaction with nations affected by SARS, and were therefore more or less able to vouch for the containment of the outbreak.

The WHO travel advisory criteria themselves came under intense criticism—they included the presence of at least 60 probable SARS cases, export of SARS to other countries, as well as community spread. Yet none of these criteria have ever been validated as reasons for issuing a travel advisory. For example, the absolute number of cases in an outbreak is largely a function of the size of a community. Issuing a travel advisory does not prevent residents of a SARS-affected area from leaving and taking SARS with them. Indeed, of the six people thought to have spread SARS from Canada, only one was a visitor returning home after a trip to Canada. Finally, “spread into the community” was never explicitly defined—if a nurse with SARS infects his/her spouse, is this considered community transmission?

DISCUSSION POINT

Whether the WHO travel advisory was justified or not is debatable. What is beyond debate is the fact that the economic and social impact of such advisories can be devastating. What is the process whereby different nations and international agencies such as WHO generate criteria for travel advisories, and proceed to issue them? What are the benefits and harms of travel advisories? In the case of Canada, to what extent was international confidence in our ability to manage SARS undermined by lack of coordination among jurisdictions, shortage of data, and the lack of a coherent communications plan?

2F. Between the Waves (April 24, 2003 - May 22, 2003)

"I can tell you definitely we are in better shape today than we have been in a month...Where did [the WHO] come from? Who did they see? Who did they talk to? Did they go to our hospitals, did they go to our clinics, did they go anywhere? They sit somewhere, I understand Geneva, I don't even know where the hell they came from, but Geneva or someplace and they make decisions..."

—Mayor Mel Lastman, at a press conference, April 23, 2003

The WHO-issued travel advisory came just as local and provincial health officials felt that they were winning the battle against SARS. This perception was strengthened by media spokespersons, front-line clinicians, and by the federal government. The Prime Minister also announced the formation of the National Advisory Committee on SARS and Public Health.

The WHO advisory, which was initially to have been in place for at least three weeks, was withdrawn on April 30, 2003 after visits to Geneva by a delegation that included Ontario Health Minister Tony Clement and the Public Health Commissioner, Dr. D'Cunha. In return, Canadian officials gave assurances to WHO that they would intensify screening of travellers to and from Canada to prevent export of the disease.

On May 14, 2003, WHO removed Toronto from the list of areas with recent local transmission. This was widely understood to mean that the outbreak had come to an end. Consistent with the notion that the disease was contained, the Premier of Ontario lifted the emergency on May 17. Directives continued to reinforce the need for enhanced infection control practices in health care settings. Code Orange status for hospitals was revoked, and the Ontario government announced a provincial panel to study the response to SARS, chaired by Dr. David Walker, dean of medicine at Queen's University. The Provincial Operations Centre was dismantled. The physician-in-chief of a major teaching hospital later observed that there was "a great and understandable rush to make things normal again after SARS I."

By mid-May, all levels of government were presenting a unified picture to the public that SARS had been contained. Rather than presenting data about the cumulative number of people labelled with probable or suspect SARS, health officials began to highlight the declining number of "active" cases and the number of new cases—figures that were not only more reflective of disease activity but also less dramatic. Health Canada began to issue bulletins only weekly, and reported in its May 21, 2003 update that no Canadian had experienced the onset of symptoms for over a month.

It appeared that the total number of cases had reached a plateau—140 probable and 178 suspect infections. Twenty-four Canadians had died, all in Ontario.

2F.1 Hospital Infection Control

Starting in late April 2003, hospitals began to ease their infection control precautions. Employees working outside designated SARS areas were, in most hospitals, relieved of their obligations to wear personal protective equipment for all patient contact. Rules regarding the minimum distance separating co-workers during meals were relaxed. Hospitals began increasing the number of patients allowed visitors. Relieved that SARS had passed, staff went back to their usual routines. Hindsight would reveal that vigilance for SARS and stringent protective measures should have been maintained for at least a few more weeks.

Provincial directives required hospitals to isolate patients with fever and respiratory symptoms in either the hospital or the emergency department until SARS had been ruled out, but there was no recommendation for formal, hospital-based surveillance programs. The SAC had actively discussed the need for heightened surveillance. Its functions, however, were being wound down. Public health officials viewed syndromic surveillance as a matter for institutional infection control and outside their mandate; they lacked resources to implement such a program in any case.

Hospitals responded by treating all patients admitted with community-acquired pneumonia as potential SARS cases until proven otherwise. Most took special precautions with inpatients who developed respiratory symptoms suggestive of infectious disease. Some hospitals also did "fever surveillance." For example, at York Central Hospital, all inpatients had their temperature checked twice daily. Chest x-rays were ordered for all York Central inpatients with fever and respiratory symptoms and they were isolated promptly; and until SARS could be ruled out, a specialist in lung diseases assessed and treated all pneumonia patients in isolation. Similar measures were used in Singapore health care facilities.

Although infection control practitioners attempted to institute comprehensive surveillance programs in some hospitals, such a program alone requires approximately 2 full-time staff members for a 500-bed hospital, more than the majority of hospitals have on staff for all infection control tasks. At North York General Hospital, for example, one full-time and one part-time infection control practitioner were responsible for 425 acute care beds. The infection control director, Dr. Barbara Mederski, occupied the role without any salary, protected time, or even an office. In the absence of a directive, and with ongoing budgetary concerns, instituting full syndromic surveillance was not seen by most hospitals as necessary or feasible.

As well, hospitals were not able to access any baseline data on rates of similar respiratory infections prior to SARS. These baseline data would have been important in assessing whether the rates of respiratory illness being observed were unusually high. The corollary was that hospitals lacked established surveillance networks with real-time pooling of data and rapid expert analysis.

DISCUSSION POINT

Infection control programs in hospitals function as a parallel system to public health efforts in the community. Infection control practitioners are responsible for tracking and managing hospital-acquired infections, educating other health care workers, and reinforcing proper precautions. The Canadian Hospital Epidemiology Committee advises that systemic problems in our current health care system include "insufficient time devoted to learning infection control practices for all health care providers" and "little, if any, monitoring of infection control practices and few consequences for non-compliance." The high rates of transmission to health care workers during SARS indicated that many had "limited awareness of the correct precautions and/or how to apply them." A recent survey found that nearly 80% of Canadian hospitals do not meet the standard recommended by the Canadian Infection Control Alliance of one infection control practitioner per 175 beds. More than 60% of hospitals do not have an infection control director with advanced qualifications (an MD or PhD) in infectious diseases, medical microbiology, or infection control. Should Canada establish higher national standards for infection control within hospital? Should provinces be initiating and funding a major overhaul of hospital infection control capacity? How should we as a country confront the shortage in infection control practitioners and experts?

2F.2 North York General Hospital

On three separate occasions in April and May 2003, officials at North York General Hospital invited experts to investigate potential SARS cases. Those involved in adjudicating the cases were a 'who's who' of leaders in the fight against SARS. Investigations at North York at times involved prominent infectious disease specialists, Toronto Public Health physicians, Health Canada personnel, and visiting experts from the CDC. Assessment was repeatedly bedevilled by the lack of an 'epidemiologic link'—a connection between what, clinically, could be a patient with SARS and a source for his or her infection.

Between April 20 and May 7, three psychiatric patients developed pneumonia. All had been on the seventh floor of North York General Hospital. One had come back to hospital through the emergency department. He was placed in a waiting area with a mask, but paced constantly and, to the concern of the staff, frequently removed his mask. All three patients were isolated and managed as potential SARS cases, although no epidemiologic link to other cases could be identified. The assessment team had divergent views as to whether the clinical picture was consistent with SARS—but in the end, chiefly because there were no epidemiologic links to known SARS patients and negative laboratory tests, they ruled out a new cluster.

Meanwhile, unbeknownst to the hospital administration, several elderly patients on the orthopaedic ward (4 West) had been fighting what were at first believed to be typical post-operative lung infections. Among them was a 96-year-old man with a fractured hip. Through means still unknown, illness spread from 4 West over the next few weeks to other patients and to several visitors and staff. On April 29, an intensive care unit nurse from North York General was admitted to Toronto General Hospital with a respiratory illness. She had cared for an 88-year-old patient from 4 West who had been transferred to the North York ICU with fever, respiratory compromise, and confusion on April 26 and subsequently died. At first, the nurses' serology was negative for SARS, but test results later were positive. In hindsight, the 88-year-old was probably part of a growing SARS cluster on 4 West.

In mid-May physicians and nurses in the emergency department assessed family members of the 96-year-old man with symptoms suggestive of SARS, and they were increasingly anxious about a continuation of the outbreak. Radiologists also expressed concerns to colleagues about sets of suspicious x-rays. Taking their cue from public health officials and citing the epidemiologic uncertainty about how all these cases

could be linked to each other, the hospital's infection control director and vice president of medical affairs tried to reassure emergency physicians and nurses at a tense meeting on May 20.

DISCUSSION POINT

During the SARS outbreak, Health Canada and Ontario posted divergent definitions for probable and suspect SARS cases. Both jurisdictions revised the definitions intermittently. Some critics argued that the Ontario definition put undue emphasis on close contact with a probable or suspect SARS case, leading to a focus on specific epidemiologic links and missed clusters of SARS. The definition was revised on May 26 after the second wave of SARS had begun. The new definition allowed for exposure to a health care setting with SARS patients, and no longer required evidence for close personal contact to label a suspect case. Critics of the Health Canada definition felt that it led to under-diagnosis of SARS by excluding cases if there was an alternative diagnosis for the relevant symptoms. On May 29, Health Canada's definition was revised to emphasize that the alternative diagnosis must "fully explain" the clinical picture. How should case definitions be constructed during infectious disease outbreaks? Did Canada have two definitions of SARS—one set by the federal government apparently based on F/P/T consensus, and another in Ontario where the outbreak was being fought?

Meanwhile, St. John's Rehabilitation Hospital had a steady flow of patients from other institutions, including a transfer from 4 West at North York General Hospital. During the third week of May, staff at St. John's informed senior management that three patients were exhibiting SARS-like symptoms, and a call went out to Toronto Public Health. The hospital immediately instituted all the appropriate precautions. Still chasing down 30 to 40 possible cases of SARS per day, personnel at Toronto Public Health agreed by telephone that there was a respiratory outbreak, but suggested that SARS was not the likely culprit—as at North York General Hospital, no epidemiologic link could be established. Toronto Public Health staff visited the hospital on May 22. Discussion again focused primarily on establishing an epidemiologic link to the patients. None was found.

2G. SARS II

(May 23, 2003 - June 30, 2003)

"SARS I was not avoidable. We were struck by lightning. Everything after that was."

—Dr. Richard Schabas, Chief of Staff,
York Central Hospital

On May 23, barely one week after WHO had declared Toronto free of local transmission, health officials acknowledged that SARS had not been defeated. The province issued a press release announcing that five people were under investigation for SARS. Anyone who had visited St. John's between May 9 and 20 or North York General Hospital between May 13 and 23 was ordered into quarantine. North York General Hospital immediately closed its doors to all new admissions, except for SARS patients. By this time, SARS had already spread not only within North York General Hospital but also to patients who had been transferred from St. John's to the Toronto General site of the University Health Network, The Scarborough Hospital, General Division, and Baycrest Centre for Geriatric Care.

Despite extensive investigations by Toronto Public Health, Health Canada and the CDC, the exact chain of events leading to the second wave of the SARS outbreak remains a mystery. In fact, a definitive link between the first outbreak and the cases on the orthopaedic unit (4 West) has yet to be established, although officials have suggested different possibilities. How the psychiatric patients fit into the overall picture is also unknown, and may never be definitively solved.

With SARS II underway, all hospitals in the GTA were asked to resume previously abandoned infection-control procedures. Only four hospitals were designated as SARS facilities. (The comparative impact of this alternative approach to handling the SARS caseload is analyzed in Chapter 8.) These four hospitals were termed the SARS Alliance. North York General's medical staff and administration staff rallied and rapidly converted their institution into a major SARS centre. The General site of The Scarborough Hospital also geared up rapidly to take on a large caseload. St. Michael's Hospital gradually took on the mandate of managing complex SARS patients, consistent with its tertiary provider role. Sir William Osler Health Centre in Etobicoke faced the greatest challenge in organizing a SARS service, but ultimately provided west-end coverage for the Alliance.

The SAC reconvened. In the absence of the declaration of a general provincial emergency, the OMHLTC now took a lead role with local public health officials in coordinating the outbreak response. A SARS Operations Centre was set up in Ministry offices at 80 Grosvenor Street. Two assistant deputy ministers jointly oversaw the institutional and clinical liaison functions. Dr. Jim Young brought his considerable experience back to the table, and chaired many of the meetings of the new SARS executive group. A number of physicians and administrators, mindful of the experience with SARS I, urged that one person be given clear authority to be in charge of the outbreak, but the problem of multiple leaders recurred.

Meanwhile, public health officials began, once again, the meticulous work of interviewing patients and tracking down contacts. There was considerable fatigue and frustration on the front lines, but also some mitigating features. The outbreak was smaller, the virus was better understood, and the necessary precautions and routines were established. By the end of May, 48 probable and 25 suspect cases had been identified in the second outbreak. Again, transmission had been limited primarily to hospital patients, health care workers, and their families. Toronto was added back to the WHO list of areas with local transmission, but WHO did not issue a travel advisory against the city.

A Clinical Advisory Team working with the Ministry put out a call for volunteers in May, and a number of American infectious disease physicians and hospital epidemiologists offered to come to Toronto. Meanwhile, as noted above, the province retained a private health care personnel agency as sole-source provider of additional physicians and nurses for the involved institutions. Organized medicine was later critical of the contract, noting that Canadian physicians who had volunteered to help were channelled through the agency. Other informants shrugged off the criticism, pointing out that the agency was able to deliver qualified personnel in the face of a planning and process void.

As May turned into June, a few setbacks occurred. A medical student had been placed in quarantine after potential SARS exposure during an obstetrics rotation at North York General Hospital. Two days after his quarantine had expired, he developed symptoms while working in obstetrics at Mount Sinai Hospital. Five women and their newborns, as well as a number of staff, were quarantined. Another incident involved 1,700 students at a high school in Markham who were quarantined after a student at their school fell ill.

On June 10, largely because of the tangled chain of events at North York General Hospital, but also because of mounting pressure from nursing associations and unions, opposition politicians, and the media, the Province of Ontario announced a formal arm's-length investigation into the SARS crisis, headed by Ontario Superior Court Justice Archie Campbell.

2H. SARS and the Health Care Worker

On June 30, Nelia Laroza, a 51-year-old nurse at North York General Hospital became the first Canadian health care worker to die from SARS. Hundreds of friends and colleagues, along with the Premier of Ontario and the Minister of Health and Long-Term Care, gathered at St. Michael's Cathedral to pay tribute. A second nurse, Tecla Lin, died on July 19, and a family physician, Nestor Santiago Yanga, died on August 13.

Perhaps no segment of society was hit harder during the outbreak than health care workers, a group that accounted for over 40% of SARS infections in the Toronto outbreak. For many, the knowledge that SARS patients included colleagues and friends was a source of considerable stress and anxiety. And for those who were afflicted, the memories are intense. In the words of one health care professional hospitalized for three weeks with SARS, "I was forced at once to confront the fact that I might not survive the infection...I was stepping into uncharted waters, a most unnerving adventure."

At focus groups convened for the Committee, nurses and support staff expressed frustration with communication delays, impractical or unrealistic directives, and the inconsistent application of rewards and incentives for those working in high-risk situations. Hospital employees described a wide range of feelings—including fear, anger, guilt, and confusion—as they struggled with personal risks, social isolation, and stigmatization of their families. While most also noted a heightened sense of pride, teamwork, and solidarity, others experienced post-traumatic stress disorder, and a minority felt they needed to change careers.

Nurses have long voiced concerns that their knowledge and experience is not taken seriously by senior decision makers. At North York General Hospital, nurses alleged that administrators ignored their warnings of an impending second SARS outbreak. Nurses also expressed concerns that the SARS unit at North York General Hospital was overloaded, and that suspect cases were being treated in the emergency department with only curtains for isolation. It may not be a coincidence that North York

nurses lacked a key advocate—the position of Chief Nursing Officer lay vacant throughout most of the SARS outbreak. At the same time, the political polarization around SARS has left lasting scars in other ways. A hospital administrator who led a successful SARS team later lamented the mass grievance campaigns launched by organized nursing in Ontario to protest special rewards for nurses working in SARS units: “It was like being in a war and having your own soldiers shooting at you.”

DISCUSSION POINT

SARS has provoked welcome discussion of the occupational culture in health care. Notwithstanding popular perceptions, it appears there was only one case of inter-institutional transmission of SARS by a part-time worker moving between facilities. But casualization has other downsides, including attenuation of a sense of workplace community and a reduced awareness of infection control protocols, both essential for front-line workers faced with an outbreak such as SARS. The Canadian Hospital Epidemiology Committee also notes that hourly pay for casual staff offers them an incentive to work while ill—a practice that, post-SARS, health care facilities have actively discouraged.

Countless health care workers faced a fundamental conflict between self-preservation, and a professional obligation to serve the greater good. Only a small number refused to treat SARS patients or work on SARS wards. Most willingly volunteered, putting their health—and potentially the health of their families—in jeopardy. Unlike other risks in the clinical setting, such as transmission of HIV or hepatitis from accidental skin punctures, SARS was acute in onset, carried an immediate mortality risk, and had no specific treatment. Perhaps more importantly, it could be transmitted to a health care worker’s children by a goodnight kiss. Hundreds of health care workers isolated themselves from their families during the outbreak, wearing masks at home, sleeping in the basement, taking meals alone, and waiting to see if they would develop tell-tale symptoms. The Committee would like to salute each and every one of them for their courage and commitment.

21. Epilogue

“In our drive to technology in the 1980s and 1990s, we forgot the basics.”

—Dr. Bill Sibbald, Physician in Chief, Sunnybrook and Women’s.

We were fortunate that the SARS virus is biologically handicapped. At least in the vast majority of cases, it requires prolonged, close contact to make the short jump from one human being to another. SARS has been contained, at least temporarily—not by the genomic revolution, not by advanced pharmaceuticals, but by old-fashioned public health measures like hand washing, infection control procedures, isolation of cases, and tracing and quarantine of contacts.

What the SARS outbreak showed, perhaps more than anything else, is the power of public health. The best current evidence is that without effective public health measures, SARS would have eventually sickened millions of people on this shrinking planet, causing not hundreds of deaths, but countless thousands. The next outbreak, however, may be even more insidious than SARS. Canada may have to deal with a deadly airborne virus, or a virus transmitted via droplets but with such a long incubation period that quarantine would be worthless. Will we be ready?