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1. Introduction

What happens when countries have to respond rapidly to sudden health threats? What are the most important lessons that policy-makers have drawn from the experience?

This WHO briefing grew out of the fifth Futures Forum on rapid response decision-making tools, held in Madrid on 16 and 17 December 2003. It was attended by director-generals of health, chief medical officers of health and other senior officials from most of the western European Member States of WHO.

Hindsight is good sight. Experiencing a sudden health emergency substantially increases the understanding of a country's decision-makers of what could have been done to avoid it and to prepare for this emergency. The purpose of this Futures Forum was to facilitate better understanding among policy-makers of response to sudden health threats by hearing from colleagues who have faced sudden health emergencies in their countries. It was agreed that openly reviewing the measures taken and their impact is vital to ensuring the best possible preparedness for similar health risks in the future.

This briefing therefore aims to help equip policy-makers to respond to any sudden health threats against which the European public may need to be protected based on the case studies and lessons drawn.

The report has four sections. Following this introduction, **section 2** is devoted to heat-waves, containing several case studies, the lessons drawn and the epidemiology of heat-waves. **Section 3** focuses on selective chemical and biological threats and contains a number of case studies and lessons drawn. Information on the epidemiology of chemical and biological threats would have exceeded the scope of this report and is therefore not included. **Section 4** contains conclusions from the Futures Forum. The **Annex** contains an alphabetical listing of tools on systemic responses to the selective threats presented in sections 2 and 3. The list will contribute to a set of policy tools for high-level decision-makers to be developed towards the end of this Futures Forum cycle on tools for decision-making in public health.

2. Extreme weather events: Heat-waves

2.1 Case studies

2.1.1 The heat-wave in France

"Essentially we had never made a plan to prepare for a heat-wave."

It was August 2003, and the weather in France was hot, a welcome start to the peak summer holiday. However, after one week of heat, a crisis unfolded. Between 1 and 20 August, there were 14 800 excess deaths *(Fig. 1)*. Emergency rooms were crowded with people, mostly elderly people. Because of the excess deaths, bodies could not be buried within the statutory six days and had to be stored in inflatable tents and refrigerated lorries. The public health crisis became a political crisis, and the hunt was on to find people to hold responsible.

This was an exceptional heat-wave in terms of length, intensity, "spread" and consequences. It lasted two weeks and covered 80% of France, with record high temperatures in 70 of the 289 meteorological stations. Temperatures exceeded 40 °C in more than one quarter of the country: as the temperature rose, so did the excess deaths. Forty percent of those who died were not isolated; they were in institutions such as psychiatric hospitals. In France, hospitals typically close many beds over the summer.

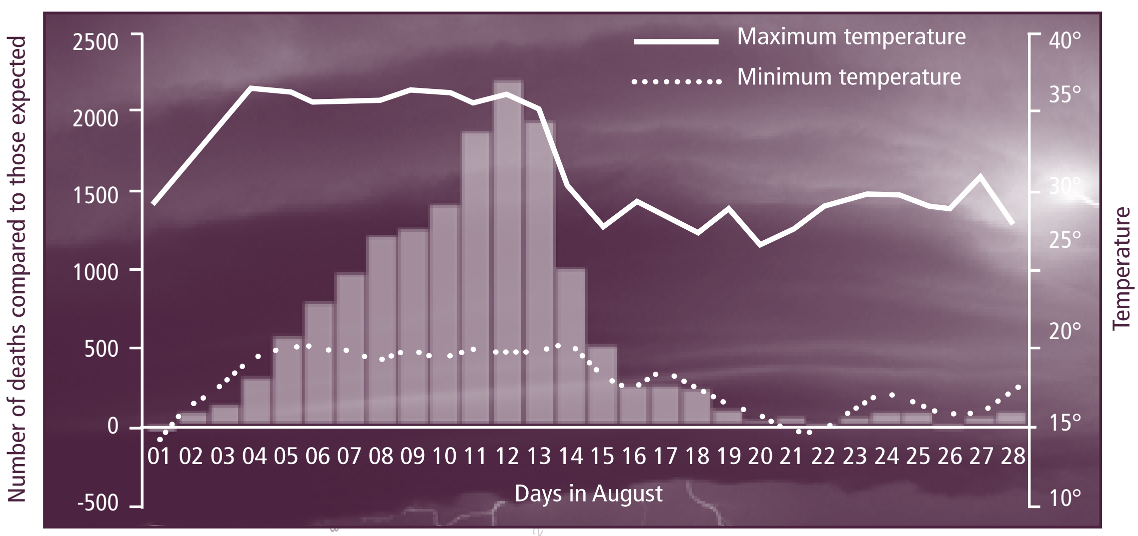

Fig. 1. Excess deaths and temperatures observed in August 2003 in France

What had gone wrong? Subsequent reports emphasized numerous factors.

a) Planning is essential. It was subsequently decided to organize national plans for extremely hot weather, and a national coordinating group was created involving the main directorate of the health ministry, social affairs and hospitals, as well as outside agencies and experts.

b) Further, the alert system needs to be improved. The next extreme event might be a cold-wave, with different alerts and health effects. Some general frameworks might be possible, however, and it was agreed that indicators need to be defined that would help the authorities to detect an unfolding crisis.

c) Defining vulnerable population groups is useful so that rapid response can focus on these groups.

d) Communication initiatives that would improve prevention need to be assessed.

e) The liaison between health and social services needs to be improved, especially for old people isolated at home.

f) The response systems need to be tested and evaluated.

g) Surveillance and coordination need to be improved between meteorological and surveillance agencies. For example, fire fighters, police and institutes for health surveillance typically have their own statistics and seldom cooperate.

"What would have helped? More air conditioning in care institutions for the elderly would have helped, along with better preparedness, mostly by having plans at local levels involving social institutions. Although delays in obtaining mortality data were heavily criticised, they would have come too late anyway. Indicators which would provide earlier information need to be developed, as well as better coordination between meteorological and health surveillance agencies. The fact that many top level executives in ministries or institutions were on holidays at the same time made also crisis communication more difficult."

Experts also began to work on recommendations for cold-waves. The first recommendation was to use the approach that had already been used in Paris in plans to protect homeless people at three temperature levels: 0 °C, 5 °C and 10 °C. The four indicators covered temperature, wind, mortality and the level of activity of cardiology units – death from exposure to cold weather comes after a time lag. The experts also defined those at risk and produced guidelines to help professionals to face cold-wave effects. Research was instigated to validate the indicators and begin prevention immediately, developing special messages.

2.1.2 The heat-wave in France: A personal view

The following is the view of a former public health decision-maker in France.

> ***"In the past, heat-waves were not considered a serious risk to human health with 'epidemic' potential in the European Region. In order to reduce the health impacts of future heat-waves, fundamental questions need to be addressed, such as whether a heat-wave can be predicted, detected or prevented, and how this may be done."***

Crises are a crucial stage or turning-point in the course of a sudden health emergency. However, epidemics can evolve without a crisis, and crises can evolve without an epidemic. This event was both an epidemic and a crisis. Thus, epidemics are not synonymous with crises: flu epidemics happen every year but are not seen as crises; bovine spongiform encephalopathy created a crisis but not an epidemic, with six deaths. Crises arise when trust is at stake: when the public feels that nothing is being done. A health crisis can contain surprise, insufficient alert, uncertainty about danger and risk, lack of effective measures, deficiencies in communication and, sometimes, distrust in political decision-makers. These features applied to the heat-wave experience in France.

1. Surprise

   The authorities took five days to realize that there was a crisis, which ended soon afterwards. By that time, nearly 15 000 excess deaths had occurred. The temperatures were the highest since recording started in 1873 – 25.5 °C at night *(Fig. 2)*. The curve of night-time temperature is a strong predictor

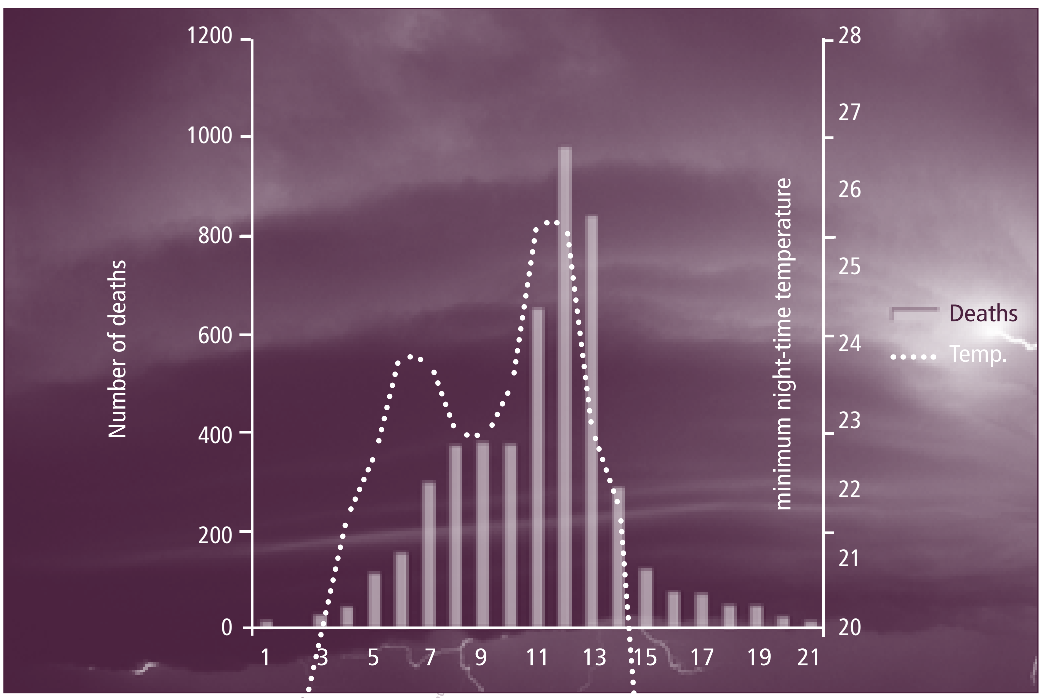

Fig. 2. Minimum night temperature and number of deaths in the Paris Region

of death, as there is a high correlation between rise at a certain temperature and excess mortality. Seventy percent of deaths occurred when the temperature rose by 2%.

2. Insufficient alert

   By the time the meteorologists told the authorities that the night-time temperature might reach 25 °C, there were already 2000 deaths. A health warning was issued, but of 100 newspapers and television stations, only one newspaper carried the story. There were also major failures – especially related to information. National surveillance authorities reported no excess deaths for 10 days, when there had actually been 3900. Fire fighters were ordered not to disclose information on the deaths. Emergency services were known to be busier in the summer, and in France some hospital beds are always closed at that time. Surveillance appeared to be sensitive to and efficient for new, rare or infectious diseases but not this extreme weather event.

3. Uncertainty of danger and risk

   Heat is not normally seen as a major hazard. Just before the heat-wave, 4000 people, including a range of experts, had been consulted on priorities and objectives in public health, and heat was not mentioned once. Yet a difference of 3–4 °C can make the difference between life and death. Uncertainty and lack of control contributes to the perception of risk. The public tends to fear and see as risky things that they do not understand. Familiar risks such as a car crash, however great, engender less fear and are seen as less threatening. What can people do about it? Heat is not normally thought of as fatal: heat-related epidemics are not well known.

4. Lack of effective measures

   Most public institutions did not have air-conditioning. It was too late to advise the public on hydration and cooling measures and too late to train health professionals. Many agencies could have been involved: the public health services, hospitals, general practitioners, the military and nongovernmental organizations could have intervened, but there was no model of action and a huge task. There were 6 million people at risk, 1 million of these at very high risk, and half a million at high risk and isolated.

5. Deficiencies in communication

   No press conference was held and there were few direct interventions in the mass media offering information and scientific advice.

6. Distrust in political decision-makers

   The case in France also illustrated how a health issue became a political issue. Political interest, however, can hinder effective public health action. Public health action should therefore, wherever possible, be separated from political expediency.

2.1.3 The heat-wave in Portugal

Portugal has an indicator for emergency health alerts, the ÍCARO Index. This was devised through the National Health Observatory and involves the Portuguese Directorate of Civil Protection and the Portuguese National Health Directorate.

Every year it has been getting hotter in Portugal. Three heat alerts were issued in 2003. Preparedness was such that, in each case, an official report was prepared within 24 hours and issued to regional health authorities and the health authorities' network to which health professionals belong. Information was on the web site for citizens, and also for professionals, and a public health emergency telephone line was open 24 hours a day. Emergency consultations were monitored.

The most extreme event was in August ***(Fig. 3)***

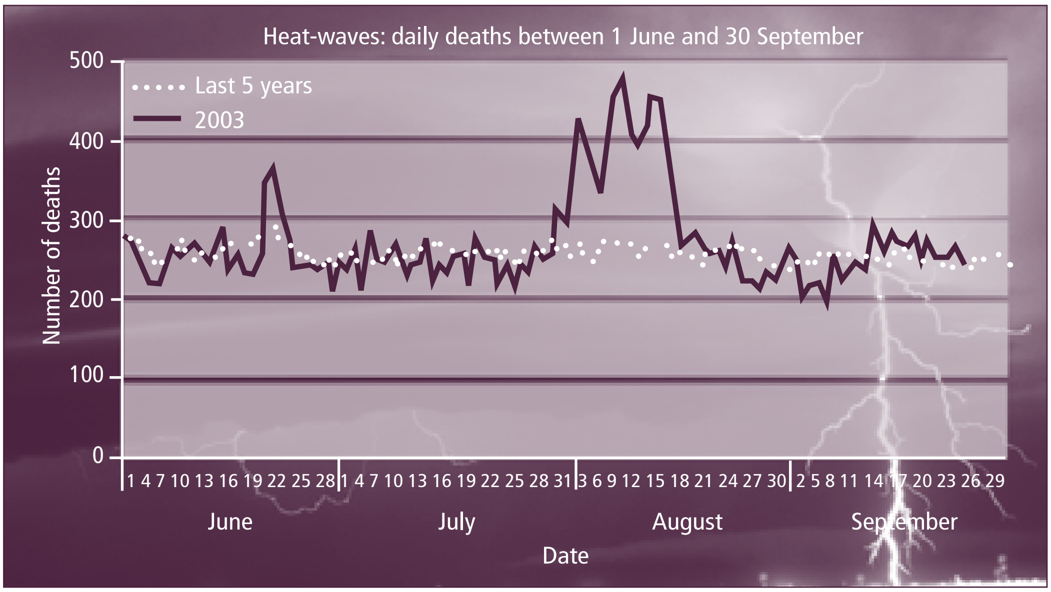

Fig. 3. Deaths during the heat-wave in Portugal in summer 2003 and the average for the previous five years on the same dates

Old people were especially affected, particularly women, and particularly in southern Portugal. Emergency consultations increased by 40%. Daily deaths were monitored; despite the preparedness, overall population deaths rose by 6% between 1 June and 30 September. Deaths among those aged 75 years and older rose by 16% and by 47% in August alone. The death rate in winter 2002/2003 had been much lower than in the same time period in the previous five years.

The ÍCARO system was considered useful for application in the 2003 heat-wave. Likewise, the public health emergency telephone line proved helpful for the population to obtain information and advice. The experience in Portugal enabled a plan to be developed for 2004 including measures targeted at improving liaison with civil protection and information for the public, especially people who live alone. This will mean working more closely with social institutions. New initiatives will include implementing a daily emergency screening sentinel system, improving collection of mortality statistics by sending death certificates to the directorate, and generally simplifying and speeding up information exchange.

2.2 Lessons from the case studies

- Informing the mass media early about health risks and about the measures taken may prevent misunderstanding. Communicating health risks is also important to prevent communication from being driven solely by political objectives.
- Health crises can be very political, and they involve the trust of the public. Being seen as playing down or underestimating the problem risks losing the trust of the public.
- Nevertheless, to avoid unnecessary anxiety and panic, a thoroughly context-adapted choice will have to be made between complete transparency, including the communication of uncertainty, and controlling information.
- Alert systems need to enable quick response to extreme weather conditions. Most weather conditions can pose health risks when they are extreme, but surveillance may not currently be designed to pick up deaths or health problems caused by extreme weather conditions. Health surveillance systems thus require reinforcement.
- An excess number of heat-related deaths among old people may not be recorded quickly because they also have high mortality in the normal physiological course of events. Scanning for excess mortality caused by extreme weather conditions therefore requires monitoring the health status of elderly people more carefully and maintaining human contacts.
- Night-time temperatures strongly predict heat-related death.
- Special caution may be required in holiday seasons to prevent a lack of capacity in the event of an emergency.
- For an unexpected health emergency, a generic indicator such as the ÍCARO Index can help to identify the extreme effects of weather conditions, such as excess morbidity and mortality.
- Establishing public call centres can be an effective measure by providing an additional channel to the public and offering advice, thus tackling exceptional health risks at individual levels.
- Planning for preparedness can help to address chronic health conditions. This is because acute crises can exacerbate or lead to an outbreak of chronic conditions. An example is the outbreak of bronchial asthma due to periods of extreme heat and humidity or diabetic coma or stroke events triggered by heat-related dehydration.
- The public health response should be triggered by an alert from the surveillance system.
- In comparing responses to different threat scenarios, countries seem to be prepared to react to some health threat scenarios – such as the threat of spreading communicable diseases – better than others. Many are less well prepared for the health risk of extreme weather conditions.

2.3 Heat-wave epidemiology

2.3.1 Definition of a heat-wave

A heat-wave has different meanings in different countries, but it is usually understood as excess compared to the average. Many countries have their own definitions both of heat-waves and of deaths from heat-waves. Definitions of heat-waves are based on either air temperature threshold, or air temperature threshold and minimum duration, or indexes based on a combination of air temperature and relative humidity.

A temperature that is normal in the south may be a heat-wave in the north since people get used to their normal climates and the body takes some weeks to acclimatize to new temperatures. There is good evidence that heat-waves early in the summer have greater effects on heat-related morbidity and mortality than heat-waves later in the summer.

2.3.2 Mortality

Several studies have shown that deaths from heat-related causes in the International Classification of Diseases are underreported in mortality statistics. Yet, heat-waves have been long recognized as a risk factor for death, particularly if night-time temperatures are high, and the high temperatures are prolonged. High levels of air pollution, particularly due to ozone, also accompany some heat-waves. In many studies, “excess” mortality is estimated by subtracting the “expected” mortality from the observed mortality and the variety of ways in which this is calculated makes comparisons between events difficult *(Table 1)*.

Table 1. Mortality attributable to selected heat-waves in Europe, 1976–1995

Heat-wave	Attributable mortality	Reference
United Kingdom, 1976	9.7% increase for England and Wales and 15.4% increase for Greater London. Almost two-fold increase in mortality rate among elderly hospital inpatients (but not other inpatients)	Lye & Kamal (1)
Portugal, 1981	1906 excess deaths (all causes, all ages) in Portugal, 406 in Lisbon (in July), including 63 heat deaths	Garcia et al. (2)
Italy, 1983	65 heat stroke deaths during heat-wave in the Latio region. 35% increase in deaths in July 1983 compared with July 1982 among those 65 years or older in Rome	Todisco (3)
Greece, 1987	2690 heat-related hospital admissions and 926 heat-related deaths, estimated excess mortality > 2000	Katsouyanni et al. (4)
United Kingdom, 1995	619 excess deaths; 8.9% increase in all-cause mortality and 15.4% in Greater London compared with moving average of 31 days for that period in all age groups	Rooney et al. (5)

Source: Koppe C et al. (6).

Summer 2003 was one of the hottest documented in Europe for more than 50 years, with many European countries experiencing prolonged, high temperatures (>35 °C), especially in the first two weeks of August *(7)*. Excess deaths among elderly people were reported in several European countries, including France, Italy, Portugal and the United Kingdom, especially in the first half of August *(8)*. Excess mortality was estimated after the event to be almost 15 000 deaths in France, more than 4000 in Italy and more than 2000 in England and Wales. As the public health response in many countries was considered delayed and inadequate, the political ramifications were great – especially in France *(7,9)*. Subsequent descriptive studies undertaken in France identified several risk factors for death related to heat-waves, including old age and residence in a nursing home *(7,10)*. The evaluation in France by the National Institute of Public Health Surveillance *(11)* was followed by assessments in Italy, Spain and the United Kingdom. Further studies are now being undertaken in France and other countries to enable the development of a plan for future use in heat-waves. Table 2 shows the preliminary results of information on the 2003 heat-waves. Further results are expected.

Table 2. Provisional estimates for mortality attributed to the heat-waves in various European countries in 2003

Country	Deaths related to heat	Excess deaths (%)	Time period	Method for estimating baseline (expected mortality)	Reference
England and Wales (United Kingdom)	Not reported	2 045 (16%) 1 495	4–13 August 1–31 August	Average deaths for the same period in years 1998 to 2002 inclusive Average of deaths for same period in years 1998 to 2002 inclusive	Office for National Statistics (12)
France	Not reported	14 802 (60%)	1–20 August	Average deaths for same period in 2000–2002 inclusive	National Institute of Public Health Surveillance (11)
Italy	Not reported	3 134 (15%)	1 June–31 August	Deaths in the same period in 2002	Conti (13)
Portugal[1]	7	2 131	1–31 August	Deaths in same period, 1997–2001	Falcão et al. (14)
Spain	59	Evaluation in process	1 July–31 August	In process	Ministry of Health and Consumer Affairs (15)

Source: Kovats S et al. (16).

[1] Personal communication, Director-General for Health. Portugal, Summer 2003 mortality: the heat-waves influence. Lisbon, December 2003.

2.3.3 Heat-related health effects

The centre for body temperature regulation in the brain (hypothalamus) attempts to keep the body core temperature within healthy limits. At rest this is about 37 °C, but with exercise the temperature can increase to 38–39 °C without any detrimental effect to health, as long as the thermoregulatory system is within its control range.

Staying within the control range requires the body to balance heat production by the body and possible other heat gains (such as solar radiation) with heat loss. Heat is produced as a result of the metabolic activity required to perform activities. Most of the energy the body uses is released as heat. The body can lose this heat by convection (warming of air or water around the body), by conduction (contact with solids, such as the floor), respiration (air inhaled is usually cooler and dryer than exhaled air) and evaporation of sweat.

Skin eruptions, heat fatigue, heat cramps, heat syncope, heat exhaustion and heat stroke are classical heat illnesses. Most heat illnesses (except for skin eruptions and heat cramps) are in essence symptoms of varying severity of failure in the thermoregulatory system.

The least severe form is heat syncope, caused by a failure of the circulation to keep up blood pressure and supply oxygen to the brain. As soon as the person is horizontal, the system recovers quickly. When the muscle pump is active (such as during exercise), blood pressure can be kept up longer and body heating may progress further, together with high cardiovascular stress, leading to heat exhaustion. In such cases, if the high heat load from exercise and/or climate is not removed this may progress into heat stroke, where the extreme body temperature (above 40.5 °C) leads to damage to cellular structures and the thermoregulatory system, with a high risk of mortality. This typically is diagnosed in fit young adults who continue exercising despite feeling unwell, such as during competitions. Heat stroke has a high case–fatality ratio and rapid onset. Complications of heat stroke include adult respiratory distress syndrome, kidney failure, liver failure and disseminated intravascular coagulation *(17)*. Deaths from heat stroke may be underreported because they are similar to other more familiar causes of death, especially coronary or cerebral thrombosis, once the body is no longer hot itself or in a hot environment.

2.3.4 Factors influencing heath illness and death

The main predisposing factors for heat illness are individual, social and environmental factors. Individual factors include: age; lack of capacity for acclimatization; dehydration because of reduced food and liquid uptake; intestinal problems; use of diuretics and alcohol abuse; use of other drugs affecting the temperature regulation system such as phenothiazines and barbiturates and other medicines; poor physical fitness; overweight; fatigue; sleep deprivation; and protective clothing. Environmental factors can include living on higher floors and the type of construction. Social factors are closely linked to environmental and individual factors. Socially deprived people, elderly people and very young people are more susceptible to extreme heat exposure.

3. Chemical and biological threats

3.1 Case studies

3.1.1 Chemical threat in Belgium

"Decision-making structures evolve rapidly: crisis preparation never ends."

In 2001, following the dioxin crisis in Belgium, a Government Coordination and Crisis Centre was established, involving the Ministries of the Interior, Defence, Justice and Public Health. The Federal Public Service (Public Health, Food Chain Safety and Environment) runs the Health Warning Unit to which focal points liaise from the other departments. A 24-hour response capacity was established including a field epidemiology team, crisis management team, the federal public health inspectors, scientific advisers and reference laboratories.

As soon as the first anthrax alert was received in Belgium, a standard procedure for handling packages was designed. The public could ring a dedicated public call centre, a web site was set up containing guidelines and information, press briefings were prepared and professionals were briefed and made familiar with various tools such as special forms to complete, to register unusual pathology. A permanent contact point was agreed. A procedure was established for emergency phone calls, how they should be handled, by whom and in what order to include the police, civil protection and others, with information being faxed to the relevant players. Between October 2001 and June 2003, 1200 hoaxes were received. Considerable energy was used dealing with them, and much mass media coverage was involved.

In October 2001, 711 anthrax alerts were received, declining to 273 in November and 71 in December. They were all negative. However, on Monday, 2 June 2003 at 18:00, three envelopes were reported to contain yellow powder, from which people had developed irritation and sneezing (Fig. 4). The police alerted the Government Coordination and Crisis Centre, and by 22:00 the next day, Antwerp Hospital had identified two toxic agents. The analysis detected adamsite, an irritant gas used in the First World War. On 4 June, the procedures were modified to take into account new risks that did not involve communicable diseases. Ten toxic envelopes were discovered in all and 62 people were diagnosed with symptoms.

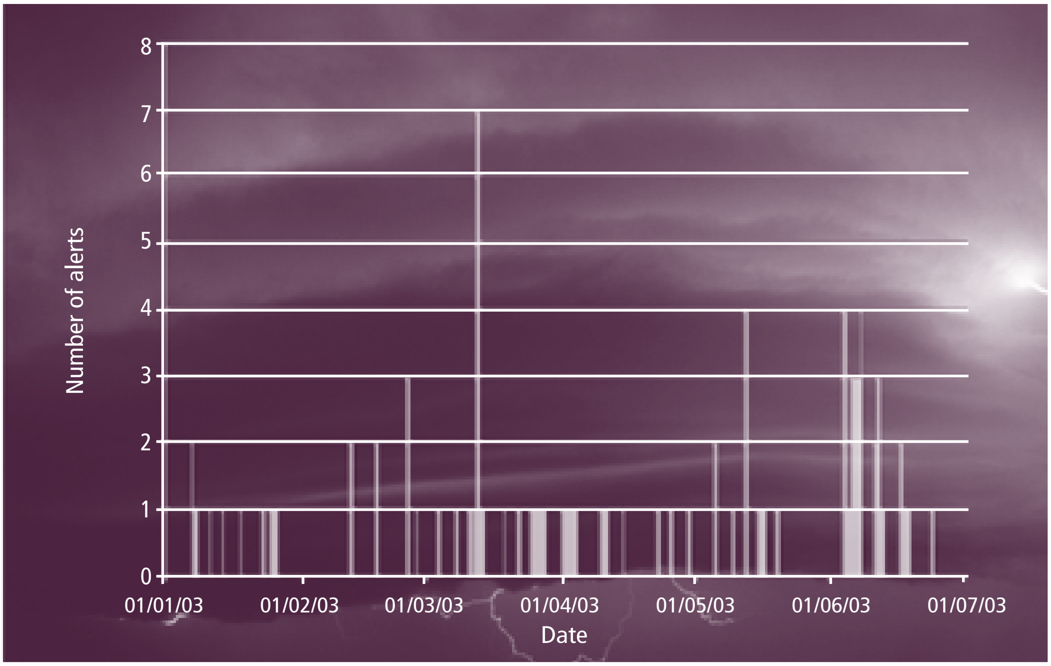

Fig. 4. Number of alerts related to suspected anthrax in Belgium, 1 January to 1 July 2003

A press briefing was held. Although 62 people were affected by a real threat, mass media interest was low because people had got quite used to the alerts.

In retrospect, two problems became clear: the procedures that had been developed for the anthrax alerts had not been applied, and if they had been applied they would not have been adequate for a chemical threat. The police had taken the person affected to a hospital with the envelopes and the hospital made the analysis. It was later realized that there was no medical input into the procedure, which would have been required. Further, the Ministry of Public Health had not hitherto been included in matters involving security services and terrorism. Anthrax had been the only agent targeted, but this threat was chemical, and the procedure had no pre-planned chemical investigation. In addition, the Ministry of Justice and Ministry of Public Health had no formal agreement, which would have been vital. Even by December 2003, the Ministry of Justice had not communicated the final results of the analysis. There was no collaboration between the laboratories of the Ministry of Justice and Ministry of Defence and the regional environmental services for sampling on the sites of the alerts. Emergency wards should be monitored on a daily basis and risk communication messages developed. Internal reorganization was subsequently initiated.

In this kind of crisis, a threat is not only a health threat but can also be a mass media threat triggering a political crisis. Scientific evidence is only part of the decision-making by the authorities and the politicians. The mass media have to be informed and handled carefully, and political considerations must be taken into account. Risk communication must be based on evidence, but crisis communication is different.

The Ministries of Justice, Defence and Interior will all now have their own crisis unit to prevent further crises. But in crisis management, the structure is pared down and has power and resources at its disposal. The conclusions from experience were that decision-making structures evolve rapidly: crisis preparation never ends. Crisis management needs to be stronger and smoother, and evaluation needs to be reinforced. Training and exercises are needed and networks need to be developed further. Establishing who has the leadership in dealing with a crisis is important, for this is still not clear. Finally, always keep an open mind, since the next threat may be quite different from the last.

3.1.2 Smallpox preparedness in Austria

"Having public health measures in place might not get politicians votes but a health crisis can put a minister out of office."

After 11 September 2001, plans were made to cope with the possibility of a smallpox threat. Building on the experience of coping with the threat of bovine spongiform encephalopathy, a plan was devised. The health system is based at the regional level with regional health directors and a centre at the Federal Ministry of Health and Women. The health directors met to discuss preparations. It was agreed in principle that preparedness was key, that medical knowledge and professional education should be improved and that a functioning international network would be needed. With this in mind, the following decisions were taken:

- to establish expert teams at the regional level;
- to devise a general reaction plan so that decision-making can be predicted;
- to establish a direct medical reporting system to the Federal Ministry of Health and Women;
- to develop a plan that would ensure that special laboratory tests would always be available;
- to place emergency plans on the web and to continuously update information for staff on the web site; and
- to stock up pharmaceuticals.

With decision-making at three levels, there should also be access to ministers at a personal level. A minister should be assigned to the coordination board that would coordinate with the police, the military and other public services.

Within six weeks, the Directorate of Public Health set up a task force. It can be contacted by mobile phone 24 hours a day. Arrangements had been made for vaccine purchase and distribution, both liquid frozen and dry frozen, along with the special documentation, procedures and transport according to WHO protocols. Teaching films were made and restricted access arranged for all physicians in Austria. The cooperation of public health professionals on all levels was paramount to ensure maximum acceptance.

The smallpox plan follows the WHO strategy of search and contain, with no mass vaccination unless absolutely necessary. It covers alert levels, contacts, sampling and other aspects. The legal basis in Austria had to be changed to require mandatory reporting and the possibility of quarantine for contacts, to allow non-licensed vaccines to be used in cases of terrorism and to allow compensation for smallpox side-effects.

Austria's response capabilities were tested with severe acute respiratory syndrome (SARS). On a Saturday at 15:00 in spring 2003, decision-makers were alerted through the mass media that three suspected SARS cases had been detected at Frankfurt Airport. By 17:00, the task force was in session, and by 21:00 an action plan was released and information sent to all airports in three languages. All regional health directors were sent early warnings, and by 22:00, all health ministries in the European Union were also informed. The system was shown to work, although it was clear that hospital hygiene guidelines were needed and that SARS diagnosis capacity should be augmented. Immediate information at a political level meant that work could be done undisturbed, and the general action plan, the specific tools and the contact with the mass media had served well overall.

3.1.3 SARS and the Special Olympics in Ireland

On 13 March 2003, WHO issued an unprecedented international health alert on a new disease, severe acute respiratory syndrome (SARS). Ireland responded immediately to this alert. The National Disease Surveillance Centre alerted health boards and issued guidance on infection control, case management, contact tracing and informing the public and professionals. A multidisciplinary expert advisory group to the Minister for Health and Children on SARS (the National SARS Expert Group) was established. By 28 March, SARS was made a statutorily notifiable disease in Ireland. Further measures included establishing an interdepartmental group at government level and health service implementation and communication groups to coordinate the response. Communication measures included press briefings, public advertisements, issuing public information leaflets and posters at airports and web site information. In accordance with WHO advice, the Department of Health and Children issued a travel advisory for those intending to travel to affected areas.

Ireland had a trickle of suspected cases that attracted considerable mass media concern, often misplaced. Both the mass media and health professionals had much anxiety and concern. This became a major political crisis, exacerbated by the public health physicians going on strike in mid-April.

Against this background, Ireland was to host the Special Olympics World Games in June 2003, the Olympics for athletes with learning disabilities. This event was to be held outside the United States the first time; 166 international delegations, 7000 athletes, 3800 coaches, 28 000 families and friends, 30 000 volunteers, 1500 mass media representatives and half a million spectators were expected. Health care services were prepared, including first aid, primary care and hospitals, and the Special Olympics Organizing Committee established a computerized health surveillance system. In April, in light of the ongoing SARS situation, the Special Olympics Organizing Committee asked the Department of Health and Children whether any additional measures would be necessary. The Minister for Health and Children asked the National SARS Expert Group for its advice.

The objectives in making the right decision were to minimize the importation of SARS, to ensure that adequate surveillance and response measures were in place, to minimize disruption to the health services and, last but not least, to minimize disruption to the Special Olympic World Games and the athletes involved. Several options were considered:

- to rely on existing WHO guidance, including exit screening from affected areas together with prompt surveillance and case management if suspected or probable cases arise;
- to quarantine delegates from the affected areas for 10 days before or after their arrival; and
- to ask delegates from affected areas not to travel to Ireland.

In arriving at a decision, the Expert Group considered several factors. SARS was a new disease, and knowledge of its epidemiology and pathogenesis was at a very early stage. The absolute risk of importing a case of SARS was difficult to quantify but was considered very low. However, the risk of a suspected case of SARS arising was estimated to be higher, although this was also difficult to quantify. Some of these athletes could be especially susceptible to respiratory tract infections. Moreover, the nature of the social and group activities planned was such that the contact chain of a suspected case could be very extensive. Diagnosing SARS is mainly a process of exclusion, and ruling out a case could theoretically take up to three weeks. Managing a suspected or probable case and contacts could be extremely disruptive to the individuals concerned and to the Games in general and place severe demands on the health care system in responding to the situation.

The final decision was arrived at after considerable deliberation and difficult decision-making. In the interests of the athletes themselves, the Games and public health generally, delegates from affected areas would be requested not to travel. The Minister for Health and Children accepted this advice and announced it publicly on 14 May.

On the same evening, WHO issued its advice on mass gatherings in the context of SARS. This advice was contrary to the decision that had been taken, warning against "irrational behaviour" and pointing out that the "best defence is not exclusion but good management". There was very considerable adverse mass media and political reaction to the Minister's announcement, with accusations of discrimination and poor judgement. However, following further intense deliberation on this issue by the Expert Group over the following weeks, the advice was not changed, for the reasons already outlined. It was further clarified that the advice applied to affected areas rather than countries and that all delegations should be asked to confirm that no delegate had been in a SARS-affected area within the 10 days prior to travel.

In the following weeks, as the SARS situation evolved, frequent meetings were convened with the Special Olympics Committee and the national Olympic committees of China, Hong Kong Special Administrative Region and Canada. Media interest in the process continued to be intense. The outcome was that the delegation from China was finally limited to those travelling from unaffected areas only. Delegates travelling from all other affected areas spent at least 10 days in an unaffected area prior to arrival in Ireland. Fortunately, by the time the Games were staged in June, the worldwide SARS outbreak had passed.

3.2 Lessons from the case studies

- The fundamental principles of responding to a health threat are identical despite the different threat scenarios. Scenarios help to predict decision-making in crises caused by new diseases or health risks.
- However, different scenarios require different ways of adapting preparedness plans. An infectious agent sent by post presents different risks to a chemical sent by post, and the response has to be different.
- In case of an emergency, standard procedures need to be developed and applied, including guidelines for health and social services professionals; information and advice to the public; and an emergency call service for both professionals and the public.
- Well defined accountability structures in public health systems make rapid reactions to threats much easier. Decision-makers and executives should communicate directly, involving as few layers as possible.
- For prevention and prediction purposes, ministries need to identify personnel whose daily work includes crisis preparedness. This includes training and exercises and strengthening networks.
- Complications and delay should be avoided in the rapid responses required during the first few hours. Although many ministries will be involved in preparedness planning, responding to a health crisis requires paring the structures and arrangements that have been set up down to form a tight team. Thus, ministries such as those responsible for health, justice, defence and the interior should focus decision-making power and resources on a single player or small group that coordinates input to the response from the different ministries.
- Crisis communication is different than risk communication, which is based on the best available evidence. In a crisis, scientific evidence forms only part of the decision-making: mass media and political considerations also have to be addressed.
- There are benefits to be gained from having a single medical reporting system to the health ministry and central laboratory capacity and rapid response on every level possible 24 hours a day.
- In many countries, such as Austria, decision-making for public health is decentralized to the regions. In critical situations, a central public health decision-making hierarchy may need to supersede regional decision-making autonomy, also to enforce mandatory reporting and quarantine and to allow the use of non-licensed vaccines at national levels. Response capacity also needs to be developed through training and exercises at the regional level.
- Training of health professionals is essential – and not only those working in the military. Training health professionals to respond to a sudden health emergency is a prerequisite for effective response systems.
- Mass gatherings can trigger or amplify population health risks.

- National capacity to cope with a surge in demand may need to be upgraded to respond to an exceptional population health risk in the system. Surveillance has to be strengthened to handle such events, along with monitoring structures, national guidelines and control structures.
- Contingency emergency planning requires continuous review locally and nationally with newly occurring threats, such as an influenza pandemic.
- Crisis responses need to be evaluated continually, emergency contingency plans need to be sufficiently flexible to adapt to a new risk and minds need to be kept open for the next risk, which may differ substantially from the last one.

4. Conclusions

Planning for emergencies

This Futures Forum illustrated, through several case studies, the endeavours of health ministries in Member States to further develop their preparedness plans and structures. Contingency emergency plans have proven useful in countries faced by expected and unexpected health threats to the population. Where they are lacking, newly emerging threats may be used to adjust and upgrade emergency preparedness and response systems.

Planning for a response in case of sudden health emergencies involves many agencies, local, regional and national authorities as well as the health ministry. Some health ministries may already operate their own alert systems and data collection, and these may need to be identified and coordinated to facilitate cooperation.

The meeting showed that some of the international threats require coordinated international action. Updating the International Health Regulations, as the legally binding set of regulations for WHO Member States on global alert and response for infectious diseases, is therefore an essential step towards facilitating early warning of emerging threats of international relevance.

European countries require progress in developing common case definitions for health risks related to heat-waves. Where such definitions currently exist, they vary across the European Region. Common indicators would facilitate effective early warnings and alert systems both nationally and across borders.

For European preparedness planning to prevent the spread of infectious diseases, it will need to be considered whether a common stock of vaccines, such as against smallpox and influenza outbreaks, will be feasible if administered by an organization without a vested interest.

Coordinating response

Dealing with an emergency requires a small team, a strict hierarchical structure and clear leadership in decision-making. Directorates of health require access to the ministers involved, in particular the health minister but also ministers responsible for justice, defence and the interior, to keep them informed. Direct access to the prime minister or chancellor at the personal level can prove effective in facilitating a coordinated response.

Developing close liaison between health and social services delivery systems will be useful in applying the lessons of the heat-wave that spread across southern Europe in summer 2003. Some population groups such as very young people, elderly people and migrants are at more risk than others in particular emergencies and therefore need to be identified in advance.

Communicating to the public

Setting out principles of public communication, education and awareness with advance preparation can prevent a health threat from becoming a political crisis. The Futures Forum did not explicitly focus on communication issues. Risk and crisis communication will therefore be the topic of the Sixth Futures Forum.

Commitments of the WHO Regional Office for Europe

The meeting resulted in the WHO Regional Office for Europe making three commitments. First, the Regional Office will share the operational information and knowledge gained through responding to sudden health emergencies and developing emergency contingency plans between countries in the Region.

Second, the Regional Office will make the International Health Regulations and its update well known within the whole Region. Finally, the Regional Office will develop the disaster preparedness and response component of its work.

Annex

Policy tools identified

The following policy tools are listed in alphabetical order. The list does not differentiate between the activities relating to the different time phases of sudden health emergencies. This list should be considered as a starting point for the development of a set of policy tools to be developed towards the end of this Futures Forum cycle on Tools for Decision-making in Public Health. The set of policy tools will be linked to concrete policy illustrations and categorized in the final policy paper.

For reference to definitions of epidemiology-related action (such as epidemiological crisis, alert systems, cluster, epidemic outbreaks, case definitions, multiple case outbreak, hypothesis testing and control measures) please contact the Futures Forum Secretariat for reference to an earlier study by A. Duran, J. Garica and B. Hendrick at: futures@euro.who.int.

Contingency emergency plans

Contingency emergency plans outline "what to do in situation X". They describe the roles and responsibilities of the various actors in the event of a particular incident. They should ideally be developed based on scenario planning, risk assessment, mathematical modelling and economic input. Contingency emergency plans should be tested with live and/or tabletop exercises to ensure that the plans will actually work in practice and to further improve preparedness and strengthen intersectoral work. National and international contingency plans have been developed for a number of scenarios including hot weather *(18)* and deliberate release episodes *(19)*.

Early warning systems

Early warning systems are developed within national surveillance systems. Early warning systems aim to detect unusual events or clusters as early as possible so that appropriate and effective intervention can be undertaken rapidly. This might include vaccination, removing a contaminated food item or isolating an infectious person. National early warning systems can be used for surveillance of infectious diseases and environmental hazards. They can be developed as part of building a national surveillance programme or ad hoc as part of a planned mass gathering such as the Olympic Games *(20)* or in response to an emergency such as refugee crisis *(21,22)*. They should be developed and implemented in a multidisciplinary team involving statisticians, programmers, epidemiologists and policy-makers. Early warning systems can be based on: direct surveillance of the health of the human population; indirectly through environmental monitoring, such as weather *(23,24)*; radiation levels *(25)*; and animal populations, such as horses for West Nile virus *(26)* or insect populations *(24)*. Some systems have multiple elements and incorporate a number of these components, such as monitoring weather, insect and animal populations for the emergence of West Nile virus *(24,26)*. Developing a system for each scenario has its own special requirements, but any early warning system must be an integral component of a surveillance and response system, so that an alert leads to action. Several national centres in Europe have implemented national early warning systems. When an early warning system is being developed within a surveillance system, the key for each situation is to maximize timeliness with the development of local, real-time surveillance to facilitate the accurate and rapid reporting of events and thus to initiate public health action.

International Health Regulations

The International Health Regulations form the basis of an international treaty ratified by all WHO Member States. They are the only legally binding set of regulations for WHO Member States on global alert and response for infectious diseases. The original International Health Regulations obligate Member States to notify WHO of a small number of serious infectious diseases (yellow fever, plague and cholera). "The guiding principle for the International Health Regulations is to prevent international disease spread by early detection of events that threaten public health." These reporting regulations have been in place for several decades but suffer from several weaknesses. In particular, they may not detect unusual disease events of international significance such as SARS. Further, they rely on countries officially notifying WHO of an outbreak, and there is little incentive to report and often even a disincentive to do so because of the potential economic effects. As part of its role in attempting to increase global health security, WHO has been supporting the revision of the International Health Regulations. A new feature will be their explicit focus on public health emergencies of international concern. A notification instrument for determining whether an event is a potential public health emergency of international concern has been developed and is being tested in several Member States. The instrument has a limited set of criteria to assist Member States in deciding whether an event is notifiable related to the seriousness of the event, whether it is unexpected, whether there is a risk of international spread and whether there is a risk of international restrictions to travel and trade. The revised International Health Regulations are expected to be ratified by the World Health Assembly in 2005.

Logistical standby emergency resources

These are multiple and include emergency services, public health services, laboratories, vaccine stocks and equipment. These resources exist in many countries – but not in others. There is thus the issue of logistical support, such as smallpox vaccine, to the countries that lack this capacity. The European Union has generated an overview on the availability and development of medicinal products for various conditions. Many European Union countries have national stockpiles of antibiotics and of smallpox vaccine, although it has been decided that a stockpile at the European Union level would provide no added value over existing national stocks. The United Nations can provide coordination, shelter and health services. Both WHO and the European Union have established an inventory of Level 4 facilities *(27)* needed to process microbiological samples in the event of a deliberate release of a dangerous pathogen. The United States Centers for Disease Control and Prevention has established a Public Health Preparedness and Response Capacity Inventory (http://www.phppo.cdc.gov/od/inventory/index.asp, accessed 22 March 2004). The Inventory is provided as a resource for state and local health departments in the United States undertaking comprehensive assessments of their preparedness to respond to bioterrorism, outbreaks of infectious disease or other public health threats and emergencies but can be used elsewhere.

Modelling and evaluation

Modelling and evaluation contain several activities, including economic evaluation, mathematical modelling, scenario planning and statistical models.

Mathematical models can potentially be used to explore and formally quantify the effects of various interventions in a series of scenarios or scenario planning. Mathematical models are essentially simple mathematical approximations of complex natural phenomena constructed based on knowledge about the epidemiological behaviour of a specific infectious agent (for example) in a population. To build the model, a series of assumptions needs to be made (for example, that measles infection leads to lifelong immunity) and various parameters applied to the model (such as the incubation of an infection). These parameters and underlying assumptions should accurately reflect knowledge already gained about sudden health emergencies, without which the model can have misleading conclusions. The model can be used to predict the future course of an infection in a population and to compare the potential impact of alternative intervention strategies, such as vaccination.

Economic evaluation provides a tool for decision-makers to quantify the potential cost of a sudden health threat and to estimate the comparative cost–effectiveness of alternative intervention strategies. An example is comparing the cost–effectiveness of the use of oral cholera vaccine in a stable refugee population at risk for epidemic cholera compared with a population with endemic cholera *(28)*. There are different types of economic evaluation, including cost–effectiveness, cost–benefit and cost–utility analysis. Economic models, similar to mathematical models, with which economic evaluation is often combined, provide estimates only as good as the underlying assumptions and parameters.

Scenario planning, also known as horizon scanning, involves identifying possible sudden health emergencies. The process usually involves gathering a group of experts to identify possible scenarios. Once scenarios are identified, a formal risk assessment provides a structured approach to using scientific evidence to quantify risks of sudden health emergencies and thus enables priorities to be set among activities for preparedness. In planning for unexpected health risks, a scenario analysis of alternative interventions can help to examine the potential impact of options. This, in turn, can be used in developing preparedness plans. Models have been developed to evaluate potential interventions for many scenarios, including smallpox outbreaks *(19)* and SARS *(29–31)*. For example, in planning for pandemic influenza, authorities in the Netherlands undertook a scenario analysis of alternative interventions *(32)* and examined the potential impact of these options. They concluded that "scenario analysis is a helpful tool for making policy decisions about the design and planning of outbreak control management on a national, regional or local level".

Several statistical and mathematical models have been developed specifically for early warning systems. Approaches used include regression, time series and cumulative sum. Each method operates on a similar principle of comparing the current observed data against historical patterns. An alarm is triggered once a predefined threshold based on historical patterns is exceeded, such as a single suspect case, an increase in incidence above a fixed threshold or an increase in incidence above a variable threshold. The model must account for reporting delays, seasonality, outliers and other factors. These models can be based on any of the data sources (plus others) outlined above.

Several European national surveillance centres have established modelling and economics groups.

National (and international) surveillance

Surveillance is the systematic collection, collation and analysis of public health data for the purpose of intervention. National surveillance is usually linked to early warning systems. Surveillance can be comprehensive or limited to a sentinel. Comprehensive surveillance covers the entire population and is required if a system does not want to miss a single case, such as viral haemorrhagic fever. This approach may create problems with timeliness, which surveillance systems can circumvent by implementing a broader, clinical case definition for initial public health management prior to laboratory confirmation. Sentinel surveillance only covers a proportion of the population and is useful for common infections. An example is a network of primary care physicians who undertake weekly reports of acute respiratory infections that can be used for early detection of epidemics of influenza *(33)*. Emergency departments can also provide a mechanism to rapidly report new diseases or epidemics *(34)*. Non-clinical data sources can also be used, including telephone consultations, absenteeism registers and over-the-counter prescriptions. To further enhance timeliness, more recent innovations have included direct Internet-based reporting rather than paper-based reporting *(35)* and real-time surveillance of electronic medical history information from primary care consultations *(36)*. Examples of surveillance systems organized at the European Union level are: the Health Surveillance System for Communicable Diseases (http://hsscd.euphin.org, accessed 22 March 2004); the European Influenza Surveillance Scheme (http://www.eiss.org/index.cgi, accessed 22 March 2004); and the European Network for Diagnostics of "Imported" Viral Diseases (http://www.enivd.de, accessed 22 March 2004).

Outbreak verification

Outbreak verification means activity at the national or international level to validate a disease outbreak. The outbreak may be reported through (national) surveillance systems, the mass media, experts or rumours. Outbreaks are also verified at the supranational and international levels. The European Union and WHO are involved in gathering intelligence as part of detecting incidents of international significance. WHO, recognizing the importance of mass media and other sources, has developed the Global Public Health Intelligence Network in partnership with Health Canada (http://www.who.int/csr/alertresponse/epidemicintelligence/en, accessed 22 March 2004). This is a semi-automated electronic system that continuously searches key web sites, alert networks and online mass media sites, public health e-mail services and web sites of national governments and public health institutions to rapidly identify information on rumours of unusual disease events. WHO then attempts to verify outbreak rumours with the relevant national authorities after triaging according to a series of criteria related to the seriousness of the disease and its capacity for international spread.

Preparedness plans

Preparedness to respond to health emergencies requires a framework that optimizes the detection and response to both known and unknown risks. This involves several disciplines, including risk assessment, mathematical modelling and economics. Preparedness plans identify and quantify known risks. The purpose of the plans is to ensure that the health and other services can predict, detect and respond adequately and rapidly to both known and unknown risks. Preparedness plans usually contain scenario planning, mathematical models, economic evaluation and contingency emergency plans. Preparedness plans are applied to sudden or emerging health threats. They are usually developed for each disease or health threat. Preparedness plans also contain information about public health infrastructures and resources, including staff and medicines. Examples of national preparedness plans are plans for an influenza pandemic or smallpox.

Public health triaging

Clinical triage systems are well established in hospital emergency departments and refugee camps, which often have limited human and logistical resources, especially at times of overwhelming demand. Priorities are rapidly set using simple algorithms to identify those who need (and would benefit) from immediate clinical intervention. Less severe cases are dealt with later. Public health triaging operates on a similar principle and can also be implemented as part of national surveillance response to a public health alert. An example is responding to a high volume of telephone calls during a public health emergency, such as the anthrax crisis in the United States *(37)*, where a triage protocol allowed high-risk cases to be rapidly identified and managed. Triaging can also be an integral component of an international early warning system, such as the WHO early warning system for central and eastern Europe and the Baltic region, which classifies incidents according to their seriousness.

Rapid assessment procedures

Rapid assessment of a detected sudden health emergency is essential – including the needs of the affected population; the nature of the event, including its epidemiological characteristics; and the interventions to be undertaken. SARS exemplified this process *(38)*. Most national centres have established this resource.

Risk assessment

Formal risk assessment provides a structured approach to using scientific evidence to quantify the risks of sudden health threats and thus enables priorities to be set among activities for preparedness. Risk assessment is often an integral part of scenario planning. Risk assessment has been especially well developed in areas such as microbial risk assessment and environmental sciences. The risks for potential scenarios can be estimated from a variety of sources, including published studies and expert opinion. Sometimes risks remain unknown to public health authorities, such as the risk of deliberate release of smallpox. This process makes these uncertainties explicit.

Risk communication

Risk communication is a vital component of the public health response to a sudden health threat *(39)*. It has been defined *(39)* as “the attempt by science or public health professionals to provide information that allows an individual, stakeholders or an entire community, to make the best possible decisions about their well-being, under nearly impossible time constraints, and to communicate those decisions, while accepting the imperfect nature of their choices”. It is important to implement for both infectious and non-infectious problems *(40)*. Both national and international authorities undertake this activity.

Standby expert networks: national and international

Standby expert networks are networks that can usually be mobilized on request within 24 hours. They exist in many European Union countries. These networks can also provide a resource to assist countries lacking capacity to respond to sudden health emergencies of international significance. The European Union has gathered this information through a programme funded by the Directorate-General for Health and Consumer Protection: the Inventory of Resources for Infectious Diseases in Europe (IRIDE) (http://iride.cineca.org, accessed 22 March 2004). The WHO Global Outbreak Alert and Response Network pools human and technical support for rapidly responding to outbreaks of international importance. This Network is a technical collaboration of over 100 institutions and partners that pools human and technical resources for rapid identification, verification and response to international outbreaks. The European Union has also created national inventories of experts for chemical and biological incidents with criteria on qualifications and experience. These experts could also be available to assist a third country or in an event of international significance. The European Union–funded training programme, the European Programme for Intervention Epidemiology Training (http://www.epiet.org, accessed 22 March 2004), provides a pool of trained European field epidemiologists.

United States Centers for Disease Control and Prevention

The United States Centers for Disease Control and Prevention (CDC) is recognized as the lead United States federal agency for protecting the health and safety of the people of the United States – at home and abroad, providing credible information to enhance health decisions and promoting health through strong partnerships. It is referred to here because decision-makers in the United States usually use CDC as a key tool in sudden health emergencies. CDC serves as the national focus for developing and applying disease prevention and control, environmental health and health promotion and education activities designed to improve the health of the people of the United States. It also provides technical reports, fact sheets and guidelines for the public in sudden health emergencies. An example of this is tips on preventing and managing heat (http://www.cdc.gov/nceh/hsb/extremeheat/heattips.htm, accessed 22 March 2004).

The CDC, located in Atlanta, Georgia, is an agency of the United States Department of Health and Human Services. The European Union is establishing an international centre for disease control in Sweden based on a similar model.

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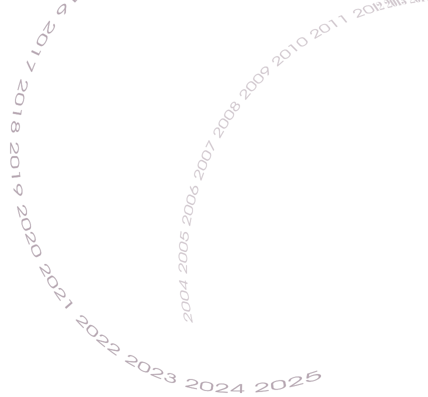
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