

5

Brief History of the Global SARS Outbreak of 2002–03

An epidemic unfolds before the global society

Severe Acute Respiratory Syndrome (SARS) was the first severe infectious disease to emerge in the twenty-first century. SARS was also a global epidemic that unfolded with an unprecedented amount of global attention. Even with the war in Iraq taking place during the early phases of the global response, SARS gained significant press and media coverage for weeks. The global community witnessed a world-wide health threat unfold and could watch and follow closely how national and international public health authorities grappled with the outbreak. The surgical mask, worn by citizens of SARS-affected areas, became a global symbol of the threat and the fear that SARS triggered.

This chapter does not attempt a comprehensive history of the SARS outbreak, because such an undertaking would itself produce a book. Rather, this chapter provides a brief narrative history of the SARS outbreak to highlight the key moments, episodes, and developments. My objective is to give the reader a general sense of what happened during the outbreak. This sense will help the reader follow the arguments in Chapters 6–8 more effectively.

Sometime before November 2002: Animal to human, Guangdong Province?

The question on many minds, not least the epidemiologists and public health experts struggling to contain SARS, was: From where did SARS come? Over the course of the outbreak, epidemiological guesses about SARS' origin were made. Although, at the time of this writing, none of the guesses had been definitively proved, the leading hypothesis is that

the SARS virus was transmitted from an animal species to humans somewhere in Guangdong Province, China.

Species-jumping pathogens are nothing new in the world of public health. Many of the great disease scourges of human history began when viruses or bacteria were transmitted from animal hosts to human populations. Tuberculosis is, for example, believed to have jumped from animals to humans during the process of human domestication of livestock. Many experts also think that HIV/AIDS originated in simian or primate species before jumping into humans sometime in the twentieth century.

The eventual identification of Guangdong Province as the origin of the species-jumping SARS virus also came as no great surprise for epidemiologists. The southern region of China has long been considered a particularly potent microbial incubator. Guangdong Province is, for example, 'famous for its "wet markets," where a bewildering variety of live fauna are offered for sale (sometimes illegally) for the medicinal properties or culinary potential. The opportunity for contact, not only with farmed animals but also with a variety of otherwise rare or uncommon wild animals, is enormous' (Breiman *et al.*, 2003, p. 1038). This region of China is also important to global surveillance efforts on influenza because of the role experts believe the region's animal-human milieu plays in nurturing strains of the influenza virus.

The southeast Asian region had also been the location of two previous scary but ultimately limited viral outbreaks – the H5N1 avian influenza outbreak in Hong Kong in 1997 and the Nipah virus outbreak in 1998–99 in Malaysia. The H5N1 virus spread from birds to humans, and the Nipah virus spread from pigs to people. Because neither the H5N1 virus nor the Nipah virus developed efficient human-to-human transmission, the outbreaks remained limited in scope and impact. The H5N1 and Nipah viruses constituted, however, warnings that species-jumping viruses were jumping and potentially dangerous. Public health experts have kept an eye on southern China and southeast Asia as a possible, if not the probable, source of the long-anticipated, killer pandemic influenza virus.

In late May 2003, WHO (2003j-2) reported that researchers in Hong Kong and Shenzhen, China announced they had detected several viruses closely related genetically to the SARS virus in two wild animal species, the masked palm civet and the raccoon-dog. The researchers also found antibodies to the SARS virus in another wild animal species, the Chinese ferret badger (WHO, 2003j-2). According to WHO (2003j-2), '[t]hese and other wild animals are traditionally considered delicacies

and are sold for human consumption in markets throughout southern China.’

These studies prompted researchers to posit in June 2003 ‘that the earliest cases of SARS, in Guangdong Province, China, may have had contact, during slaughter or due to proximity to so-called “wet” markets, with certain wild animals species consumed as delicacies in southern China’ (WHO, 2003u-2). At the time of this writing, scientists still had not proved or disproved these hypotheses about the origin of SARS. As WHO (2003u-2) argued in June 2003, ‘[a]dditional studies are urgently needed before any firm conclusions can be reached. Answers to these questions will also greatly assist predictions of the future evolution of SARS.’

November 2002 to February 2003: Outbreak in Guangdong Province

Public health officials are fairly confident, however, that, from a yet to be identified source, the SARS virus emerged in human populations in Guangdong Province sometime prior to or during November 2002. During this month a mysterious outbreak of an atypical respiratory disease occurred. The first SARS case ‘is thought to have occurred in Foshan, a city southwest of Guangzhou in Guangdong Province, in mid-November 2002’ (Huang, 2003, p. 65). Provincial health authorities and the Ministry of Health in Beijing were aware of, and had investigated, the outbreak in Guangdong Province by the end of January 2003 (Huang, 2003, pp. 65–6). The health authority for Guangdong Province issued a report on cases of atypical pneumonia in the Province on 23 January, but this report was not circulated widely and was not shared with WHO (SARS Expert Committee, 2003, p. 195). The reports written after these investigations were ‘top secret’ under Chinese law, making any public reporting or discussion of the outbreak a violation of state secrecy laws (Huang, 2003, p. 66). Despite efforts by local and central government officials to suppress news and information about the outbreak, word of the disease problem gradually emerged in an ever-widening arc, propelled by the Internet (Pottinger and Buckman, 2003). Some of the information getting out indicated that, by January 2003, the outbreak in Guangdong Province was causing panic in the population (Pomfret and Goodman, 2003).

WHO’s Global Outbreak Alert and Response Network (Global Network) had picked up information about an influenza outbreak in mainland China on 27 November 2002, but the report was never translated into

English at WHO (National Advisory Committee, 2003, p. 24). Further, this early information was full of 'noise' because it did not, at that time, clearly point to an outbreak of an unusual respiratory disease. Early WHO efforts to peg the outbreak focused on influenza or a possible re-emergence of the H5N1 virus (Chase *et al.*, 2003; Stein, 2003f).

The amount of information WHO's Global Network collected about disease problems in southern China increased through early February (Stein, 2003f). According to the *Washington Post*, awareness of the outbreak in Guangdong Province rose to new levels in the days following a mobile phone text message, sent on 8 February, that read: 'There is a fatal flu in Guangzhou' (Pomfret, 2003r). Mobile phone users re-sent this message 40 million times on 8 February, 41 million times on 9 February, and 45 million times on 10 February (Pomfret, 2003r). The same news spread rapidly through e-mail and Internet chat rooms in China and beyond (Pomfret, 2003r). Despite government restrictions on publishing information, journalists in Guangzhou printed stories about the outbreak from 9–11 February (Garrett, 2003). On 10 February, local media published, for example, a circular that 'acknowledged the presence of the disease and listed some preventive measures, including improving ventilation, using vinegar fumes to disinfect the air, and washing hands frequently' (Huang, 2003, p. 67).

On 10 February, ProMED-mail, a leading non-governmental global electronic reporting system for outbreaks of emerging infectious diseases, posted one such e-mail message asking about an epidemic in Guangzhou being linked, in Internet chat rooms, to hospital closings and fatalities (ProMED-mail, 2003). Also on 10 February, the WHO office in Beijing received an alarming e-mail message from the son of a former WHO employee in China, which the office passed along to Dr David Heymann, WHO's Executive Director of Communicable Diseases: 'Am wondering if you have information on the strange contagious disease... which has already left more than 100 people dead. The outbreak is not allowed to be made known to the public... but people are already aware... and there is a "panic" attitude' (Piller, 2003).

WHO made its first official approach to the Chinese government for information on 10 February. On 11 February, the Chinese government made its first report to WHO, notifying the Organization 'of an outbreak of acute respiratory syndrome with 300 cases and five deaths in Guangdong Province' (WHO, 2003c). On the same day, 'Guangdong health officials finally broke the silence by holding press conferences about the disease' (Huang, 2003, p. 67), at which such officials 'informed the public that the situation was under control' (SARS Expert Committee,

2003, p. 196). On 12 February, WHO (2003d) stated that the Chinese Ministry of Health had reported 305 cases and five deaths of acute respiratory syndrome from 16 November 2002 until 9 February 2003. The Chinese Ministry of Health also reported that cases were recorded in six municipalities in Guangdong Province – Foshan, Guanzhou, Heyuan, Jiangmen, Shenzhen, and Zhongshan – but that no new cases had been reported in the past week in three municipalities (Foshan, Heyuan, and Zhongshan) and the number of cases was decreasing in the other three (Guangzhou, Jiangmen, and Shenzhen) (WHO, 2003d). China’s communications to WHO clearly indicated that the outbreak was under control and declining. Perhaps this position explains why China declined WHO’s offers of assistance to address the outbreak (Pottinger *et al.*, 2003).

By 14 February, China had reported that it had ruled out influenza, anthrax, pulmonary plague, leptospirosis, and haemorrhagic fevers as the source of the respiratory outbreak in Guangdong Province (WHO, 2003d; WHO, 2003e). Into this environment came reports of a possible outbreak of avian influenza in Hong Kong. On 19 February, WHO (2003f) reported that the H5N1 virus had been isolated from a nine-year-old boy from Hong Kong who had traveled to Fujian Province, China in January with his mother and his sisters. The boy’s father was admitted to hospital in Hong Kong on 11 February and the boy was admitted on 12 February (SARS Expert Committee, 2003, p. 197). The boy recovered from this illness, as did his mother, but one sister and the father died of illness on 4 February and 17 February, respectively (WHO, 2003f; SARS Expert Committee, 2003, p. 197). On 19 February, WHO noted that it did not know whether the boy’s family members who fell ill had been infected by the H5N1 virus. WHO put its Global Influenza Surveillance Network on alert (WHO, 2003f). On 20 February, WHO (2003g) disclosed that the father who died on 17 February had been infected by the H5N1 virus.

These cases of avian influenza raised the question of whether the outbreak of atypical respiratory disease in Guangdong Province was caused by the H5N1 virus. The Chinese Ministry of Health informed WHO on 20 February, however, that the probable causative agent of the Guangdong outbreak was *Chlamydia pneumoniae* (WHO, 2003h). Government officials imposed another blackout on reporting news of the outbreak on 23 February (Huang, 2003, p. 67). By 27 February, WHO (2003i) reported that the Chinese Ministry of Health had declared the outbreak in Guangdong Province over and that no evidence existed to link the Guangdong situation with the H5N1 cases in Hong Kong. As late as 7 March, however, WHO still had not completely excluded the H5N1

virus as the cause of the Guangdong outbreak (SARS Expert Committee, 2003, p. 201).

February 2003: Guangdong, Hong Kong, Hanoi

In mid-February 2003, Dr Liu Jianlun, a professor of nephrology at Zhongshan University in Guangzhou, Guangdong Province, had been treating patients suffering from atypical pneumonia at a hospital in Guangdong Province (Pottinger, 2003a). On 21 February, despite feeling feverish, Dr Liu arrived in Hong Kong to attend his nephew's wedding (Pottinger, 2003a; SARS Expert Committee, 2003, p. 198; National Advisory Committee, 2003, p. 24). Dr Liu stayed on the ninth floor, Room 911, of the Metropole Hotel in Hong Kong for one night (WHO, 2003e-1; Pottinger, 2003a; SARS Expert Committee, 2003, p. 198). Dr Liu was admitted to a Hong Kong hospital on 22 February with severe pneumonia, and he died on 4 March (SARS Expert Committee, 2003, p. 18). Experts believe that Dr Liu was infected with SARS-CoV and that, during his brief stay on the ninth floor of the Metropole Hotel, he communicated the virus to at least 16 other guests and visitors to the same floor of the hotel, including a resident of Hong Kong, an American national with business interests in Vietnam, Singaporean nationals, and two Canadian nationals (WHO, 2003e-1; WHO 2003g-3; Pottinger, 2003a). The seeds of a global epidemic were planted on the ninth floor of the Metropole Hotel.

The American businessman who stayed on the ninth floor of the Metropole Hotel at the same time as Dr Liu, Johnny Chen, traveled to Hanoi, Vietnam after finishing his visit to Hong Kong. Mr Chen fell ill in Hanoi in late February 2003 (Cohen, Fritsch, and Pottinger, 2003). He was taken to the Hanoi French Hospital, where his condition worsened. Dr Olivier Cattin, a physician at the Hanoi French Hospital, wondered whether Mr Chen's severe respiratory illness could be avian influenza connected to the outbreaks of the H5N1 virus he had heard about in Hong Kong earlier in the month (Cohen, Naik, and Pottinger, 2003). Mr Chen had come to Hanoi from Hong Kong.

Dr Cattin consulted with Dr Carlo Urbani, a WHO epidemiologist in Hanoi. Dr Urbani is credited with being the first to identify that the illness affecting Mr Chen was a new disease syndrome (WHO, 2003w). Dr Urbani made this diagnosis on 28 February (Cohen, Naik, and Pottinger, 2003). Dr Urbani's worries about Mr Chen's ailment escalated as hospital staff at the Hanoi French Hospital began falling ill with

symptoms that mirrored the mysterious respiratory condition affecting Mr Chen (WHO, 2003l).

March 2003: A world-wide health threat

Dr Urbani's 28 February diagnosis of an unknown severe respiratory syndrome proved the trigger for a cascade of events that led WHO to take drastic action. As more staff at the Hanoi French Hospital fell ill, Dr Urbani communicated his concerns about Mr Chen's illness and the apparent spread of the syndrome among hospital staff to the Vietnamese government and his WHO colleagues. Difficult and heated talks with Vietnamese government officials on 9 March led to Vietnam agreeing to take the aggressive measures prescribed by Urbani and his WHO colleagues for the situation in Hanoi (Cohen, Naik, and Pottinger, 2003; Nakashima, 2003b). By 10 March, approximately 20 staff at the Hanoi French Hospital had become ill with the same syndrome Dr Urbani diagnosed in Mr Chen (WHO, 2003j). Dr Urbani told Dr Klaus Stöhr, a WHO influenza specialist, that 'we're losing control of the hospital' (Cohen, Naik, and Pottinger, 2003). Dr Urbani's actions helped prime WHO for the events about to break upon the Organization and the world.

Alarm bells at WHO began ringing loudly on 12 March when Hong Kong reported an outbreak of a severe respiratory illness at one of its public hospitals (WHO, 2003j; SARS Expert Committee, 2003, p. 203). Hong Kong's hospital authority had noticed that an unusually high number of medical staff at the Prince of Wales Hospital were not reporting to work because of suffering from a flu-like illness (Cohen, Naik, and Pottinger, 2003). By 12 March, the situation was severe enough for Hong Kong's health director to call WHO (Cohen, Naik, and Pottinger, 2003). WHO faced the possibility that the Guangdong, Hanoi, and Hong Kong outbreaks were connected. If these outbreaks were related, WHO would be facing a severe new respiratory disease that had already demonstrated cross-border mobility.

On 12 March, WHO issued a global alert about cases of atypical pneumonia (WHO, 2003j). The decision proved difficult for many reasons, including the unprecedented nature of the decision. WHO's Mike Ryan remembered: 'We wondered: "Are we mad? Are we going to panic the world?"' (Cohen, Naik, and Pottinger, 2003). In the alert, WHO disclosed the hospital outbreaks in Hanoi and Hong Kong and provided a description of the symptoms the illness appeared to present in patients. WHO recommended that medical staff isolate patients with atypical

pneumonia who may be connected to the Hanoi or Hong Kong outbreaks through barrier nursing techniques. WHO also recommended that any suspect cases be reported to national authorities. The global alert sought to raise the level of epidemiological awareness around the world given the unknown nature and scope of the new severe respiratory syndrome.

The global alert on 12 March was carefully worded to avoid linking the Guangdong, Hanoi, and Hong Kong outbreaks. The alert stated, for example, that 'no link has been found between these [Hong Kong] cases and the outbreak in Hanoi' (WHO, 2003j). The careful wording could not hide WHO's concern that these three outbreaks were related. WHO wanted to express this concern without making statements the epidemiological data could not yet support. The alert began: 'Since mid-February, WHO has been actively working to confirm reports of outbreaks of a severe form of pneumonia in Vietnam, Hong Kong Special Administrative Region (SAR), China, and Guangdong Province in China' (WHO, 2003j).

In the days immediately following the global alert of 12 March, WHO began receiving reports of cases of severe atypical respiratory illnesses from multiple countries. By 15 March, WHO received information on more than 150 new suspected cases of atypical pneumonia for which a cause had not been identified from Canada, China, Hong Kong, Indonesia, the Philippines, Singapore, and Vietnam (WHO, 2003k). Although the reports of such cases to WHO indicated that the 12 March global alert had increased awareness around the world about possible cases of unusual respiratory illnesses, the reports also provided evidence that an international outbreak was underway.

In the early morning hours of 15 March, Singapore urgently notified WHO of a Singaporean physician with symptoms of atypical pneumonia on board a flight from New York to Singapore, with a stop-over in Frankfurt, Germany (WHO, 2003b, p. 3). WHO worked with German officials to remove the physician and accompanying family members, who were immediately isolated and given hospital care (WHO, 2003b, p. 3).

Later on 15 March, in light of these developments, and after difficult discussions among its infectious disease experts, WHO issued another global alert, this time in the form of an emergency travel advisory (WHO, 2003k). This decision was riskier politically than the 12 March global alert because it linked the spread of the mysterious syndrome with air travel, making the 15 March alert 'a decision that would have huge implications for world business and tourism' (Cohen, Naik, and

Pottinger, 2003). Given the lack of much information about the syndrome and its characteristics, some of WHO's infectious disease experts worried about the impact on WHO if the emergency travel advisory proved a mistake or an over-reaction (Cohen, Naik, and Pottinger, 2003). Eventually, the arguments in favor of issuing the emergency travel advisory carried the day.

By this point, WHO was certain that the new illness was not influenza (Chase *et al.*, 2003). In this alert, WHO gave the new illness a name – Severe Acute Respiratory Syndrome, or SARS. WHO Director-General Gro Harlem Brundtland stated in the alert that '[t]his syndrome, SARS[,] is now a worldwide health threat. The world needs to work together to find its cause, cure the sick, and stop its spread' (WHO, 2003k).

The 15 March global alert made no recommendations that people restrict their travel to any destination reporting SARS cases. WHO provided, however, information on the symptoms and signs of SARS to assist travelers, airlines, physicians, and governments. The global alert described the removal and subsequent isolation of the Singaporean physician and family members on the flight from New York to Frankfurt. Although air travel was clearly playing a role in spreading SARS, WHO's emergency guidance to travelers and airlines did not expressly address the possibility that SARS may be transmitted during flights. The global alert repeated WHO's recommendations that patients with suspected cases of SARS be isolated with barrier infection-control techniques and treated clinically as indicated and that all suspect cases be reported to national health authorities.

WHO now had the task of leading and coordinating the investigation and containment of an international epidemic of a new respiratory syndrome. A central function of WHO's responsibility for this task was acting as a clearing-house for surveillance data on SARS and for information on the best public health and clinical approaches to containing the syndrome and treating those afflicted. On 16 March, WHO (2003l) issued the first of many updates on the multi-country outbreak of SARS, as the Organization quickly took the lead on SARS surveillance and response efforts.

The 16 March update reported what WHO had learned about the epidemiology of SARS. The causative agent was not known, and the syndrome appeared to be transmissible from person-to-person through aerosol and/or droplet means as well as through bodily fluids. WHO reported that the majority of SARS cases to date had occurred in individuals who had very close contact with persons already infected with SARS, such as health care personnel and family members. Over 90 per cent

of SARS cases had occurred in health care workers. The 16 March update provided those handling SARS cases with more technical guidance for this task. It contained Internet jump links to two documents: (1) Hospital Infection Control Guidance for Severe Acute Respiratory Syndrome (SARS); and (2) Management of Severe Acute Respiratory Syndrome (SARS). WHO would continue to revise this technical guidance as the epidemiology of SARS became better understood.

The 16 March update also contained information about the status of the SARS outbreak in the countries believed affected. Table 5.1 summarizes this initial data. From this date forward, WHO posted on its website a daily summary of reported cases of SARS.

Conspicuously missing from the list of countries reporting suspected cases of SARS was China. As noted earlier, suspicions about the possible link between the Guangdong outbreak of November 2002–February 2003 and the various outbreaks now categorized as SARS had been strong. In connection to China, the 16 March update tersely stated: ‘An epidemic of atypical pneumonia had previously been reported by the Chinese government starting in November 2002 in Guangdong Province. This epidemic is reported to be under control’ (WHO, 2003l).

On 17 March, WHO (2003m) reported that China had issued a report summarizing ‘an outbreak of what may be the same or a related disease that began in Guangdong Province in November and peaked in mid-February.’ This summary report did not, apparently, provide any updated information because it only included data on the diagnosis and management of the 300 cases reported by China in February. WHO also reported on 17 March that China had requested help from an

Table 5.1 SARS outbreak data as of 15 March 2003

<i>Country</i>	<i>Suspected cases</i>	<i>Deaths</i>
Vietnam (Hanoi)	43	2
Hong Kong	100	1
Singapore	16	0
Thailand	1	0
Canada	7	2
Philippines	1*	0
Indonesia	1*	0
Germany	1*	0

Note: *Unconfirmed case

Source: WHO 2003l

international team and that WHO was assembling the requested assistance (WHO, 2003m; Carrns *et al.*, 2003).

With health authorities around the world alerted to the SARS threat, and with reporting of cases from around the world happening, for the most part, openly and rapidly, WHO moved to ramp up the scientific and epidemiological investigation of SARS. Through its Global Network, WHO began on 17 March to coordinate a global scientific effort involving eleven laboratories in 10 countries to identify the pathogen causing SARS (WHO, 2003m; Stein, 2003a). This unprecedented scientific collaboration sought to locate the causative agent for SARS and filter that basic scientific research into the development of diagnostic technologies for SARS.

This global scientific effort produced preliminary findings, which WHO released on 18 March, that suggested that the causative agent behind SARS was a virus from the paramyxoviridae family (WHO, 2003n; Stein, 2003b). Viruses in this family are often associated with respiratory infections and include the mumps and measles viruses. The paramyxoviridae family also includes the Nipah virus, which emerged in Malaysia in 1998 causing 265 deaths (WHO, 2003o). The Nipah virus did not, however, establish human-to-human transmission (WHO, 2003o). The causative agent of SARS had established such transmission between persons with the syndrome and those in very close contact with them, such as health care personnel and family members. Whatever was causing SARS was, thus, more dangerous to global public health than the Nipah virus but not yet exhibiting the more potent human-to-human transmissibility of viruses such as influenza or smallpox. WHO stressed, however, that preliminary scientific findings suggesting a paramyxovirus did not represent definitive success in locating the SARS pathogen (WHO, 2003o).

WHO continued building global networks to help with the response to SARS. To its Global Network for surveillance and response and its global SARS laboratory network, WHO instituted an unprecedented global network of clinicians to share information and experiences on the diagnosis and treatment of SARS (WHO, 2003p). WHO (2003p) reported on 20 March that the 'network brings together, via two daily teleconferences, clinicians in the most heavily affected Asian countries and in Europe and North America.' These global 'electronic grand rounds' (Stein, 2003c) were designed to disseminate globally and rapidly best practices on SARS diagnosis and treatment as an integral element of the overall effort to contain the spread of SARS and the suffering it inflicted on the infected (WHO, 2003p). The WHO official in charge of the effort, Mark Salter, told the *Washington Post* that '[t]he WHO has never

brought together this many clinicians with such rapidity. It's ground-breaking' (Stein, 2003c).

Efforts to trace the origins of the multi-country outbreak were also bearing some fruit. On 20 March, WHO (2003p) reported the release of Hong Kong's investigation of the 'index' case of the SARS outbreak in Hong Kong. Hong Kong's index case was an acquaintance of Dr Liu Jianlun, the professor-physician from Guangdong Province, who met with Dr Liu in the Metropole Hotel during Dr Liu's February stay in Hong Kong (WHO, 2003p). Johnny Chen, the American businessman who contracted SARS while at the Metropole and who sparked the outbreak in Hanoi, also was the source for the outbreak in Hong Kong's Princess Margaret Hospital, to which Mr Chen had transferred from Hanoi (WHO, 2003e-1).

In addition, the Hong Kong epidemiologists found the source of SARS infection in other people – three from Singapore and two from Canada – connected to the Metropole Hotel and Dr Liu (WHO, 2003p). Singapore's initial report of SARS cases on 13 March involved the three persons who returned to Singapore after visiting Hong Kong and staying at the Metropole Hotel (WHO, 2003i). Canada's initial cluster of cases was traced back to the two Canadians who stayed at the Metropole Hotel in Hong Kong (WHO, 2003p). All were individuals who either stayed on, or visited, the ninth floor of the Metropole Hotel between 12 February and 2 March (WHO, 2003p).

These investigations began to give the multi-country outbreaks of SARS an epidemiological profile that pointed directly at Guangdong Province in China. The index cases for the SARS outbreaks in Hong Kong, Vietnam, Canada, and Singapore all traced back to a Chinese medical professional from Guangdong Province who traveled to Hong Kong with a fever after treating patients suffering from serious atypical pneumonia. The suspected connection between the Guangdong outbreak and the SARS epidemic now began to solidify.

As WHO (2003q) stated on 21 March, '[t]he outbreak in southern China is linked geographically and by timing to the current outbreak of Severe Acute Respiratory Syndrome (SARS) which first surfaced in Asia in mid-February and caused its first known death on 13 March.' Said WHO's Meirion Evans on 27 March about the link between the Guangdong and SARS outbreaks: 'Everything we've seen so far indicates it's the same disease' (Wonacott, Borsuk, and Cohen, 2003).

The importance of China to the global efforts on SARS increased. A WHO team left for China after 21 March to assist Chinese authorities with their investigation of the Guangdong outbreak (WHO, 2003q).

That same day, the *Washington Post* reported statements from Chinese doctors challenging the government's claims that the outbreak of atypical pneumonia had been contained in Guangdong Province (Pomfret and Goodman, 2003). The initial meetings between the WHO team and Chinese health officials on 24 March did not go well (Cohen, Naik, and Pottinger, 2003). On 25 March, the *Washington Post* reported that WHO officials in Beijing were indicating that information they had been given was insufficient and were pressing Chinese officials for more information (Pomfret, 2003a).

WHO's global laboratory network continued to function productively, achieving isolation of the virus causing SARS and making progress on the development of diagnostic technologies (WHO, 2003r). Although scientists had not yet agreed what kind of virus they had isolated, WHO officials working on the epidemic were heartened by the nature and speed of the global scientific collaboration. The pace of the scientific effort revealed not only how far microbiology had come since HIV emerged in the early 1980s but also the spirit of global collaboration exhibited in the effort (Chase *et al.*, 2003). James Hughes, director of the CDC's National Center for Infectious Diseases, noted that the global collaboration of the scientific laboratories was 'historic. The laboratories around the world – which at other times might be competing with each other to be first to sort this out – are sharing all their information on a daily basis as it's developing, and that's why we're able to make as rapid progress as we have made' (Chase *et al.*, 2003).

Further progress was made as the global scientific network rapidly zeroed in on the identity of the culprit virus. On 26 March, WHO (2003t) indicated that researchers were increasingly focusing on the coronavirus family. The next day, WHO (2003u) reported that data produced by the global scientific network pointed to a coronavirus as the causative pathogen for SARS (SARS-CoV). WHO epidemiologist Klaus Stöhr described SARS-CoV as 'unlike any known human or animal member of the virus family' (WHO, 2003u).

As March began to draw to a close, the global response to SARS appeared to be off to a good start. The *Washington Post* opined that '[t]he international response has been better than many expected, reflecting a number of positive changes within the World Health Organization over the past decade' (*Washington Post*, 2003a). WHO had taken rapid and unprecedented actions that had produced encouraging results in terms of surveillance, response, epidemiological findings, and basic scientific research. Former CDC Director Jeffrey Koplan complimented WHO by observing 'here's a group that acted forcefully and quickly'

(Cohen, Naik, and Pottinger, 2003). Further, compared to the highly efficient person-to-person transmissibility of influenza, the SARS outbreak was, according to WHO, 'not rampaging' (Pottinger and Buckman, 2003). All was not well, however, in the global campaign against SARS. At least three problems confronted the effort.

First, SARS outbreaks continued to grow in virtually all the countries in which SARS-CoV had established a foothold and a chain of human-to-human transmission. Thus, the outbreaks in Hong Kong, Singapore, and Canada grew larger as March progressed. Only Vietnam appeared to have contained its SARS problem during March. On 29 March, WHO (2003w) reported that '[t]he number of cases in Vietnam remained at 58 for the sixth day in a row, indicating that the outbreak in Hanoi is well-controlled.'

The continued growth of the epidemics in Hong Kong, Singapore, and Canada meant that public health authorities had not yet been successful at breaking the chain of human-to-human transmission. Although epidemiological data still indicated that very close contact with a person with SARS was required for transmission, some developments suggested that transmission outside health care facilities may become a problem. Fear of SARS transmission on aircraft grew during March, fueled by reports that people had contracted SARS while passengers on aircraft (Pottinger, 2003b; Stein and Brown, 2003). WHO (2003s) addressed these concerns on 25 March, when it reported information from Hong Kong about passengers on a Beijing tour who had developed atypical pneumonia. WHO (2003s) commented that, '[a]s "close" contact is possible during a flight, in passengers sitting close to an infected person, such transmission cannot be ruled out. The evidence to date indicates that in-flight transmission is very unusual.'

A second transmission scare happened in Hong Kong at the end of March when Hong Kong authorities issued unprecedented isolation orders against residents of the Amoy Gardens apartment building (Pomfret and Weiss, 2003). The isolation orders sought to break a chain of SARS transmission in Amoy Gardens, a transmission pattern in the community different from the dominant health care transmission setting. Eventually the Amoy Gardens outbreak affected 329 residents with 42 deaths (SARS Expert Committee, 2003, p. 40). Both this episode and the concerns about SARS transmission on aircraft suggested that more work on SARS' epidemiology was needed, despite the progress that had been rapidly made. Neither of these developments persuaded WHO, however, to change its position that travel to, and travel from, SARS-affected areas was not dangerous.

The second problem confronting the global effort against SARS at the end of March was the syndrome's continued international spread. By the end of March, WHO was receiving reports of SARS cases from 13 countries (WHO, 2003x). Although WHO's global alerts and recommendations helped most countries prevent onward transmission of imported SARS cases, WHO remained concerned about international travel as a means of spreading SARS. Of significant concern for WHO was the prospect of SARS importation into developing countries that did not have very strong public health systems. On 20 March, WHO (2003p) noted that '[u]p to now, all imported cases have occurred in countries well-equipped and well-prepared to institute WHO-recommended precautions, including isolation and barrier nursing practices, for preventing spread to others, whether healthcare workers or family members.' This circumstance positively affected the SARS response to date. But even these well-equipped and well-prepared countries were struggling to contain SARS transmission. WHO was concerned about the potential impact on global SARS efforts if human-to-human transmission of SARS got underway in poor, less well-prepared nations.

Evidence of WHO's growing concerns about SARS spreading through international travel came on 27 March, when WHO issued new recommendations to prevent travel-related spread of SARS (Pomfret, 2003c). WHO (2003u) recommended that authorities in areas experiencing human-to-human transmission of SARS institute the screening of air passengers departing the affected areas in flights to other countries. As of 27 March, these recommendations affected only four countries – Hong Kong, Singapore, Vietnam, and Canada; but WHO's issuance of the recommendations demonstrated WHO's growing concern about international travel spreading SARS from countries that had not yet broken the chain of human-to-human transmission.

The third major problem for the WHO-led global SARS effort was China. Although the epidemiological link between the Guangdong outbreak and the SARS outbreak was strong, China did not provide WHO with updated data on the Guangdong outbreak between its initial report on 10 February and 25 March. On 26 March, China reported to WHO new figures in the November–February outbreak in Guangdong Province – 792 cases and 31 deaths from an atypical pneumonia (WHO, 2003o; Pomfret, 2003b). The WHO team invited to help the Chinese government concluded that the atypical pneumonia cases reported were cases of SARS, but Chinese officials 'seemed wedded to the notion

that the outbreak was caused by a rare respiratory strain of Chlamydia bacteria' (Cohen, Naik, and Pottinger, 2003). The new Chinese data only covered a period from 16 November 2002 until 28 February 2003. At this point, it was the end of March; and WHO had no data from China for nearly a month, a month in which SARS had become a world-wide health threat.

With the Guangdong outbreak now definitely identified as SARS, China became the country with the largest number of reported cases. The initial task was to update Chinese data for March and get China to improve its surveillance and reporting for SARS. WHO needed to know whether, as China claimed, the Guangdong outbreak had been controlled and was over, or whether Guangdong Province and perhaps other areas of China were 'hot zones' for SARS.

As March wound down, some signs of improved Chinese cooperation appeared. China notified WHO of SARS cases outside Guangdong Province as of 26 March: ten cases and three deaths in Beijing and four cases with no deaths in Shanxi (WHO, 2003u). China pledged to improve its reporting system (WHO, 2003t), contribute to the global scientific effort to identify the causative agent of SARS (WHO, 2003t), participate in the global network on SARS diagnosis and treatment (WHO, 2003v), provide WHO access to Chinese medical records on SARS cases (WHO, 2003v), enhance surveillance in Beijing, gear up laboratory capability, set up a public hotline, and to continue contact tracing (WHO, 2003x). These steps were victories for WHO, 'which has walked a fine line between trying to pressure China for more information and encouraging cooperation' (Pomfret, 2003d).

Ominously, however, the request of the WHO team in Beijing to travel to Guangdong Province to investigate the outbreak there had not been approved by the end of March. WHO officials told the Chinese that '[i]f SARS is not under control in China, there would be little chance of controlling the global threat of the disease' (Cohen, Naik, and Pottinger, 2003). WHO (2003x) diplomatically noted in the final SARS update of March 2003 that '[d]iscussions concerning a visit by the [WHO] expert team to Guangdong Province are continuing with the Ministry of Health.'

On 29 March, Dr Carlo Urbani, the WHO epidemiologist in Hanoi who first identified SARS and helped alert WHO of this new threat, died from his SARS infection (Stein, 2003f). His death was a particularly painful reminder to those still fighting SARS that, by the end of March, the global effort had reached not the beginning of the end of the struggle, but only the end of the beginning.

April 2003: The crisis deepens

On 1 April 2003, WHO (2003y) reported that it had received notifications of 1804 cases of SARS with 62 deaths from 15 countries. On the last day of April 2003, the numbers had risen to 5663 cases with 372 deaths reported from 26 countries (WHO, 2003t-1). For the global SARS campaign, April was the cruelest month. But, it was also the campaign's finest hour.

The deepening of the SARS crisis in April can be attributed to three factors: (1) problems created by continuing questions about the epidemiology of SARS and its causative agent; (2) the threat posed to international travel by SARS 'hot zones'; and (3) the behavior of the country at the epicenter of the global outbreak, China. Led by WHO, the global effort against SARS had to confront each of these major problems during April; and, in two of these cases, WHO faced decisions unprecedented in its history of fighting infectious diseases.

In terms of the epidemiology of SARS, April 2003 witnessed the definitive scientific demonstration that the new coronavirus identified in March was indeed the causative agent of SARS. On 16 April, WHO (2003k-1) announced that its global network of collaborating laboratories had finished putting the identified coronavirus through the tests known as 'Koch's postulates,' which epidemiologists believe provide the definitive tests for whether a microbial agent causes disease. The final steps – introducing the coronavirus into animal hosts, which subsequently develop the disease – confirmed scientifically what experts had begun to suspect when the global laboratory network first identified the new coronavirus. WHO was excited about these developments and noted that the 'astounding pace' of scientific research on SARS-CoV strengthens the global effort against the syndrome by providing key information and tools scientists could use in creating technologies for SARS prevention and control (WHO, 2003k-1).

Despite the accomplishment of identifying the new coronavirus and confirming it as the causative agent of SARS, the global SARS effort confronted difficult epidemiological challenges that indicated that much of how SARS-CoV caused illness in humans and spread in populations was not clear. Although the lack of such knowledge was hardly surprising given how recently the outbreak began, the questions meant that WHO and others battling the spread of SARS often did not have answers for pressing questions.

A key quest, undertaken by the global network of scientific laboratories, was to develop diagnostic technologies that would allow public

health officials and health care workers to identify with more precision people infected with SARS-CoV. More precise diagnostics would allow more discriminating and effective public health and health care responses. As WHO (2003l-1) argued, '[w]ithout a more reliable diagnostic tool, hospital staff confronted with a suspect SARS case have no option other than to isolate patients and manage them according to strict infection control practices as precautionary measures. Such measures are stressful for patients and place a considerable stain on health services.' But, as WHO (2003g-1) noted on 11 April, '[t]he development of a diagnostic test has proved more problematic than hoped.' Each of the three tests developed, to that point, had significant shortcomings.

The ELISA test provided reliable results but only after the onset of clinical symptoms of SARS, meaning that the test could not be used to detect cases at an earlier stage before infected persons had a chance to spread the virus (WHO, 2003g-1). The immunofluorescence assay (IFA) test gave results earlier in a SARS infection but was a slow test requiring the growth of SARS-CoV in cell culture (WHO, 2003g-1). The PCR molecular test proved useful for even earlier stages of a SARS infection but unfortunately produced many false-negatives, making it unreliable as a diagnostic tool (WHO, 2003g-1). In the absence of good diagnostic technologies, diagnosis of SARS remained focused on clinical symptoms, history of the infected (especially recent travel history), and chest X-rays (WHO, 2003g-1). At the end of April 2003, WHO (2003q-1) strongly advised national authorities 'to continue to base decisions concerning what constitutes a suspect and a probable case of SARS on the present clinical and epidemiological case definition, and not to rely on the results of diagnostic tests.'

A second set of epidemiological questions that plagued the global SARS effort in April 2003 revolved around the transmission of SARS-CoV. Although WHO knew that intimate contact with SARS patients was a primary means of transmission of the disease, WHO was concerned that, in some areas, such as Hong Kong and Canada, SARS continued to spread both within health care settings and in the community despite the use of strict patient isolation and infection-control techniques (WHO, 2003g-1). In connection with Hong Kong, the SARS outbreak at the Amoy Gardens apartment complex demonstrated that spread of SARS-CoV in the community from an environmental source could efficiently occur (WHO, 2003n-1). Further, data indicated that infections connected to the Amoy Gardens outbreak were more serious than non-Amoy infections, raising questions of whether the Amoy Gardens cases 'represent infection with high virus loads, as might occur following

exposure to a concentrated environmental source, or whether the virus may have mutated into a more virulent form' (WHO, 2003n-1).

In connection with Canada, WHO (2003n-1) expressed concern about suspect and probable SARS cases related to a charismatic religious group, the health care workers who treated them, and close family and social contacts. WHO (2003n-1) noted that this 'outbreak is particularly disturbing because of its potential to move into the wider community.' Questions surrounding this Canadian outbreak connected to speculation that some of the worst situations involving SARS stem from so-called 'super-spreaders.'

WHO (2003f-1) raised the 'super-spreader' concept on 9 April in discussing the outbreak in Singapore. WHO (2003h-1) traced SARS outbreaks at two Singaporean hospitals to a single 'super-spreader'. WHO (2003f-1) defined a super-spreader as 'a source case who has, for as yet unknown reasons, infected a large number of persons.' WHO (2003g-1) noted that '[i]t remains unknown whether such "super-spreaders" are persons secreting an exceptionally high amount of infectious material or whether some other factor, perhaps in the environment, is working to amplify transmission at some key phase of virus shedding.' Cautioning that SARS transmission patterns remain only partly understood, WHO (2003f-1) commented that 'evidence suggests that such "super-spreaders" may have contributed to the evolution of SARS outbreaks around the world.'

Skepticism emerged, however, about the 'super-spreader' concept (Saywell, 2003). The main reasons for the skepticism involved the lack of scientific evidence for the phenomenon and the existence of alternative, more plausible explanations for high infection rates being associated with individual cases. The most plausible alternative was that the 'super-spreader' phenomenon had less to do with a particular individual shedding virus at especially high rates and more to do with the non-application or misapplication of infection control techniques at critical times. As WHO (2003j-1) commented on 15 April, 'when SARS was just becoming known as a severe new disease, many patients were thought to be suffering from atypical pneumonia having another cause, and were therefore not treated as special cases requiring special precautions of isolation and infection control Since infection control measures have been put in place, the number of new cases of SARS arising from a single SARS source case has been significantly reduced.'

The diagnostic and 'super-spreader' problems illustrate that the global campaign against SARS was operating in April 2003 under serious constraints involving a lack of basic information about the epidemiology

of SARS and appropriate technologies to guide more precise and effective interventions. The continued growth of the SARS outbreak, both within most SARS-affected countries and through international travel, exacerbated the difficulties WHO and its collaborating partners faced in getting SARS under control.

The second major factor deepening the SARS crisis in April 2003 concerned the spread of SARS through international travel. At the beginning of April, WHO's Hitoshi Oshitani stated that SARS was 'the most significant outbreak that has been spread through air travel in history' (Pomfret, 2003e). Until the beginning of April 2003, WHO had not recommended that travelers postpone travel to SARS-affected areas, maintaining that outbreaks were confined to specific settings, such as health care facilities, and were not threats to public health in the community. As SARS continued to spread within SARS 'hot zones,' such as Hong Kong and Guangdong Province, WHO became more and more concerned about travelers visiting these destinations, contracting SARS, and spreading it to their countries of origin upon their return home. WHO's worries on this issue became so severe that it took actions unprecedented in the history of the Organization.

At the end of March 2003, as mentioned above, WHO (2003u) recommended that airport authorities in SARS-affected areas screen passengers leaving for other countries for potential symptoms of SARS. These recommendations were indications of WHO's growing fears about the spread of SARS through international travel. On 3 April, WHO (2003z) issued recommendations 'that persons traveling to Hong Kong and Guangdong Province of China consider postponing non-essential travel.' According to WHO (2003a-1), '[t]he new travel advisory is intended to limit the spread of SARS by reducing travel to high risk areas.' As WHO (2003b-1) noted, '[t]his is the first time in the history of WHO that such travel advice has been issued for specific geographical areas because of an outbreak of an infectious disease.'

As the outbreak at the Amoy Gardens suggested, WHO had been growing increasingly concerned about the pattern of SARS transmission in Hong Kong; and evidence developed at the beginning of April that heightened WHO's worries. WHO partly based its decision to recommend that non-essential travel to Hong Kong be postponed because, 'since March 19, nine travellers have been identified as SARS cases on returning from a visit to Hong Kong Special Administrative Region of China' (WHO, 2003a-1). WHO (2003b-1) observed that '[t]he data on these cases, and what is known about the incubation period of SARS, indicate that travel to Hong Kong can contribute to the international spread of SARS.'

In terms of the travel recommendations against non-essential travel to Guangdong Province, WHO (2003a-1) emphasized that its decision was influenced by '[n]ew information provided today [2 April 2003] by [Chinese] provincial authorities of more than 300 new cases in March alone [, which] indicates the outbreak there continues.' WHO (2003b-1) also focused on the fact that the outbreak in Guangdong Province 'has also shown evidence of spread in the wider community' and spread across international borders. WHO (2003g-1) also justified its advisory on Guangdong Province by asserting that the 'recommendations were made for Guangdong as maximum security against spread of SARS outside of Guangdong in the absence of a complete understanding of transmission patterns of the outbreak there.' As with Hong Kong, WHO perceived that the 'hot zone' in Guangdong Province was sufficiently dangerous to warrant advising non-essential travelers to avoid the province until the outbreak was under control.

Prior to WHO's recommendations against non-essential travel to Hong Kong and Guangdong Province, national governments, such as Canada and the United States, had issued travel advisories encouraging their nationals to postpone non-essential travel to SARS-affected areas (Stein, 2003d; Stein and Brown, 2003). For example, on 29 March, the CDC warned US nationals against unnecessary travel to all of China, Singapore, Hanoi and Hong Kong (Stein, 2003e). Until 2 April, such national-level recommendations did not accord with WHO's advice on travel to these locations.

The issuance of such travel advisories by national governments did not constitute, however, radical acts of sovereign governments. WHO's actions with respect to travel to Hong Kong and Guangdong Province were radical steps for the Organization. As illustrated by complaints from the Chinese government about the travel advisories (Pomfret, 2003f), WHO did not issue the recommendations with the express permission of China. WHO's decisions represented, therefore, independent acts that carried potentially adverse economic consequences for Hong Kong and Guangdong Province. In the travel advisories, WHO wielded considerable authority and power *vis-à-vis* Hong Kong and Guangdong Province.

An indication of the deepening SARS crisis in April 2003 is the further issuance of travel advisories against two other SARS 'hot zones' toward the end of April. On 23 April, WHO (2003p-1) extended its recommendations against non-essential travel to Beijing and Shanxi Province in China and Toronto, Canada. WHO based these decisions on the following criteria: 'the magnitude of the outbreak, including both the number of

prevalent cases and the daily number of new cases, the extent of local chains of transmission, and evidence that travellers are becoming infected while in one area and then subsequently exporting the disease elsewhere' (WHO, 2003p-1). WHO asserted that the 'travel advice is issued in order to protect public health and reduce opportunities for further international spread' (WHO, 2003p-1).

The power of WHO travel advisories, and the controversy they could provoke, both became apparent in the reaction of the Canadian government to the advisory against Toronto: 'the reaction of Canadian officials was swift and angry, with politicians and public health officials from multiple levels of government travelling to Geneva to provide documentation that Toronto's outbreak was under control and to request that WHO remove the travel advisory' (National Advisory Committee, 2003, p. 202). Both provincial and federal governments in Canada criticized the WHO travel advisory as unwarranted in connection with Toronto (Heinzl and Chipello, 2003). Business and economic leaders in the Toronto community also complained that the travel advisory would further damage the tourism industry, which was already reeling from the SARS outbreak in Toronto (Heinzl and Chipello, 2003). As Health Canada's National Advisory Committee on SARS and Public Health later argued, 'the economic and social impact of such [travel] advisories can be devastating' and 'the effects of the travel advisories have been profound on the economies of targeted countries' (National Advisory Committee, 2003, pp. 37, 202). To the growing SARS problem, WHO now had to deal with Canadian anger and determination to have the travel advisory against Toronto lifted (Brown, 2003a).

Although WHO originally stated that its travel advisory against Toronto would be re-evaluated in three weeks (WHO, 2003p-1; Brown, 2003b), or twice the incubation period for SARS, WHO lifted its travel advisory against Toronto six days later, on 29 April (WHO, 2003s-1), after intense criticism and lobbying by the Canadian government (Brown, 2003c; Heinzl, 2003). WHO (2003s-1) cited four reasons for changing its mind about travel to the Canadian SARS 'hot zone': (1) the number of probable SARS cases in Toronto decreased in the week since the travel advisory was issued; (2) 20 days had passed since the last cases of SARS transmission in the community occurred; (3) no new confirmed cases of SARS exportation from Toronto had occurred; and (4) Canadian assurances that Canada would implement the pro-active passenger screening measures at airports recommended by WHO on 27 March. The WHO about-face on the Toronto travel advisory raised questions about whether politics played any role in the issuance and removal of

the advisory (Frank, 2003), and such questions could only make WHO's job of controlling the worsening global SARS outbreak more difficult in the near future.

The third major reason why April witnessed a deepening of the SARS crisis was the behavior of China. As indicated earlier, March 2003 ended with mixed signals from China about the SARS outbreak. On the one hand, China promised to participate more actively in the WHO-led global campaign to control SARS. On the other hand, China was still behaving in ways that suggested it was not being entirely forthright about what was happening within its territory, as illustrated by the fact that the WHO team in Beijing had not been permitted, at the end of March, to visit Guangdong Province.

A pattern of ostensibly increasing Chinese cooperation appeared at the beginning of April 2003. On 1 April, the spokesman for the Chinese Foreign Ministry stated that '[t]he Chinese government has not covered up. There is no need. We have nothing to hide' (Wonacott, McKay, and Hamilton, 2003). On the same day that the WHO (2003b-1) issued its travel advisories against Hong Kong and Guangdong Province (2 April), China provided new data on the outbreak in Guangdong Province to cover the month of March. This new data pushed China's number of SARS cases to 1153, with 40 deaths, as of 31 March (WHO, 2003b-1). In addition to releasing new data on SARS in Guangdong Province, China approved the WHO team's visit to Guangdong to investigate the SARS outbreak there (WHO, 2003b-1). On 3 April, the Chinese Minister of Health announced on television that Beijing had only 12 cases of SARS and that the outbreak in China was under control (Cohen, Naik, and Pottinger, 2003). The same day China published a booklet entitled 'SARS is Nothing to Be Afraid Of' (Hiatt, 2003). On 4 April, China began submitting daily electronic reports to WHO on the SARS outbreak in its territory (WHO, 2003c-1).

Also on 4 April, the head of China's Center for Disease Control publicly apologized 'for failing to inform the public about a sometime fatal respiratory illness that has infected more than 2,000 people worldwide,' a statement that 'was unprecedented for a government that almost never acknowledges mistakes' (Pomfret, 2003g). The statement also contradicted earlier comments of Chinese government officials, such as the Minister of Health's statements on 3 April, that China had handled the outbreak properly (Pomfret, 2003g). WHO (2003d-1) praised China's decisions to put in place a system of alert and response for detection and reporting of all emerging and epidemic-prone diseases and to hold daily press conferences.

Events soon proved these Chinese moves toward cooperation and contrition to be duplicitous. The report of the WHO team that investigated the SARS outbreak in Guangdong Province praised the response of the provincial authorities but warned that other areas of China, such as Beijing, seemed much less prepared should SARS spread more widely in China (WHO, 2003f-1). On 7 April, China was reporting that Beijing had only 19 SARS cases (Pottinger and Hutzler, 2003) and four SARS-related deaths (WHO, 2003d-1). Doubts about this report from Beijing surfaced prominently when a staff member of the International Labour Organization (ILO), in Beijing for an ILO meeting, died of SARS in Beijing on 6 April (Pomfret, 2003h). WHO (2003d-1) noted on 7 April: 'At present it is unclear how the staff member contracted SARS. He had travelled to Beijing via Thailand, where no local transmission has been reported.' To explain the death of the ILO staff member, either the SARS situation in Thailand or Beijing had to be worse than was being reported to WHO. Although the Chinese Ministry of Health argued that the ILO staff member contracted SARS on a flight from Bangkok to Beijing (thus pointing the finger at Thailand as the source of the SARS infection), Chinese health officials did not try to track down other passengers on the same flight to check for other possible SARS infections (Hutzler, 2003a).

WHO's concerns about a SARS outbreak in Beijing intensified. On 9 April, news broke that a prominent Chinese doctor and Communist Party member, Jiang Yanyong, publicly accused the Chinese government of covering up the extent of the SARS outbreak in Beijing (Pomfret, 2003i). He argued that the actual number of SARS cases in Beijing was several times higher than what the government was reporting and that he and his colleagues were incredulous to hear the Chinese health minister saying on television (on 3 April) that the outbreak was under control (Pomfret, 2003i). Although Jiang originally sent his accusations against the government by e-mail to China Central Broadcasting and Phoenix Television based in Hong Kong, Jiang's bombshell made its impact after *Time Magazine* posted Jiang's e-mail on its web site, after which 'Time's report and a large number of other articles from the Western press were translated and sent to e-mail boxes all over China' (Pomfret, 2003r).

On 10 April, WHO asked the Chinese government if it could investigate the outbreak in Beijing to evaluate the validity of reports that the Beijing outbreak was much larger than China was reporting (Hutzler, 2003a). Henk Bekedam, head of WHO's office in Beijing, said on 10 April that '[t]here are various rumors right now, and we're not getting

clear answers' (Pomfret, 2003i). On 11 April, WHO (2003g-1) diplomatically reported that '[p]articular concern centres on the situation in Beijing. Yesterday, WHO deepened discussions with Beijing health authorities, particularly concerning the efficiency of systems for case reporting and contact tracing.'

WHO (2003h-1) reported on 12 April that the Beijing Health Bureau invited a WHO team to visit health facilities in the city and to review generally the SARS outbreak in Beijing. On 14 April, the *Wall Street Journal* reported that Chinese officials were 'only slowly granting access' to the WHO investigating team, 'raising concerns about whether further outbreaks of the flu-like illness can be controlled worldwide without the full cooperation of China' (*Wall Street Journal*, 2003a). Also on 14 April, WHO (2003i-1) noted that authorities in Beijing 'have not granted WHO experts permission to visit military hospitals, which have been the focus of numerous rumors.'

Both news reports and WHO statements contained information on 15 April that China's government was beginning to understand the gravity of the concerns connected to the SARS outbreak in Beijing specifically and China generally. The *Wall Street Journal* reported on 15 April that 'China's government, publicly acknowledging that the spread of SARS poses serious risks for the country, is sounding its most urgent note yet about the pneumonia, as the number of new infections rose sharply' (Hutzler, 2003b). Chinese Premier Wen Jiabao warned that SARS could affect China's economy, international image, and social stability (Pomfret, 2003j). In keeping with this sense of heightened urgency coming from the Chinese government, WHO (2003j-1) announced on 15 April that '[t]he WHO team of experts in Beijing was today granted permission to visit military hospitals' and described this decision as 'a welcome indication of China's willingness to come to terms with the SARS outbreak on the mainland.'

Subsequent events revealed, however, that the new commitment and cooperative spirit shown by the Chinese government was, yet again, a charade. The *Washington Post* reported on 16 April that Chinese physicians accused government officials of 'significantly underreporting both the incidence of severe acute respiratory syndrome in China's capital and the role Beijing plays as a new source of the disease's spread' (Pomfret, 2003k). The *Washington Post* added that the reason for the cover-up in Beijing was fear that WHO would issue travel advisories against Beijing, as it had for Hong Kong and Guangdong Province, if the true number of SARS cases in the city were reported (Pomfret, 2003k). The WHO team in Beijing indicated that it was still not receiving full

information from Beijing government officials about the SARS situation (Pomfret, 2003k). Unofficial information provided by local doctors about China's official underreporting of SARS cases around the country also began to increase (Jakes, 2003), bolstering the view that China was continuing to try to cover up the epidemic.

By this point in the SARS outbreak, China's role in the epidemic had become clear; and, as the epicenter of the SARS outbreak, WHO and others working on the global SARS effort knew that effective Chinese action on SARS was critical to containing this new disease's global potential. Yet, by 15 April, repeated attempts to hide the full scale of the outbreak marred China's cooperation in the global campaign against SARS. China's behavior was deepening the SARS crisis because the key to containing the global outbreak of SARS was controlling SARS-CoV in China. Foreign reporters in China were also starting to chastise WHO for not confronting China's cover-up (Cohen, Naik, and Pottinger, 2003). How this situation unfolded would shape the fight against SARS and its prospects for success.

In an unprecedented move, WHO went on the offensive against China. On 16 April, the *Washington Post* reported the following:

The World Health Organization said today that China is underreporting cases of the SARS virus and maintains secret military files that make it impossible to control and monitor the spread of the disease in the Chinese capital. WHO researchers, speaking in unusually blunt language, said at a news conference that the government has misled the public about the spread of severe acute respiratory syndrome, or SARS. Officials said the number of patients infected with the virus in Beijing could be 200, more than five times what the government has acknowledged. 'We have very clearly said you have an international community over here that does not trust your figures,' said Henk Bekedam, head of the office of the World Health Organization in Beijing. (Pomfret, 2003l)

WHO estimated that Beijing had as many as 200 SARS cases even though government officials had only reported 37 cases (WHO, 2003m-1; Pomfret, 2003m). The *Wall Street Journal* referred to these WHO statements as the delivery of 'a humiliating public rebuke to Beijing officials for downplaying the extent of the disease' (Pottinger, 2003c).

At its press conference, WHO's criticism extended beyond the Beijing situation because WHO stated that it had not 'received sufficient information to determine the scale of the outbreak in China, the

epicenter of the mysterious new disease' (Wonacott, Lawrence, and Pottinger, 2003). Further, WHO even expressed concern about China's overall approach to public health. WHO's Henk Bekeidam indicated that 'he was concerned that unless China allocated more money for public health, poor people would not be able to pay for treatment if they contract SARS. "We do believe that the government has not invested in health in the last 30 years," he said. "The government has left it to the people to pay for health care and who among the poor will be able to afford treatment?"' (Pomfret, 2003l).

Typically, WHO refrains from publicly criticizing its member states because such criticism puts the intergovernmental organization in a difficult position in its work with member governments. WHO's public criticism of the Chinese government represented a radical break with the traditional diplomacy that characterizes relations between the Organization and member states. Such a radical move by WHO underscores the urgency with which it viewed the deepening SARS crisis. The sweeping nature of the criticism from WHO, which involved the Beijing situation, the outbreak in China generally, and the Chinese government's neglect of public health, was also breathtaking. These actions by WHO suggest that the Organization concluded that 'business as usual' with the Chinese government was not going to provide a sufficiently robust response to bring SARS under control in China and, thus, reduce the threat SARS in China would pose to other countries. As with the issuance of the travel advisories earlier in the month, WHO's public criticism of China was a bold act in its effort to lead the global campaign against SARS.

WHO's boldness was rewarded with a transformation of Chinese policy on SARS. But this transformation did not occur without the help of one final, embarrassing incident for the Chinese government. On 16 April, Chinese officials allowed the WHO's experts to begin visiting military and other hospitals in the Beijing area (WHO, 2003l-1). As later reported in *Time*, 'hospital officials removed dozens of SARS patients from their isolation wards and transferred them to locations where they could not be observed by the inspectors' (Jakes, 2003). On 18 April, *Time* published an exposé of the Chinese government's attempts to hoodwink WHO personnel (Jakes, 2003). With information provided by doctors and medical staff at hospitals subject to WHO visits, *Time* revealed a large-scale effort to hide the size of the SARS outbreak in Beijing from WHO through the transfer of dozens of SARS patients out of hospitals to facilities not visited by WHO (Jakes, 2003). 'These actions,' observed the *Washington Post*, '... mark the most egregious in

a series of steps taken by the Chinese government to cover up the extent of the epidemic' (Pomfret, 2003n).

On 18 April, the leaders of China's Communist Party 'declared a nationwide war on the SARS virus and ordered officials to stop covering up the extent of the epidemic that is spreading throughout China' (Pomfret, 2003m). According to WHO (2003m-1), China's Communist Party leaders demanded accurate, timely, and honest reporting of SARS cases, called SARS a serious threat to the country's reforms, development, and stability, and warned that Party and government officials would be held accountable for the SARS situation in their respective jurisdictions.

On 20 April, the Communist Party removed the Minister of Health and mayor of Beijing from their Party posts for their role in covering up the SARS epidemic in China (Pomfret, 2003o). The Chinese government also increased, on 20 April, the number of confirmed SARS cases in Beijing from 37 to 346, 'a tacit acknowledgement that it had previously lied about the toll' (Pomfret, 2003o). On 21 April, China reported another 109 SARS cases in Beijing (WHO, 2003o-1); and the Secretary of Beijing's Communist Party issued an apology for the mishandling of the epidemic (Pomfret, 2003p). Also on 21 April, the Chinese government cancelled the traditional week-long May Day holiday to prevent hundreds of thousands of people from traveling throughout the country and contributing to the spread of SARS (WHO, 2003o-1; Pomfret, 2003p). Toward the end of April, China also closed movie theaters, discos, Internet bars, public libraries, and churches; quarantined thousands of people and dozens of hospitals; and fired two more high-ranking officials for failing to handle SARS appropriately (Pomfret, 2003q). These, and subsequent actions by the Chinese government, demonstrated that China had finally stopped trying to cover up the SARS epidemic and had moved to mount a vigorous nation-wide response to SARS, working closely with WHO and other elements of the global SARS effort.

As noted earlier, WHO (2003p-1) issued travel advisories against Beijing and Shanxi Province on 23 April because of the magnitude of the outbreaks in those areas, the extent of local chains of transmission, and evidence that travelers were becoming infected while in those areas and then exporting the disease elsewhere. China was now subject to four WHO travel advisories – for Hong Kong, Guangdong Province, Beijing, and Shanxi Province – an indication of the overall seriousness of the SARS problem in China, the danger of local transmission, and the threat China's SARS situation posed for international travel and the public health in other countries.

With improved reporting from the Chinese government, WHO noted at the end of April 2003 that SARS cases had been reported in 21 of China's 31 provinces (WHO, 2003s-1) and that China's 3460 probable SARS cases accounted for more cases than the rest of the world combined (WHO, 2003t-1). Although the Chinese government appeared to have changed its behavior significantly by the end of April, precious time and opportunities to bring China's SARS outbreak under control had been lost in April. Whether WHO's boldness in challenging China's behavior, and China's subsequent policy reversal, would allow the global campaign to contain the SARS epicenter in China remained worryingly unclear as April 2003 came to a close.

May 2003: Turning the corner

During May 2003, the global SARS outbreak continued to grow. On 1 May, WHO (2003u-1) reported a cumulative total of 5865 probable SARS cases with 391 deaths involving 27 countries. On 29 May, WHO (2003m-2) reported a cumulative total of 8295 cases with 750 deaths from 28 countries. Unlike the growth of the epidemic in April, the May increase in SARS cases and deaths did not represent a deepening of the SARS crisis. In fact, developments during the course of May indicated that the global effort to bring SARS under control was beginning to turn the corner on bringing the outbreak under control. WHO's Mike Ryan captured the mood in mid-May when he said that the message to take away from the progress achieved to date was 'one of celebration that the measures are working, but also a call to action because we've got a lot more to do yet before we end this problem' (Stein, 2003h).

The most visible signs of progress came from most of the original SARS 'hot zones' – Guangdong Province, Hong Kong, Singapore, and Vietnam. Each of these SARS-affected areas experienced significant progress from late April until the end of May in handling their SARS outbreaks. WHO announced on 28 April that Vietnam had become the first country to succeed in containing the SARS epidemic when Vietnam detected no new SARS cases for 20 days (WHO, 2003r-1; Nakashima, 2003a).

Singapore's success in controlling its outbreak during May was evident when WHO (2003n-2) removed Singapore on 31 May from the list of areas with recent local transmission of SARS. Singapore was initially scheduled to be removed from the list of SARS-affected areas on 11 May; but, on that date, Singapore reported a new case of SARS to WHO, an indication of Singapore's commitment to open reporting and cooperation with WHO (WHO, 2003n-2).

Progress was also apparent in connection with three of the hottest 'hot zones' – Hong Kong, Guangdong Province, and Toronto. As noted above, WHO lifted the travel advisories for Toronto on 30 April. On 14 May, WHO (2003b-2) dropped Toronto from its list of areas experiencing local SARS transmission. WHO (2003i-2) lifted the advisories for Hong Kong and Guangdong Province on 23 May because 'the situation in these areas has now improved significantly.' The health authorities in Hong Kong and Guangdong Province succeeded during May in reducing the number of new cases and the extent of local transmission and in preventing exported cases (WHO, 2003i-2).

The examples of Vietnam, Singapore, Toronto, Hong Kong, and Guangdong Province underscored WHO's comments in its 13 May SARS update that '[e]xperiences in a growing number of countries indicate that the disease can be contained, thus supporting WHO's overall objective: to prevent SARS from becoming widely established as another new disease in humans' (WHO, 2003a-2). Supporting the approach being taken against SARS was the failure of new 'hot zones' to develop despite the SARS virus spreading to 28 countries by the end of May. Many countries reported a small number of cases of SARS; but, except for one country (Taiwan), these cases did not develop into epidemics within those countries because of appropriate surveillance and response activities implemented by public health officials. WHO noted, for example, that only one case of SARS transmission had occurred on European soil during the outbreak (Richburg, 2003).

The progress made in the SARS 'hot zones' and the success in keeping SARS under control in most countries into which the SARS virus was imported occurred, by and large, without the global SARS campaign gaining any new technological weapons developed from scientific research or benefiting directly from breakthroughs in scientific knowledge about SARS. In May 2003, WHO revised its SARS case definition 'to take into account the appropriate use of results from laboratory tests'; but WHO continued to warn against the inappropriate use of diagnostic tests in connection with dealing with suspected SARS cases because all such available tests have weaknesses (WHO, 2003u-1).

The global SARS efforts witnessed the development of more scientific and epidemiological knowledge about SARS, including studies on the environmental survivability of SARS-CoV (WHO, 2003w-1; WHO, 2003c-2), the overall case fatality rate (WHO, 2003x-1), the incubation period of SARS-CoV (WHO, 2003x-1), risk of SARS transmission during air travel (WHO, 2003e-2; WHO, 2003h-2), and the presence of SARS-CoV in wild animals in southern China (WHO, 2003j-2). Experts

discussed many of these topics at the first global consultation on SARS epidemiology held at WHO headquarters in Geneva on 16–17 May (WHO, 2003d-2). These scientific endeavors did not, however, change WHO's recommended surveillance and response approaches to SARS cases, including 'the earliest possible isolation of all suspect and probable cases of SARS' (WHO, 2003x-1).

Although significant progress was seen in the original SARS 'hot zones' and in new countries of SARS importation, the global SARS effort continued to face difficult challenges in May 2003. Foremost among these challenges was the continuing struggle to contain SARS in China. As WHO (2003u-1) stated on 1 May, '[t]he next few months will prove crucial in the attempt to contain SARS worldwide, which now greatly depends on whether the disease can be controlled in China.' Evidence of the difficulty of this task can be found in the travel advisories WHO issued against the following Chinese provinces during May 2003: Tianjin, Inner Mongolia, and Hebei (WHO, 2003y-1; WHO, 2003d-2). Thus, at the end of May, four Chinese provinces and Beijing were subject to WHO advisories recommending that non-essential travel to these areas be postponed. These advisories meant that WHO had concluded that the number of new cases of SARS, extent of local transmission, and threat of SARS exportation remained significant in these areas.

Questions remained, and cropped up, about Chinese-generated data during May 2003, as illustrated by the puzzlement WHO officials expressed at the end of May concerning China's reports of very low numbers of new cases and deaths related to SARS (Chen *et al.*, 2003). In addition, tensions between China and WHO flared at the end of May when the Deputy Minister of Health, Gao Qiang, argued at a news conference on 30 May that the Chinese government had not concealed the outbreak and claimed that its February notifications to WHO alerted the world to the problem (Cherney and Chang, 2003). According to journalist Laurie Garret (2003), WHO 'went ballistic' and sternly warned China that '[i]f you're going to try and tell us that you were not lying before, . . . we are going to have to pull our office out of Beijing. We can't work with you anymore.' WHO's response prompted Gao to reappear a few days later to recant his 30 May claims, ending what could have been a much more serious crisis. Despite these questions and tension, neither WHO nor news reports indicated that China's government was backtracking on its commitment to fight SARS vigorously. As the *Wall Street Journal* put it, 'China is as good at fighting SARS as at hiding it' (Chen, 2003).

China, now more forcefully assisted by WHO and other international partners, faced not only the epidemiological challenge of SARS but also the high level of distrust and anxiety China's attempt to cover up the epidemic had caused in the Chinese population. China's more rigorous response to containing the epidemic, which including improved surveillance activities, heightened infection control procedures in health care facilities dealing with SARS cases, closing schools, and instituting large-scale quarantines, began to show some positive, if tentative, effects by mid-May.

The *Wall Street Journal* reported on 13 May the declining number of daily cases China was notifying but quoted epidemiologists as arguing that it was too soon to read much into such declines (Chang, 2003a). Interestingly, on the same day, China's leaders again demanded that government officials provide full and immediate data on the outbreak (Pomfret, 2003s). Although WHO still had concerns about the lack of full information from China's military, it 'praised China for beginning to take the disease seriously but cautioned that the epidemic had not begun to fade' (Pomfret, 2003s; Chang, 2003b).

In addition to the ongoing struggle in China, the global SARS effort had to deal with some new problems in May 2003. WHO added Mongolia (WHO, 2003u-1) and the Philippines (WHO, 2003x-1) to the list of areas experiencing recent local transmission of SARS in early May, suggesting that SARS was making inroads into two countries not previously considered problem areas. Fortunately, WHO removed both Mongolia and the Philippines from its list of SARS-affected areas later in the month, demonstrating that these countries had brought local transmission of SARS under control (WHO, 2003z-1; WHO, 2003f-2).

The most troubling new problem to arise in May was the SARS outbreak in Taiwan. Although Taiwan had been on WHO's initial list of SARS-affected areas in late March, the epidemic in Taiwan worsened in late April and early May. On 2 May, the *Wall Street Journal* observed that '[o]utside of mainland China, Taiwan's SARS outbreak is now the fastest moving in all of Asia' (Regalado and Dean, 2003). WHO (2003v-1) reported on 3 May that '[t]he spread of SARS in Taiwan has accelerated considerably during the past week.' With the permission of China, a WHO team began to provide assistance to Taiwan in early May as the Taiwanese outbreak grew (WHO, 2003v-1). On 8 May, WHO issued a travel advisory against Taipei (WHO, 2003y-1); and, on 21 May, WHO extended the advisory to cover all of Taiwan, indicating that WHO believed that the magnitude of the outbreak in Taiwan, the extent of local transmission on the island, and the potential for exportation of

SARS were significantly high for the entire territory of Taiwan (WHO, 2003g-2).

Vigorous action by the Taiwanese authorities, assisted by WHO, began to show results even before the month of May ended. On 28 May, WHO (2003l-2) reported that the latest notification of new cases from Taiwan marked 'the continuation of a downward trend that became apparent earlier in the week' and opined that Taiwan was 'now much closer to bringing SARS under control.' The progress made in the Taiwanese SARS outbreak continued to confirm the effectiveness of the surveillance and response approaches the global SARS campaign had developed, refined, and implemented in many different jurisdictions.

By the end of May 2003, the ongoing SARS outbreaks in China and Taiwan were more than sufficient to keep the global SARS campaign from becoming complacent about the threat SARS posed. The re-emergence of local transmission of SARS in Toronto at the end of May highlighted the continuing danger SARS-CoV posed and the need for vigilance on the part of public health officials and health care facilities (WHO, 2003k-2; Brown, 2003d). Infectious disease experts in the United States warned of resurgence of SARS in the winter months of late 2003 and early 2004 (Connolly, 2003). Fears remained about SARS spreading to 'the less-developed parts of Asia and Africa, which have far less effective health systems to identify and isolate cases, and vast populations especially vulnerable to new infections because of AIDS' (Stein, 2003g; Stein, 2003i).

The global SARS campaign received a significant boost at the annual World Health Assembly at the end of May 2003. The World Health Assembly – WHO's highest policy-making body – approved two resolutions that supported WHO's leadership on, and actions taken during, the SARS outbreak. In the resolution on SARS, the World Health Assembly described SARS as 'the first severe infectious disease to emerge in the twenty-first century' and recognized that SARS 'poses a serious threat to global health security, the livelihood of populations, the functioning of health systems, and the stability and growth of economies' (World Health Assembly, 2003a). The World Health Assembly acknowledged the need for intensive and urgent international collaboration and noted WHO's crucial role in leading the world-wide campaign to control and contain SARS. The SARS resolution also urged WHO member states to implement many of the lessons learned in the SARS effort, such as the importance of reporting cases promptly and transparently to WHO.

The resolution on the revision of the International Health Regulations (IHR) indicated that the SARS experience had confirmed the inadequacy of the existing IHR, urged WHO member states to support the IHR

revision process, and requested the WHO Director-General to continue to use non-governmental sources of information as part of global surveillance activities, to issue global health alerts about the presence of a public health threat that may constitute a serious threat to neighboring countries or to international health, and to collaborate with governments in assessing the severity of public health threats and the adequacy of response measures (World Health Assembly, 2003b). The IHR resolution paved the way for the actions taken and lessons learned in the SARS outbreak to form part of the governance responses to future infectious disease threats – a clear indication that the SARS outbreak was becoming more than a public health crisis and was beginning to serve as a model for future global public health policy.

June 2003: ‘Stopped dead in its tracks’

June 2003 opened with WHO recognizing further progress against SARS, indicating that the momentum generated in May continued strongly. On 4 June, WHO reported that no deaths from SARS had been reported, the first time since 28 March that no country reported any SARS-related fatalities (WHO, 2003o-2; Stein, 2003j). WHO (2003o-2) commented that, ‘[w]ith outbreaks in all the initial “hot zones” either contained or coming under control, SARS is clearly in decline, indicating that recommended control measures are effective when combined with political commitment and determination.’

The progress was particularly evident with respect to China, the SARS epicenter. Between 6 June and 9 June, China reported only one probable new case of SARS (WHO 2003p-2). WHO officials began a visit to China on 10 June ‘to learn which measures taken by China have so rapidly brought the country’s SARS outbreak – the largest in the world – under control’ (WHO, 2003q-2). More tangible evidence of China’s progress against SARS came on 13 June when WHO lifted its travel advisories against the Chinese provinces of Hebei, Inner Mongolia, Shanxi, and Tianjin and removed Guangdong, Hebei, Hubei, Inner Mongolia, Jilin, Jiangsu, Shaanxi, Shanxi, and Tianjin from the list of areas with recent local transmission (WHO, 2003s-2). These moves left Beijing as the last area in China on the list of areas with local SARS transmission and subject to a WHO travel advisory, and WHO removed Beijing from the local-transmission list and lifted this advisory on 24 June (WHO, 2003w-2). The progress made in China against SARS in May and June was nothing short of stunning.

Further evidence that SARS was in retreat came when WHO removed, on 23 June, Hong Kong – one of the original SARS ‘hot zones’ – from the list of areas experiencing local transmission (WHO, 2003v-2). By the end of June 2003, no countries remained subject to a WHO travel advisory and only Toronto and Taiwan remained on the list of areas experiencing local transmission of SARS. WHO removed Toronto from this list on July 2 (WHO, 2003z-2), and Taiwan on 5 July (WHO, 2003a-3).

On 17 June, WHO Director-General Gro Harlem Brundtland told the first global conference on SARS in Kuala Lumpur, Malaysia that, on the eve of the outbreak’s hundredth day, the world, in the face of ‘a new disease, striking a globalized society,’ has ‘seen unprecedented international solidarity against a shared microbial threat of unknown dimensions’ (Brundtland, 2003). She argued that the remarkable speed and sweep of the achievements of the global SARS efforts meant that ‘we have seen SARS stopped dead in its tracks in some of the worst affected areas’ (Brundtland, 2003). On 27 June, WHO declared that the world should be free of human SARS cases in two or three weeks (Reuters, 2003).

The effective end of the SARS outbreak in all countries during June 2003 meant that WHO began switching gears on SARS. As WHO (2003x-2) observed on 30 June, ‘[a]s no new cases of SARS have been reported anywhere in the world since 15 June, WHO is moving from an emergency response to a research-based agenda aimed at protecting the world against any future resurgence of SARS.’ During June, as the SARS outbreaks in all countries were brought under control, WHO repeatedly warned that political and public health vigilance continued to be vital against SARS (WHO, 2003o-2; WHO, 2003r-2; WHO, 2003t-2; WHO, 2003a-3). WHO (2003t-2) argued on 18 June that ‘[a]s long as a single case of SARS exists or is suspected anywhere in the world, and as long as fundamental questions about the origins of the virus remain unanswered, all countries need to remain on guard.’ On 5 July, WHO (2003a-3) warned that ‘SARS will continue to menace the global public health system.’

Stopping SARS ‘dead in its tracks’ less than four months after the appearance of this new virus and respiratory disease in the globalized world of the early twenty-first century will undoubtedly rank as one of the great success stories in the history of global public health efforts on infectious diseases, and the greatest achievement in this realm since the eradication of smallpox in the late 1970s. What this chapter’s brief history of the SARS outbreak does not adequately communicate, however, is the landmark significance of the SARS outbreak to governance of infectious diseases. The next two chapters explore this historic feature of the global SARS outbreak of 2002–03.