

INVESTIGATION 1

# SARS: First Pandemic of the Twenty-first Century

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Beware the threat of the spores, Bad news parcels bide their time.  
They lurk to enter the unsuspecting, and unleash dormant evil that multiplies.

SETU K. VORA, 'Threat of the Spores', *Emerging Infectious Diseases*,  
vol. 10, no. 4, April 2004 [www.cdc.gov/eid](http://www.cdc.gov/eid)

## INTRODUCTION

Infectious disease and related health concerns have rarely found a place in national security discourse in the past. Of late, the issue has assumed prominence and has been included in the national security debate. Disease spread poses a threat to human and national security. The entire gamut of human and public health concerns rests on the proposition that 'it could seriously threaten both the individual and quality of life that a person is able to attain within a given society, polity or state'.<sup>1</sup> The argument that the transnational spread of disease poses a threat to (human) security is validated by recent developments, such as the HIV/AIDS epidemic, the spread and virulence of emerging and re-emerging infectious diseases (ERID),<sup>2</sup> the threat of bio-terrorism and epidemics that weaken fragile state structures.<sup>3</sup>

The emergence of infectious diseases on the global agenda highlights the discovery of new disease agents, increasing antibiotic resistance and the devastating impact of epidemics—cholera in Latin America, plague in India, the Ebola virus in Africa,<sup>4</sup> and more recently, severe acute respiratory syndrome (SARS) which

transcended national boundaries and assumed the form of a global pandemic in 2003. This paper focuses on the outbreak of SARS as the first pandemic of the twenty-first century, reviews the causes and course of the disease and explores key lessons learnt from the outbreak that could shape the future of infectious disease control.

### THE OUTBREAK

The severe acute respiratory syndrome hit the world in a virulent form within three months of its outbreak in Foshan and Guangzhou of Guangdong province in South China as atypical pneumonia in mid-November 2002. Soon it spread to Vietnam and Hong Kong and from there it made its way to other parts of the world including most of the Southeast Asian countries. According to the World Health Organization's (WHO) latest estimation, it had afflicted 8,096 persons and had caused 774 deaths affecting at least 29 countries spread over five continents.<sup>5</sup> These 'vectors without borders' clearly demonstrated the potential hazards of unrestricted air travel and human mobility that transcends national boundaries and regions during the disease outbreak.

Although the initial cases of the disease affected more than 300 people and caused five deaths in Guangdong, the official report of the outbreak was received by the WHO after almost three months on 11 February 2003.<sup>6</sup> Subsequently, the new disease was named SARS and a new coronavirus<sup>7</sup> was identified as the causal agent after preliminary case definition was established. An analysis of the complete genome sequence of the SARS virus suggested that it is not closely related to any of the three previously identified coronavirus subfamilies, nor does it seem to have arisen through a chance genetic recombination between known coronaviruses. According to Malik Peiris, a virologist at the University of Hong Kong, its unique sequence suggests that it evolved independently from other members of the family, in some animal host, over a long time.

Before the WHO surveillance team could establish that the cases matched the definition of SARS, an infected doctor in Guangdong province triggered the spread of the virus in the ninth floor of the Metropole hotel in Hong Kong, where he had stayed,

and days later guests and visitors to that hotel had seeded a cluster of cases in the hospital systems of Hong Kong, Vietnam, Singapore, and even Canada, that became 'hot zones' within no time. The initial 'hot zones' were characterized by a rapid increase in the number of cases, primarily among health care workers and their close contacts. In Hong Kong, Canada and Vietnam, SARS first took root in hospital settings, where the staff exposed themselves to the infectious agent without taking adequate precautions. They were unaware that a new disease had surfaced. All these initial outbreaks were subsequently characterized by chains of secondary transmission outside the health care environment. Most of the infected doctors and health care workers who had treated the early cases, and foreign nationals, mainly tourists flew home or elsewhere, and acted as a vector of the deadly virus. Soon the whole world came under the grip of SARS which created panic among people and nations alike.

#### EPIDEMIOLOGY OF SARS

The earlier suspicions about the epidemiology of SARS are now better understood. The genesis of the SARS-CoV has been traced to wild civets and raccoon dogs that are considered culinary delicacies in southeastern China. At this stage domestic pigs and poultry do not appear to have been the hosts. Serologic data indicates that there had been previous infections of humans and animals in this region. In humans, who are infected with the virus, the incubation period varies from 5 to 15 days. This lag time allows these people to travel by air almost anywhere in the world after they have been exposed. Once it becomes symptomatic, the disease spreads by person-to-person contact. Most, but not all, cases arise from close contact with an infected person. However, details regarding transmission have yet to be analysed.

#### SARS, CHINA AND BEYOND

When SARS crossed the political boundaries of mainland China, it spread almost everywhere in the Asia Pacific. Its spread within the host country and its virulence varied, probably due to adequate

protective measures and climatic conditions. Among the 30 affected countries worldwide, China, Hong Kong, Taiwan, Canada and Vietnam bore the brunt of the SARS pandemic.

*China.* The origin of the disease was traced back to the Chinese mainland where sporadic cases of SARS have been reported till recently. Lately, three cases of SARS infection came to light after the containment of the disease since its outbreak in 2003. The first instance was reported on 5 January 2004 when Chinese health officials confirmed that a 32-year-old man had contracted SARS in southern Guangdong province. Immediately, China announced a plan to slaughter thousands of civet cats, believed to be the natural host of the SARS-CoV. Again, on 17 January, the health officials confirmed two new cases of infection in the same province. On 22 April 2004, the Chinese Ministry of Health informed the WHO that a nurse working in a Beijing hospital had contracted the virus fifteen days earlier and was in intensive care. Out of the 171 close contacts under medical observation, five suspected patients were isolated following fever.<sup>8</sup> China's Ministry of Health confirmed that a woman who had died in Anhui province had SARS—the first death from the illness in 2004. This confirmation brought the total number of confirmed SARS cases in China to five—two in Anhui, three in Beijing—with four more suspected cases in the capital.<sup>9</sup>

*Hong Kong.* The Special Administrative Region, Hong Kong (China) was the second most affected region, fatality-wise, and the city had more cases in proportion to its population than any other affected region. There were 1,755 reported cases and 299 deaths.<sup>10</sup> In Hong Kong, the first officially recognized outbreak of SARS occurred in the first week of March 2003 in the Prince of Wales Hospital.<sup>11</sup> Soon after more than 300 cases were reported from the Arnoy Gardens apartment block in Kowloon Bay and as per investigation reports the virus had spread through a sewage pipe. This was the only instance of an environmental transmission of SARS.<sup>12</sup>

Educational institutions were closed down in mid-March, and the economy was hit hard by a sharp decline in the inflow of

foreign tourists resulting in a substantial loss of foreign exchange earnings. In late May the infection rate dropped and the WHO lifted its warning against travel to Hong Kong. Although the Hong Kong authorities were criticized for their slow response and failure to quarantine the early cases, they swung into action thereafter to contain its horizontal spread.

*Taiwan.* The first case of SARS in Taiwan was reported on 18 March, but the outbreak really occurred in late April and early May 2003. When the total worldwide death toll was 229, Taiwan had only 29 probable cases without any fatality. At that time it was believed to be a minor outbreak as most of the cases were imported and local transmission was negligible. On 22 April, a new cluster of seven infections was reported in Heping Hospital in Taipei, leading to a number of local transmissions that culminated in 116 probable cases and 10 deaths within a fortnight.<sup>13</sup> The death toll reached 180 out of 665 reported cases by the time SARS completely subsided in Taiwan. According to the WHO, 90 per cent of the cases in Taiwan occurred in a hospital setting. The rapid spread of SARS in Taiwan was attributed to lack of experience in containing outbreaks, delayed expert assistance from the WHO along with poor health infrastructure, hospital mismanagement, and lack of seriousness on the part of the health authorities. The situation was exacerbated when more than 150 medics and para-medics including Taipei's top health official Chiu Shu-ti, resigned from their jobs as a protest against inadequate safeguards. On 5 July, Taiwan was the last country to be removed by the WHO from its list of SARS infected areas.

*Canada.* This is the only country outside Asia which witnessed severe outbreaks in two phases. The virus entered Canada via an infected woman who returned home from Hong Kong. Within a short span of time she transmitted the infection to five members of her family. On 5 March 2003, the woman died of SARS in Toronto followed by one of her sons. However, the failure to immediately identify the causative agent led to nosocomial transmission<sup>14</sup> in the Toronto area, extending to health workers at Scarborough Grace Hospital. The suspected and most of the

probable SARS cases identified in Toronto occurred within health care facilities. In small number of cases, the infection was due to household and community transmission, mostly after hospital visits.

However, quarantine measures instituted in late April seemed to have brought SARS under control. To the utter astonishment of the health authorities, the disease resurfaced a month later with a new cluster of cases in a hospital on the northern side of Toronto. On 23 May, the medical community realized that nosocomial transmission of SARS to patients and visitors had been occurring in a single ward of the North York General Hospital (NYGH) throughout April and early May.<sup>15</sup> A second phase of the outbreak (SARS II) was declared at the NYGH, and was designated as a level-3 institution, which implied that SARS had been transmitted through unprotected exposure.<sup>16</sup> Toronto became the first area to be taken off and then put back on the WHO's list of affected areas. On 2 July, the city was declared SARS-free by the WHO authorities; by that time SARS had infected 251 people and killed 41 of them.

*Singapore:* Like Canada, SARS spread to Singapore by an infected woman, Esther Mok, who returned home after staying on the ninth floor of the Metropole hotel in Hong Kong. Singapore reported 238 cases and 33 deaths. Unlike other affected regions, Singapore had adopted 'exemplary' and stringent measures to contain SARS, primarily by thermal imaging of air passengers to detect those who had high temperatures.<sup>17</sup> The health authorities even distributed digital thermometers to school students to enable them to check their temperature daily. Most importantly, the battle against SARS led to a drastic new legislation to punish those who might break the home quarantine orders or expose the community to the infection by other means of wilful action or sheer neglect. The law, an expansion of the scope of the Infectious Diseases Act, provides for severe fines and/or jail terms.<sup>18</sup> Despite all these measures, the disease resurfaced in Singapore in September when a researcher working in the Environmental Health Institute (EHI) Laboratory contracted SARS.<sup>19</sup> It was the first case of infection in Singapore since the WHO declared the country SARS-free on

31 May 2003. However, effective measures and readiness prevented the virus from creating havoc.

*Vietnam:* Vietnam has been praised as a model case in the fight against SARS; it was the first country to contain an outbreak of the deadly virus. The disease killed 5 people out of a total of 63 infected cases.

*Other SARS affected regions.* Although SARS reached the borders of the US, the UK, Spain, Sweden and even India, it proved fatal in at least four other countries. Malaysia, the Philippines, Thailand and South Africa reported SARS-related deaths, though not on the same scale as in Asia or North America. Malaysia reported five cases of SARS, including two deaths. The country was the first to impose travel restrictions after the first death occurred in early April 2003. The Philippines was declared SARS-free on 21 May but it reported fourteen cases and two deaths. Thailand's first celebrated SARS patient was Dr Carlo Urbani, who died of SARS after identifying the causative agent and warned the world of the impending anarchy. Out of a total of nine cases, only two died of the disease. South Africa, the only country affected in Africa, reported one death in April. The victim was infected in Hong Kong in March.

#### SARS SCARE IN INDIA

Although SARS was not fatal in India, it created panic and confusion within the health establishments, as well as among the people. The first case of SARS was reported from Goa, where a 32-year-old marine engineer tested positive. The patient, who sailed from Hong Kong to Mumbai, reached Goa on 1 April and was admitted to the Goa Medical College Hospital from where he was discharged on 14 April. The Director-General of the Indian Council of Medical Research (ICMR) had confirmed the case. At least nineteen more persons have tested positive for the SARS virus in laboratory tests but none of them fall within the WHO definition of SARS. The WHO had categorically stated that a mere laboratory diagnosis is not enough to declare a person as

suffering from SARS but the person should have clinical symptoms too. The WHO had described India as SARS-free on 1 May 2003. After a week, the WHO put India back on the list of countries reporting probable cases. According to the WHO's representative in India, N. Kumara Rai, the world body had taken into account one new case in Kolkata.<sup>20</sup> These declarations by the WHO and the Health Ministry caused considerable confusion in the general populace.<sup>21</sup>

Regarding its impact on trade and commerce, the Federation of Indian Chambers of Commerce and Industry (FICCI) had described SARS as the 'most serious single factor' which could adversely affect growth in Asia. A survey conducted by the FICCI following its initial reaction had revealed that there was no catastrophic effect on Indian trade and commerce, and the SARS scare had a moderate effect on trade and investment flows between India and ASEAN countries.<sup>22</sup> The Confederation of Indian Industry (CII) had stressed that SARS could lead to uncertainty in the global as well as Indian economy and it may prove to be a major hindrance to economic growth.<sup>23</sup> Citing Chinese customs statistics, a study observed that bilateral trade between India and China during January and March 2003 had witnessed an impressive growth of 77.8 per cent, with total trade touching US\$ 1.66 billion. India's exports to China during the first quarter of 2003 crossed all previous records in bilateral trade by shipping \$ 947 million worth of goods, registering a growth of 119.2 per cent.<sup>24</sup> Though an exhaustive study of the real impact of SARS on Indian economy is not available, it is more or less clear that the panic did not affect India's economy as the Plague outbreak did in 1994.

#### CONTROVERSY OVER ORIGIN

The controversy surrounding the origin of SARS became the most debated issue in 2003. On 16 January 2004, the WHO declared that it had found evidence suggesting that civet cats do carry SARS. Before that several questions had been raised on the source and natural host of the disease. Since the initial cases were reported from China, which is known for its secrecy and subsequent efforts

to suppress the early outbreaks, this raised many eyebrows. Two major controversies gained ground in the wake of the outbreak: SARS as a creation of communist China for bio-warfare purposes, and it is an alien virus from space.

*SARS as a bio-weapon.* Regarding the origin of SARS, the alarmists had their say. According to them, the outbreak may not have been caused by a naturally found virus. They alleged that the Chinese military had a hand in it and its massive cover-up. According to Richard Fisher, senior fellow at the Jamestown Foundation, a Washington-based think tank, a bio-weapon link should not be ruled out. There were speculations about a possible leak from a secret military bio-weapon programme.<sup>25</sup> Russian medical expert Professor Sergei Kolesnikov, a renowned member of the Russian Medical Sciences Academy, claimed that the SARS virus is a hybrid of two viruses—measles and mumps—and could only be produced in laboratory conditions. This indicates that the SARS virus could be a biological weapon developed by China.<sup>26</sup>

Wei Jingsheng, a Chinese dissident in exile, without dismissing reports that SARS emanated from China's biological weapons research facilities, noted that the Chinese President, Hu Jintao, had conducted an inspection tour, including a visit to the Chinese Military Medical Academy, a bio-military research facility, to dismiss rumors of a bio-weapon leak.<sup>27</sup> This suspicion gained strength when WHO officials were denied access to Chinese military hospitals during a field inspection. A media story claimed that Beijing's hospital administrators had ordered large numbers of SARS infected patients to be transferred from No. 309, one of the city's military-run hospitals, to No. 3 Armed Police Hospital in Fengtai before a WHO inspection team visited the former (No. 309) in the last week of April 2003. Most of the cases, including severe ones, were transferred out, leaving just a small number of cases to be inspected by WHO officials. This cover-up, it was alleged, followed the army's experimentation with this deadly bio-war weapon.<sup>28</sup>

On the other hand, many believed that the bio-weapon theory was far-fetched. Stephanie Lieggi, an expert in the East Asia Nonproliferation Program at the Center for Nonproliferation

Studies, Monterrey, described the speculations as baseless, owing to the lack of plausible evidence to support these claims.

*Space theory.* Scientists claimed that the SARS virus could have reached the earth from outer space, piggyback on a comet or on an extra-terrestrial object. Chandra Wickramasinghe at the Center for Astrobiology, University of Cardiff, forcefully advocated this theory called 'panspermia'. According to him, several aspects of the SARS outbreak like the strange nature of Coronavirus, supported the unorthodox point of view about panspermia.<sup>29</sup> The other advocates of this theory include the Indian scientist Jayant Narlikar at the Inter-University Center for Astronomy and Astrophysics, Pune. The virus, according to this theory, may have entered the atmosphere east of the Himalayas, where the stratosphere is thinnest, and was subsequently deposited in southern China. An earlier collaborative study between these two scientists recovered bacteria from stratospheric samples collected from a height of 20 miles.<sup>30</sup> Refuting the claim, Edison Liu of the Genome Institute of Singapore debunked the theory as scientific imagination bordering on fantasy.<sup>31</sup> However, there is no concrete evidence to confirm the panspermic theory as responsible for SARS.

## LESSONS LEARNED

What have we learned from the SARS outbreak to prevent future situations involving these infectious pathogens? The emergence of a disease follows two steps: introduction into the human population and perpetuated transmission. Although preventing the introduction of a new disease is ideal, containing a zoonosis<sup>32</sup> is a necessity. First, the most important requirement is the need to report, promptly and accurately, cases of any disease with the potential for spreading worldwide in this interconnected and mobile world. Second, timely global alerts prevent imported cases from triggering widespread outbreaks in new areas. Third, travel recommendations, including screening measures at airports, help to contain the international spread of an emerging infection.

There are other loopholes and related lessons that can be

derived from the existing health establishments of many countries. An outbreak can be contained even without curative drugs or vaccines if existing interventions are tailored to circumstances and backed by political commitment. Although risk analysis about new and emerging infections is a major challenge, it is vital to ensure that accurate information is successfully and unambiguously communicated to the public.<sup>33</sup>

## ASSESSMENT

Following the outbreak of SARS, government authorities had adopted various strategies to cope with the killer virus. The most effective mechanism was to promptly set in place modalities to prevent the further spread of the disease. These included quarantine of infected patients, issuing travel advisories to SARS-affected countries, immigration checks and border controls, public information programmes, and even closure of schools and institutions. While Singapore and other affected countries acted promptly, China was severely criticized for complacency, lack of seriousness and its slowness in responding to the request of WHO for a medical team inspection in Guangdong. According to the WHO Director-General, Gro Harlem Brundtland, the spread of the disease could have been contained had the Chinese authorities treated the matter seriously at an early stage and with greater alacrity. China's belated response was due to the authorities' concern with the economic fallout. The slow process of 'silence-denial' to acknowledge and cooperate is not really surprising given the prevailing attitude towards infectious diseases in the country.<sup>34</sup>

The SARS outbreak was eventually brought under control by a coordinated response. Measures like improved screening and reporting of cases, immediate isolation of SARS patients, enhanced hospital infection control practices, and quarantine of close contacts were the most effective ways to prevent further proliferation of the virus through person-to-person transmission.<sup>35</sup> Many health practitioners opined that containment, quarantine and Internet (information dissemination) helped conquer SARS, which otherwise would have spelt disaster on an unprecedented scale. The current belief is that SARS had species-jumped from

an animal to humans. The virus is capable of infecting several species including monkeys and common cats. Mice and rats have been shown to be relatively resistant to SARS.

However, much about SARS remains a mystery, including its origins. How it actually started and from which animal source it came remains unclear. There is serious concern that SARS could re-emerge. As some cases have recently resurfaced in China, the outbreak is a wake-up call for the world.

## NOTES

1. For a complete analysis of the changing nature of security concerns and disease see, Jennifer Brower and Peter Chalk, *The Global Threat of New and Re-emerging Infectious Disease*, New York: RAND Corporation, 2003, pp. 1-12.
2. 'Emerging infectious diseases are those whose incidence in humans has increased during the last two decades or which threaten to increase in the near future. The term also applies to newly appearing infectious diseases or diseases that are spreading to new geographical areas. Re-emerging diseases are those that were easily controlled in the past, but which have developed anti-microbial resistance.' This definition of ERIDs is quoted from Andrew T. Price-Smith, *The Health of Nations*, Cambridge: MIT Press, 2002, p. 2.
3. Commission on Human Security, *Human Security Now*, New York, 2003, pp. 97-8.
4. Ibid.
5. See WHO Summary of Probable SARS Cases with Onset of Illness from 1 November 2002 to 31 July 2003 (based on data as of 31 December 2003). [http://www.who.int/csr/sars/country/table2004\\_04\\_21/en](http://www.who.int/csr/sars/country/table2004_04_21/en). Accessed on 25 April 2004.
6. Joseph Fewsmith, 'China and Politics of SARS', *Current History*, vol. 122, no. 665, September 2003, p. 250.
7. Human coronaviruses cause up to 30 per cent of colds but they rarely cause lower respiratory tract disease. In contrast, coronaviruses cause devastating epizootics of respiratory or enteric disease in livestock and poultry. The SARS-associated Coronavirus (SARS-CoV) could have arisen as a mutant of a human coronavirus that acquired new virulence factors. For a detailed description, see, Kathryn V. Holmes, 'SARS-Associated Coronavirus', *New England Journal of Medicine*, vol. 348, no. 20, 15 May 2003, pp. 1948-51.
8. 'SARS: One Suspected Case Reported in China', [www.who.int/csr/don/2004\\_04\\_22/en](http://www.who.int/csr/don/2004_04_22/en)

9. The deceased 53-year-old woman, with the surname Wei, contracted the illness from her daughter—the second confirmed in case Anhui. The daughter, was a laboratory worker in Beijing, is in a stable condition. The mother, previously diagnosed as a suspected SARS case, died on 19 April. 'First 2004 SARS Death', 30 April 2004 [<http://edition.cnn.com/2004/WORLD/asiapcf/04/30/china.sars/>]
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11. B. Tomlinson and C. Cockram, 'SARS: Experience at Prince of Wales Hospital', *Lancet*, vol. 361, 2003, pp. 1486–7.
12. 'SARS: Lessons From a New Disease', *The World Health Report*, 2003, p. 74.
13. Ying-Hen Hsieh, C.W.S. Chen and S.B. Hsu, 'SARS Outbreak, Taiwan, 2003', *Emerging Infectious Disease*, vol. 10, no. 2, February 2004, p. 201.
14. Nosocomial infections are those that originate or occur in a hospital or hospital-like setting.
15. Center for Disease Control and Prevention, 'Update: Severe Acute Respiratory Syndrome—Toronto, Canada, 2003', *Morbidity Mortality Weekly Report (MMWR)*, 13 June 2003, vol. 52, no. 23, 13 June 2003, pp. 547–50. URL <<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5223a4.htm>>
16. Mona R. Loutfy, et al., 'Hospital Preparedness and SARS', *Emerging Infectious Diseases*, vol. 10, no. 5, May 2004, p. 771. [www.cdc.gov/eid](http://www.cdc.gov/eid)
17. 'Singapore Deploys New Weaponry in SARS Battle', *Reuters*, 16 April 2003.
18. 'SARS Spread: Singapore to Punish Violators', *The Hindu* (Chennai), 26 April 2003.
19. 'SARS in Singapore', 10 September 2003. [http://www.who.int/csr/don/2003\\_09\\_10/en](http://www.who.int/csr/don/2003_09_10/en)
20. 'SARS: India Back on List', *The Hindu*, 9 May 2003.
21. About the confusion and chaos, see R. Ramachandran, 'The SARS Confusion', *Frontline*, vol. 20, no. 10, 10–23 May 2003.
22. 'SARS Effect on Indo-ASEAN Trade Moderate', 2 May 2003. [www.rediff.com/money/2003/may/02sars.htm](http://www.rediff.com/money/2003/may/02sars.htm)
23. 'SARS a Threat to Indian Economy, says CII', <http://www.rediff.com/money/2003/apr/12sars.htm>
24. See Mehmood-ul-Hassan Khan, 'Global Comparative Study and Socio-economic Implications of SARS', 24 January 2004. <http://usa.mediamonitors.net/content/view/full/4252>
25. 'SARS Leaked from Bio-weapon Program', *The Age*, 1 May 2003. [www.theage.com.au](http://www.theage.com.au)
26. 'SARS Virus could be China's Bio-weapon: Russian Expert', *Indian Express*, 12 April 2003.

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16. Mona R. Loutfy, et al., 'Hospital Preparedness and SARS', *Emerging Infectious Diseases*, vol. 10, no. 5, May 2004, p. 771. [www.cdc.gov/eid](http://www.cdc.gov/eid)
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18. 'SARS Spread: Singapore to Punish Violators', *The Hindu* (Chennai), 26 April 2003.
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23. 'SARS a Threat to Indian Economy, says CII', <http://www.rediff.com/money/2003/apr/12sars.htm>
24. See Mehmood-ul-Hassan Khan, 'Global Comparative Study and Socio-economic Implications of SARS', 24 January 2004. <http://usa.mediamonitors.net/content/view/full/4252>
25. 'SARS Leaked from Bio-weapon Program', *The Age*, 1 May 2003. [www.theage.com.au](http://www.theage.com.au)
26. 'SARS Virus could be China's Bio-weapon: Russian Expert', *Indian Express*, 12 April 2003.

27. Wei Jingsheng, 'SARS Tests Communist Rule in China', *International Herald Tribune*, 29 April 2003.
28. John LeBoutillier, 'SARS: Chinese Biowar Accident', Friday, 2 May 2003. <http://www.newsmax.com>
29. According to the theory of Panspermia, comets seeded life on the earth four billion years ago and living organisms like microbes continue to arrive on this planet. Towards the end of the nineteenth century this hypothesis on the origins of life gained currency, particularly after the suggestion by a Swedish chemist, S.A. Arrhenius, that life on earth arose from panspermia, micro-organisms or spores floated through space by radiation pressure from planet to planet or solar system to solar system.
30. 'SARS from the Stars?', *The Hindustan Times*, 9 May 2003. Also see for a detailed analysis, Ajay Lele, *Bio-Weapons: The Genie in the Bottle*, New Delhi: Lancer, 2004.
31. 'Scientist Sinks SARS Space Theory', <http://www.news.com.au/>
32. Zoonoses are responsible for most of the emerging infectious diseases, including Ebola virus, West Nile virus, monkey-pox and HIV. In the case of SARS Coronavirus (SARS-CoV), according to Malik Peiris of the University of Hong Kong, serological evidence indicates that the virus was spread through interspecies transmission from wild game markets in Guangdong, China.
33. 'SARS: Lessons from a New Disease', *The World Health Report*, 2003, p. 73.
34. Mely Caballero-Anthony, 'SARS: A Security Priority', <http://www.ntu.edu.sg>
35. For a detailed study, see, United States General Accounting Office (GAO), *Asian SARS Outbreak Challenged International and National Responses*, April 2004, pp. 28-9.