NEW HEALTH THREATS in the 21st century

chapter

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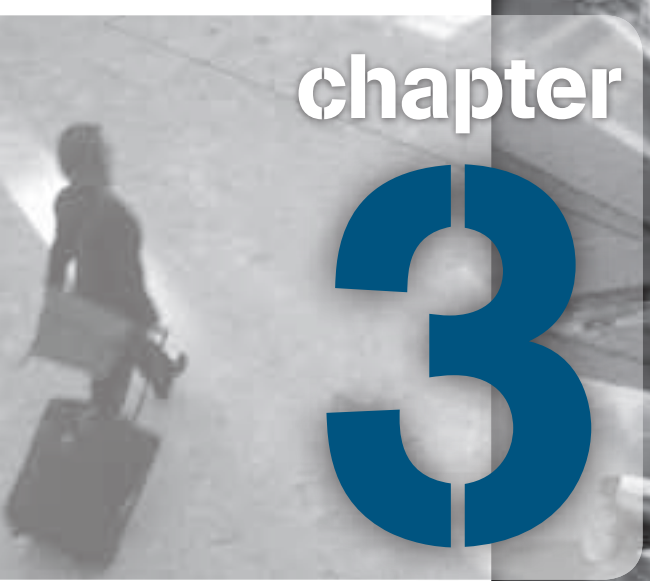
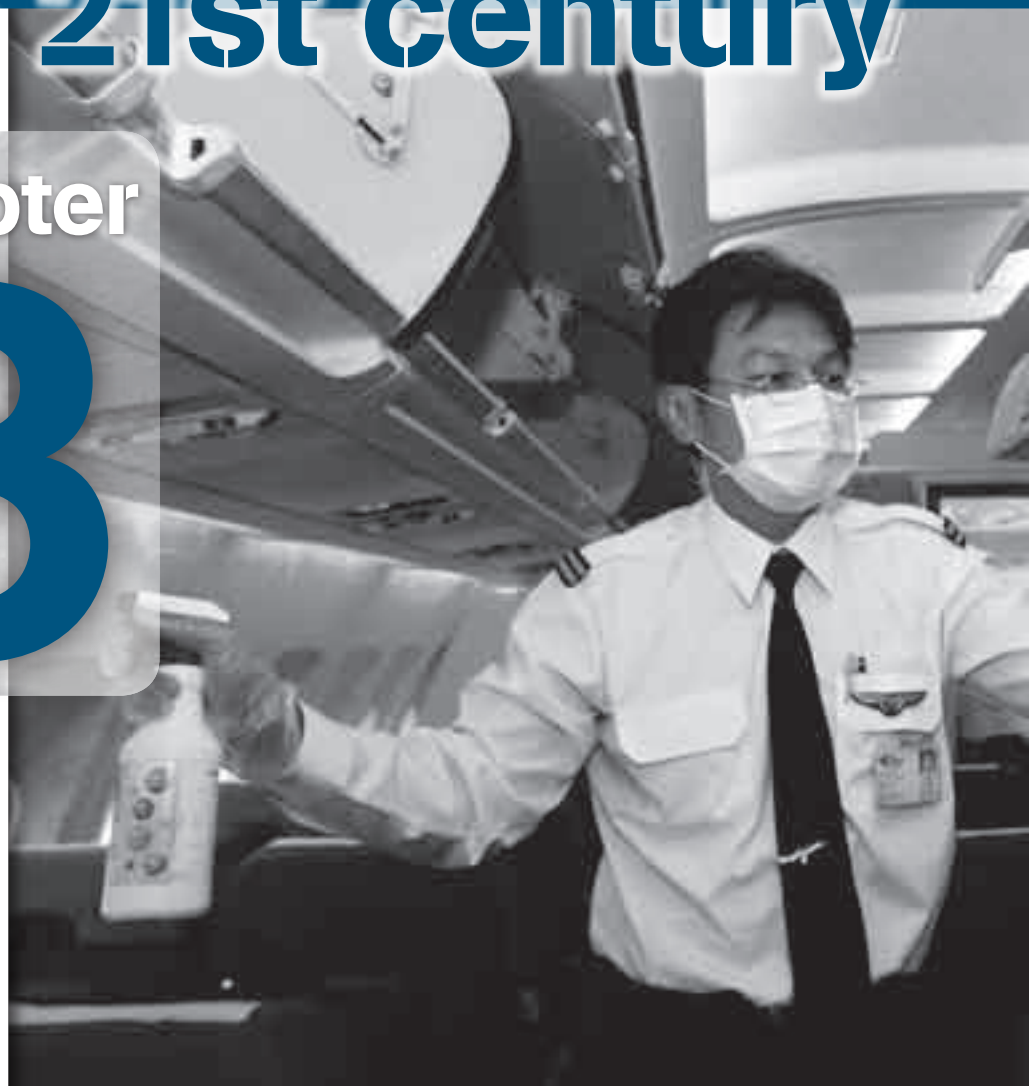




The previous chapter identified the main causes of infectious diseases and other acute events that threaten collective public health. Chapter 3 continues with a number of major events that have occurred in the first few years of the 21st century and which represent new threats to national and global public health security. The examples discussed are bioterrorism in the form of the anthrax letters in the United States in 2001, the emergence of Severe Acute Respiratory Syndrome (SARS) in 2003, and large-scale dumping of toxic chemical waste in Côte d'Ivoire in 2006.

These events demonstrate how much the world is changing in terms of its vulnerability to new threats to health. Chronologically, the first of these is the arrival of bioterrorism on the international stage with the anthrax letters attack in the United States in 2001. This was followed in 2003 by the emergence and rapid international spread of the deadly new disease SARS. The international impact of this disease contributed to the growing political will to complete the revision and strengthening of the International Health Regulations (1969), and to enable a much more proactive approach to preparedness for an expected human influenza pandemic (see Chapter 4).

In 2006, the illegal dumping of hundreds of tons of chemical waste in Côte d'Ivoire provoked tens of thousands of cases of respiratory and other illnesses, and illustrated a growing phenomenon – how globalization has exacerbated the dangers inherent in the movement and disposal of hazardous wastes. The episode, described later in this chapter, is linked to the extended response system to chemical incidents that covers such environmental health emergencies (see Chapter 2).

THE ANTHRAX LETTERS

Coming only days after the terrorist events of 11 September 2001 in the United States, the deliberate dissemination of potentially lethal anthrax spores in letters sent through the United States Postal Service (*1*) added the deliberate release of biological or chemical agents to the realities of life in the 21st century. Anthrax spores were found in four envelopes. In addition to the human toll – five people died among 22 cases (*2*) – the anthrax attack caused massive disruption of postal services in many countries around the world and had huge economic, public health and security consequences. It prompted renewed international concerns about bioterrorism, provoking countermeasures in many countries and requests for a greater advisory role by WHO that led to the updated publication of *Public health response to biological and chemical weapons: WHO guidance* (*3*).

For years, the United States and other industrialized countries had lived with the fear – frequently fed by hoax calls and alarms – of just such an attack. Although there was no evidence that they had been used, it was well known that stocks of biological weapons, including anthrax, were held by a number of countries. Investigations into the accidental release of anthrax from a military biological weapons facility in the former Soviet Union in 1979 showed how lethal it could be (see Chapter 2).

In 1990, during the Gulf War, the United States Government's concern about potential anthrax attacks led to the vaccination of more than 100 000 military personnel. In 1995, this concern was again aroused when the United Nations Special Commission indicated that Iraq had been developing and testing anthrax weapons during the Kuwait War. In 1998, a programme was initiated to vaccinate all United States military personnel, and government agencies were given directives for responding to possible deliberate biological or chemical attacks on civilian centres.

Starting in 1997, the United States experienced an increasing number of anthrax threats and hoaxes that, by the end of 1998, were regular occurrences. Prominent among these were envelopes containing various powders and materials, which were sent through the mail to abortion and reproductive health clinics, government offices and other locations. Until the events of 11 September 2001, none of these materials had tested positive for pathogenic *Bacillus anthracis* and there had not been a case of inhalational anthrax in the United States since 1976.

By 2001, with federal assistance, most American state governments and authorities of large cities had begun to develop plans to deal with bioterrorism and many had staged mock attacks to test local emergency response capacity. Effective medical measures for prevention and treatment of the two forms of the disease – cutaneous and inhalational anthrax – were established and published in the medical literature well before the anthrax letter attacks.

Nevertheless the anthrax letters – dated 11 September 2001 and postmarked seven days later – caused huge public alarm and prompted a massive public health response. In the end, a total of 22 persons are thought to have been infected: 11 each with cutaneous and inhalation anthrax. The five patients who died were all infected with inhalation anthrax (*3*). Twenty of the 22 patients were exposed to work sites that were found to be contaminated with anthrax spores; nine had worked in mail processing facilities through which the anthrax letters had passed. Drugs were made available on an emergency basis to some 32 000 people who were potentially exposed. Altogether, about 3.75 million antimicrobial tablets were distributed. People presumed to be at higher risk were advised to remain on a prolonged course of 60 days and were also given the option of anthrax vaccination. The CDC sent emergency teams of epidemiologists and laboratory and logistics staff to support local, state and federal health investigations and medicine distribution.

The collection and testing of environmental and clinical samples, as well as materials from suspicious incidents and hoaxes, placed an immense burden on the CDC, public health laboratories throughout the country and government agencies. The magnitude of the clinical and environmental testing undertaken would have quickly overwhelmed the nation's capacity had a significant investment not already been made in expanding laboratory training and capacity through a system called the Laboratory Response Network (LRN). The network links state and local public health laboratories with advanced capacity laboratories, including clinical, military, veterinary and agricultural laboratories, and those for testing water and food.

One legacy of the crisis was the introduction of permanent decontamination, detection and security equipment at mail processing facilities across the country. In order to reduce potentially contaminated dust and aerosols from the atmosphere in its centres, the Postal Service introduced some 16 000 high efficiency particulate air filter vacuum machines and, as a precaution, routinely sterilizes mail going to federal agencies by electron-beam irradiation. For the two fiscal years 2003 and 2004, US$ 1.7 billion was budgeted for additional modifications and improvements in the government's ability to protect the health of postal workers and to prevent pathogens and other hazardous substances from being distributed through the mail.

Even though the deliberate release of the anthrax was directed at one country, it had region-wide effect in the Americas. This was especially so as public health infrastructures had to divert resources to face an overwhelming demand for laboratory tests for suspected tainted postal items, personal protective equipment and for the decontamination of facilities.

Occurring as it did so soon after the September 2001 terrorist attacks, the anthrax offensive prompted a profound rethinking of threats to national and international security. It showed the potential of bioterrorism to cause not just death and disability, but social and economic disruption on an enormous scale both in the United States and internationally.

A simultaneous concern was that smallpox – a debilitating, disfiguring and frequently deadly disease that was eradicated in 1979[1] – could be used over 20 years later as one of the most effective biological weapons conceivable. This was of particular concern given that mass smallpox vaccination had been discontinued after eradication, thus leaving unimmunized populations susceptible. An expert who had led the smallpox eradication campaign warned in June 1999, "If used as a biological weapon, smallpox represents a serious threat to civilian populations because of its case fatality rate of 30% or more among unvaccinated persons and the absence of specific therapy. Although smallpox has long been feared as the most devastating of all infectious diseases, its potential for devastation today is far greater than at any previous time" (*4*).

WHO has participated in international discussions and bioterrorism desktop exercises, arguing that the surest way to detect a deliberately caused outbreak is to strengthen the systems used for detecting natural outbreaks, as the epidemiological and laboratory principles are fundamentally the same. Consideration of the appropriate response to a biological attack, especially to the smallpox virus, served to test – on a global scale – the GOARN mechanisms recently introduced by WHO. In addition, the debate in medical journals, the media, and security and defence circles helped to persuade political leaders that improved national capacities for disease surveillance and response are directly relevant to national and international security.

SARS: VULNERABILITY REVEALED

In 2003, SARS – the first severe new disease of the 21st century – confirmed fears, generated by the bioterrorism threat, that a new or unfamiliar pathogen would have profound national and international implications for public health and economic security. SARS defines the features that give a disease international significance as a public health security threat: it spreads from person to person, requires no vector, displays

[1] The global eradication of smallpox was certified by a commission of eminent scientists in December 1979 based on intensive in-country verification activities. It was subsequently endorsed by the World Health Assembly in 1980.

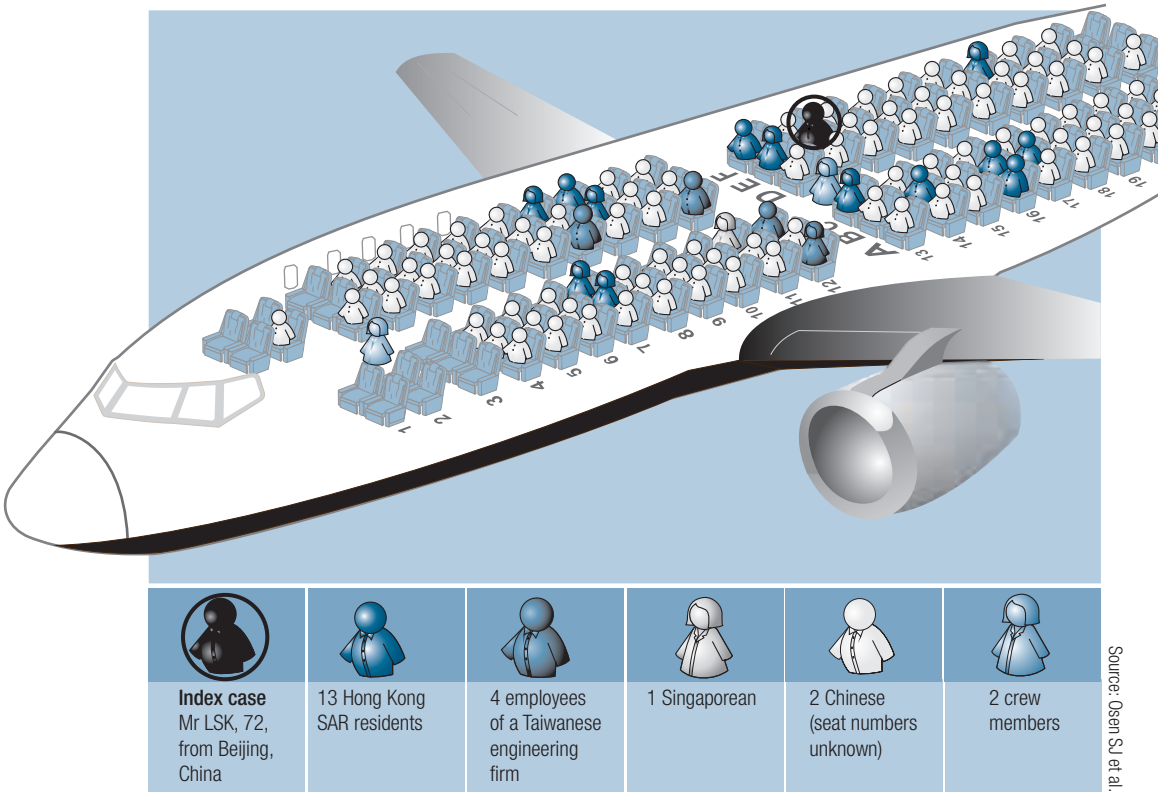
no particular geographical affinity, incubates silently for more than a week, mimics the symptoms of many other diseases, takes its heaviest toll on hospital staff, and kills around 10% of those infected. These features enable it to spread easily along the routes of international air travel, placing every city with an international airport at risk of imported cases (see Figure 3.1).

New, deadly and initially poorly understood, SARS incited a degree of public anxiety that brought travel to affected areas to a virtual standstill and drained billions of dollars from economies across entire regions. Box 3.1 details the economic costs of the SARS epidemic and projects the possible economic consequences of a large influenza pandemic.

SARS demonstrated that the risks and dangers to health arising from new diseases have indeed been increased by the ways in which nations and their populations interact globally. It showed the magnitude of damage that an emerging disease with the appropriate features can cause in a world where airlines carried an estimated 2.1 billion passengers in 2006 (*7*), where financial markets and businesses are tightly intertwined, and where information is instantly accessible (see Figure 3.2).

The emergency response and the level of media attention stimulated by SARS were on a scale that challenged public and political perceptions of the risks associated with emerging and epidemic-prone diseases (see Box 3.2). The outbreak raised the profile of public health to new heights. Neither the public nor government officials at the highest levels could ignore the adverse effects that a health problem was having on economies, societies, politics and the international image of countries. Not every

Figure 3.1 Probable SARS transmission on flight CA112 in March 2003



A total of 22 passengers, and the index case, met WHO's definition of a probable case of SARS.

Box 3.1 Economic impact of SARS and influenza pandemics

The 2003 epidemic of SARS could possibly have been a global pandemic responsible for millions of deaths. Instead, using classic surveillance and epidemiological response techniques, the epidemic was limited to 8422 cases with a case-fatality rate of 11% (***5***). Even so, the estimated cost of the epidemic to Asian countries was US$ 20 billion in gross domestic product (GDP) terms for 2003, or a more dramatic US$ 60 billion of gross expenditure and business losses (***6***).

The main drivers of the economic impact of SARS were tourism and consumer confidence for non-essential spending. The actual number of SARS cases was relatively small, but the fear of transmission caused foreign tourists to choose alternative holiday locations, and the local population felt safer avoiding restaurants and other public leisure venues. These sectors of the economy are significant contributors to the GDP of many countries.

Both human and economic consequences were mostly confined to the second quarter of 2003. Although the duration and economic impact of the outbreak were checked by strong leadership and coordinated international public health action, this success invites the question "what could have happened?"

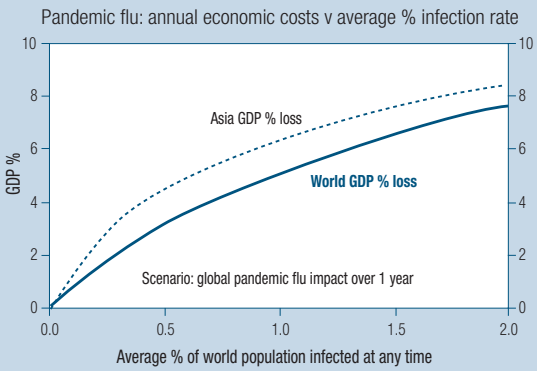
The total cost of SARS to Asian countries breaks down to over US$ 2 million per person infected. A true influenza pandemic would certainly last longer than three months, but the economic implications of an influenza outbreak lasting a year or more are not a simple multiplication of what was seen in the case of SARS, as illustrated below.

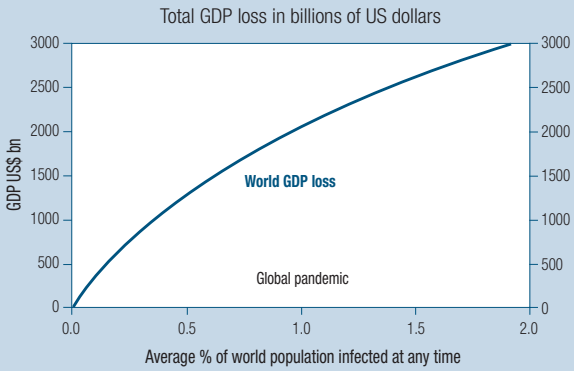
If a pandemic were to persist for over a year, as has been predicted, the long-term consequences in terms of job loss and bankruptcy would continue to produce hardship for many years. The longer the pandemic remained active, the greater the damage in terms of losses in productivity, along with hospitalization and other healthcare expenditures.

Of course, the larger the pandemic, in terms of proportion of the population infected, the greater the economic impact. For infection rates up to 1% of the world's population, a decrease in global GDP of 5% could be expected, with an additional loss of 1% per additional percentage increase in infection rate (***6***). Once a critical infection rate was reached, the cumulative economic disruption would produce a shut-down of the global economy, similar to that seen in the United Kingdom's agricultural economy following the 2001 outbreak of foot and mouth disease but, in this case, on a global scale (***6***).

The potential calamity caused by a global influenza pandemic justifies naming the control of such a pandemic a global public good. Current stocks of vaccines and anti-viral medications are not adequate in any country, let alone in developing countries. Pandemics, by definition, have no respect for national and regional borders. The health impact of the pandemic influenza virus will be shared, as will the economic losses.

Estimated economic impact of pandemic influenza





Source: Oxford Economic Forecasting Group.

country felt threatened by the prospect of deliberate biological attack, but every country was concerned by the arrival of a disease like SARS.

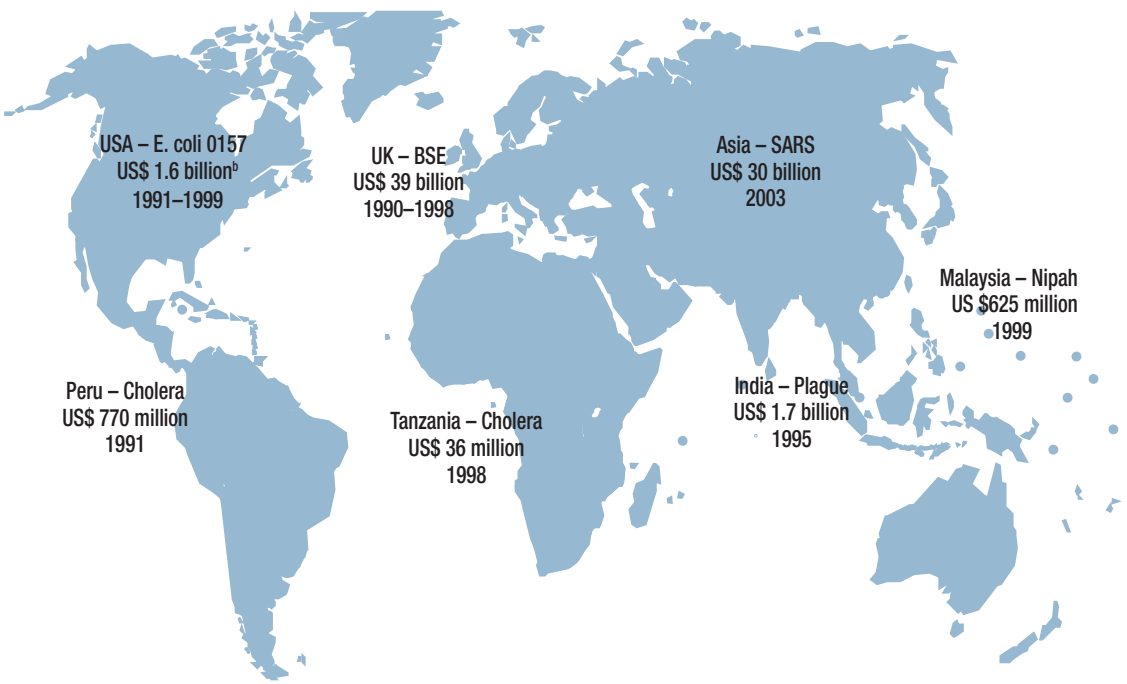
SARS also highlighted the fact that the danger arising from emerging diseases is universal. No country is automatically protected – by virtue of its wealth or its high levels of education, standards of living and health care, or equipment and personnel at border crossings – from either the arrival of a new disease on its territory or the subsequent disruption this can cause. SARS was, to a large extent, a disease of prosperous urban centres. Contrary to expectations, it spread most efficiently in sophisticated city hospitals.

SARS did not become endemic in humans or gradually fade away. Its spread was halted less than four months after it was first recognized as an international threat – an unprecedented achievement for public health on a global scale. Had SARS been allowed to establish a foothold in a resource-poor setting, it is doubtful whether the demanding measures, facilities and technologies needed to interrupt chains of transmission could have been fully deployed. If SARS had become permanently established as yet another indigenous epidemic threat, it is not difficult to imagine the consequences for global public health security in a world still struggling to cope with HIV/AIDS.

DUMPING OF TOXIC CHEMICALS

As well as the international mobility of people, the global movement of products can have serious health consequences. The potentially deadly risks of the international movement and disposal of hazardous wastes as an element of global trade were vividly illustrated in Côte d'Ivoire in August 2006. Over 500 tons of chemical waste were unloaded from a cargo ship and illegally dumped by trucks at different sites in

Figure 3.2 Direct economic impact of selected infectious disease outbreaks, 1990–2003[a]



[a] Excludes economic impact of human sickness and death.
[b] Date source: (*8*).

Toxicological dumping in Côte d'Ivoire – the clean up begins.

Box 3.2 The role of the mass media in risk perceptions

News travels fast – and it has never travelled faster than in today's world of instant information. The mass media have a powerful influence on people's perceptions of risks, whether from a new disease epidemic, deliberate attacks or natural catastrophes. The Internet, television, radio, newspapers and magazines are the most influential sources of everyday information on risks to health.

How should the media evaluate and communicate information on health risks such as avian influenza or SARS? Such situations challenge the media to be responsible when dealing with complicated scientific issues and conflicting political goals. What information should be conveyed? How fully should uncertainties and controversies be explained to the public?

In covering health issues, the media perform two major functions: they explain and report scientific information and government policies for the public and, at the same time, reflect the concerns of the general public. Health-related events such as chemical accidents, medical research discoveries, communicable disease epidemics and safety defects in new medicines are all likely to make headlines. Government press releases, scientists and international scientific journals are often their main sources of information. Journalists tend to use the best-organized sources and those press releases that encapsulate technical information in lay terms. In addition, international news organizations frequently syndicate health-risk stories around the world (*9*).

According to a study by the Nuffield Trust, mass communication can either heighten levels of anxiety or provide reassurance at times of acute public health events. Authorities such as governments may use the mass media, but can seldom keep control of the information delivered. They have to strike a difficult balance between saying too much and saying too little: one course of action may cause an overreaction, the other may seem complacent (*10*).

Mass communication has both a positive and negative potential for risk perception. When no information about health risks is provided through official channels, the media will find it elsewhere and their reports may create or heighten a sense of anxiety. For those in authority, doing or saying nothing has become a dangerous strategy. For example, early reports of a disease outbreak are often alarmist, as was shown in the case of the SARS outbreak in 2003. This can establish a baseline of accepted "facts" or beliefs that may be difficult to correct when more – and especially more accurate – information becomes available.

"On the other hand, mass communications can be used to reassure the public. In this respect, the role of WHO during SARS is instructive," says the Nuffield Trust study. "As a trusted international body it was able to use mass communication to inform and reassure anxious publics. Indeed, the speed of modern communication can even be a reassurance in itself: as SARS demonstrated, modern communication technology allowed the rapid exchange of information which allowed better preventative action, while the exchange of scientific data through secure web sites, etc. allowed the SARS genome to be identified remarkably quickly."

The study says health professionals – and in particular professional bodies – have a role to play in reassuring the public over the risks involved, but such responses need to be agile and perceived as independent and authoritative.

and around Abidjan. One month after the dumping, almost 85 000 consultations had been recorded at different medical facilities in relation to the chemical incident and its consequences: 69 people had been admitted to hospital and eight deaths had been attributed to the event.

The composition of the "slop" unloaded from the vessel was initially unknown, but it caused eye, nose and throat irritation, breathing difficulties, headaches, nausea and vomiting, and growing anxiety among thousands of people. The most severe cases presented with respiratory distress, dehydration, and nose and intestinal bleeding. In addition to the eight deaths attributed to the incident initially, more are suspected to have occurred due to the worsening of pre-existing medical conditions such as asthma, respiratory conditions or cardiovascular disease. Even several weeks after the dumping, the foul odours persisted at certain times of the day, and people with nose, throat and skin irritation, as well as malaise, nausea and gastrointestinal effects, were still seeking medical attention at the hospitals, where free care and medication was provided.

The waste was eventually identified as a mixture of sodium hydroxide, phenols, mercaptanes, hydrogen sulphide, hydrocarbons and other chemicals used to clean oil transporters' tanks, all of which can have severe toxic and caustic effects requiring symptomatic treatment.

This incident had important public health, social and economic consequences. It occurred in a climate of social unrest and political instability that was further intensified by the reactions of the people. Street demonstrations and violent incidents occurred every day.

Thousands of people arrived at the medical centres with either health complaints or – especially in the case of pregnant women – fears about the future consequences of exposure to the chemicals, stretching the provision of normal medical care to the limit. Pharmaceutical stocks, X-ray plates, laboratory reagents and other supplies were soon scarce. As the medical personnel were overwhelemed, more staff had to be recruited in order to deal with the overflow of consultations. The public health system was in crisis and unable to provide the medical care required by the population.

In addition, there was increasing local and international concern about potential water and food contamination, as dead fish were reported in the lagoon and vegetables grown near contaminated sites were being sold in the local markets. Some of the contaminated areas that happened to be waste disposal sites were closed for security reasons and, as a consequence, the normal garbage collection system was disrupted and domestic rubbish began piling up in different areas of the city.

The situation required government intervention at the highest level as well as the support of national and international organizations. WHO provided technical advice to country authorities, acquired pharmaceuticals and other resources for the over-worked hospitals, supplied computers and case data forms, prepared and circulated information notes, and established contacts with other organizations of the United Nations system.

Neighbouring countries were concerned that rivers and the sea would carry contamination and they remained on the alert. One of the main international concerns was that the ship transporting the waste had sailed from northern Europe and had called at a number of ports, including some others in western Africa, on its way to Côte d'Ivoire. It was unclear in the aftermath of the incident whether it had taken on, or discharged, chemical waste at any of those ports of call.

In today's world, public health security needs to be provided through coordinated action and cooperation between and within governments, the corporate sector, civil society, the media and individuals. No single institution or country has all the capabilities needed to respond to international public health emergencies caused by epidemics, natural disasters, environmental emergencies, chemical or biological attacks, or new and emerging infectious diseases. Only by detecting and reporting problems in their earliest hours can the most appropriate experts and resources be deployed to prevent or halt the international spread of disease.

Chapter 4 examines recent experience in avian influenza alert and response, the new threat of XDR-TB and natural disasters caused by extreme weather events.

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