



Public health response to extreme weather and climate events

Working paper

Summary

Severe floods, windstorms, heat-waves and cold-waves have caused dramatic political, social, environmental and health consequences in Europe over the past few years. In response to these events, ministries of health and other public health authorities, along with national and international meteorological services and organizations, are focusing increased attention on developing appropriate strategies and measures to prevent health effects from extreme weather and climate events in the future. Efforts are being made to understand the lessons learnt from recent events, to evaluate the effectiveness of the measures taken and early warning systems in place, and to use the knowledge gained to target future activities. The recent events have also increased interest in whether the intensity and frequency of future extreme weather and climate events could be expected to change as one result of a changing climate.

With this in mind, a working group organized by the World Health Organization (WHO) and the European Environment Agency (EEA) has made the following recommendations.

1. The political, social, environmental and health consequences of extreme weather events have increased in Europe in recent years. We recognize that the climate is already changing, and that the intensity and frequency of extreme weather events, such as floods, heat-waves and cold-waves, may change in the future. These events will continue to pose additional challenges to current and future populations, in terms of health risk management and the reliability of infrastructure, including health services, power supply and others.
2. There is a need for ministries of health and other ministries to recognize that actions must be taken to reduce the current and future burden of disease due to extreme weather and climate events and to include the prevention of health effects due to weather and climate extremes among national health priorities.
3. We urge ministries of health and other ministries, as well as research institutions, to improve our understanding of the regional and national burden of disease due to weather and climate extremes and to identify effective and efficient interventions, such as early warning systems, surveillance mechanisms and crisis management.
4. We urge effective and timely coordination and collaboration among public health authorities, meteorological services and agencies (national and international), emergency response agencies and civil society in developing local, regional and national monitoring and surveillance systems for the rapid detection of extreme weather events and their effects on public health; developing civil emergency and intervention plans, including activities to prevent morbidity and mortality due to weather and climate extremes; and improving public awareness of extreme weather events, including actions that can be taken at individual, local, national and international levels to reduce impacts.
5. We call on WHO, through its European Centre for Environment and Health, in collaboration with the World Meteorological Organization, the European Commission, EEA and other relevant organizations, to support these commitments and to coordinate international activities to this end. In particular, there is a need to develop guidelines for estimating the burden of disease due to weather and climate extremes; to develop indicators for intercountry and intracountry comparison and monitoring of progress; to coordinate the development of new methods, including sentinel monitoring and surveillance systems, to provide timely information on the health impacts of weather and climate extremes at the European level; to develop and evaluate more effective and efficient interventions, such as early warning systems, to reduce negative impacts; and to

harmonize interventions across regions and countries to facilitate the sharing of data and lessons learnt.

Background

1. Severe floods, windstorms, heat-waves and cold-waves have affected the World Health Organization (WHO) European Region during the last few years. Their political, social, environmental and health consequences have stimulated debate on whether appropriate action might, at least in part, prevent the health effects of such extreme weather and climate events. In response, the European Environment and Health Committee and the WHO Regional Committee for Europe requested that the WHO European Centre for Environment and Health (ECEH) organize a meeting to exchange information and to discuss and develop recommendations on public health and environmental responses to weather and climatic extremes, to be submitted to the European Member States at the Fourth Intergovernmental Preparatory Meeting in Malta. The meeting on “Extreme weather events and public health responses”, held in Bratislava on 9 and 10 February 2004, was convened by WHO, in collaboration with the European Environment Agency (EEA), and hosted by the Ministry of Health of Slovakia. This document presents its recommendations concerning actions to identify, prevent and reduce the health impacts of extreme weather and climate events, in particular floods, heat-waves and cold-waves. In developing these recommendations, the organizers and participants incorporated the available knowledge and experience of the many international, European, national and local initiatives on the subject, in order to avoid overlaps and duplication.

Synopsis of the issue

Potential changes in the intensity and frequency of extreme weather and climate events

2. Europe has experienced an unprecedented rate of warming in recent decades. Between 1976 and 1999, the average number of periods of extreme warmth each year increased twice as fast as the corresponding reduction in the number of periods of extreme cold. Over the same period, in most of Europe, the increase in the mean daily maximum air temperature during the summer months was greater than 0.3 °C per decade. For example, the frequency of very hot days in central England has increased since the 1960s, with extremely hot summers in 1976, 1983, 1990 and 1995. Sustained hot periods have become more frequent, particularly in May and July.

3. It is predicted that the current increasing instability of the climate system may lead to increased climate variability and, with it, a change in the frequency and intensity of extreme temperatures. An unprecedented heat-wave affected the European Region in the summer of 2003. The intensity and duration (two weeks) of the heat-wave in France was exceptional in the country’s meteorological history.

4. Climate variability is expected to increase with rising ambient air temperatures. Cold-waves are expected to continue to affect areas already vulnerable to cold temperature extremes. The wind and ice storms that may be associated with cold-waves could cause interruptions in electricity supplies in several countries.

5. Flood hazards and associated health risks have increased in many areas because of a number of climatic and non-climatic factors. The latter include the impact of changes in terrestrial systems (hydrological systems and ecosystems) and economic and social systems. Land use changes, which induce land cover changes, affect the rainfall–runoff relationship.

Deforestation, urbanization and reduction of wetlands decrease the available water storage capacity and increase the runoff coefficient, leading to growth in flood amplitude and reduction of the time-to-peak. Urbanization has adversely influenced flood hazards by increasing the extent of impervious areas. In addition, more industrial and human activities are carried out in flood-prone areas. Flood losses in 2002 were higher than in any single year in the past. The floods in central Europe in August 2002 (on the rivers Danube and Elbe and their tributaries) caused damage exceeding €15 billion. Damage was also caused to water and electricity installations and health care institutions.

Recommendation A

The political, social, environmental and health consequences of extreme weather events have increased in Europe in recent years. We recognize that climate is already changing, and that the intensity and frequency of extreme weather events, such as floods, heat-waves, and cold-waves, may change with a changing climate. These events will continue to pose challenges to current and future generations, in terms of health risk management and the reliability of infrastructure, including health services, power supply, and others.

Extreme weather and climate events pose a risk to human health in the European Region

6. A heat-wave struck France in early August 2003 after warmer than average temperatures in June and July. The period from 4 to 12 August broke all historical records since 1873 for Paris in terms of minimum, maximum and average temperatures, and duration. This unprecedented heat-wave, associated with high levels of air pollution, was accompanied by excess mortality that began early and rose quickly: 300 excess deaths on 4 August, 1200 on 8 August and 2200 on 12 August. Total excess mortality between 1 and 20 August, compared with average daily mortality for the period 2000–2002, was 14 802. This represents an increase of 60% in mortality from all causes. The observed excess mortality particularly affected the elderly (70% for those aged 75 years and over), but was also severe for those aged between 45 and 74 years (30%). In all age groups, female mortality was 15% to 20% higher than male mortality. Almost the whole country was affected by the excess mortality, although its intensity varied significantly from one region to another: 20% in Languedoc-Roussillon (south), but 130% in Île-de-France (Paris and suburbs). The excess mortality clearly increased with the duration of extreme temperatures. The mortality rate was highest in nursing homes where the number of deaths observed was twice that expected.¹

7. High excess mortality rates were also observed in other European countries, such as Italy, where general mortality for all ages in the 21 capitals of the Italian regions was 15% higher than during the same period in 2002; in particular, the figure for those aged 75 years and over was 21%. It may be noted that deaths of elderly people represent more than 90% of the overall excess mortality. Portugal recorded a 26% increase in mortality in August 2003 compared to the average of the previous five years. Information on the full extent of the impacts of the 2003 heat-wave will be available soon.

8. Studies from several countries indicate that mortality risk increases every winter in all European countries. During cold-waves, increased risk of injuries and frostbite has been observed in northern central Europe, northern Europe and the mountainous regions of Europe. Cold-waves may affect cardiovascular and peripheral diseases, cerebrovascular diseases and

¹ Impact sanitaire de la vague de chaleur d'août 2003. *Bulletin épidémiologique hebdomadaire*, 2003, 45–46.

respiratory diseases, and may contribute to communicable diseases. Cold-waves are likely to affect poorer and marginalized population groups more severely.

9. Health impacts of floods can occur during or after flooding events. Relatively low numbers of flood-related deaths are recorded in Europe in comparison with other regions. Between 1980 and 2002, 260 flooding events resulted in 2500 victims.² The number of deaths associated with flooding is closely related to the life-threatening characteristics of floods (rapid rising of water, deep flood water and objects carried by the rapid flow of water) and the behaviour of victims. Injuries (such as sprains, strains, lacerations and contusions) may occur during flooding, but are more frequent in the aftermath of a flood disaster as residents return to their homes to clean up damage and debris. Infectious diseases are not common and are normally confined to illnesses endemic to the flooded region. Most of these illnesses are attributable to reduced sanitation or to overcrowding among displaced people. Some studies have shown an increased incidence of common mental health disorders for long periods after a flooding event. Anxiety and depression may last for months and possibly even years after the flood event and so the true health burden is rarely appreciated. During the 2002 floods in Dresden, two public health issues needed immediate attention: 1) the maintenance of public hygiene; and 2) the problems involved in evacuating complete hospitals.

Recommendation B

There is a need for ministries of health and other ministries to take actions to reduce the current and future burden of disease due to extreme weather and climate events and to include the prevention of health effects due to weather and climate extremes among national health priorities.

Knowledge gaps in risk assessment and management

10. Assessment of the environmental and health consequences of heat-waves has highlighted a number of knowledge gaps and problems in public health responses. 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. Knowledge gaps exist: in characterizing the relationship between heat exposure and a range of health outcomes; in understanding interactions between harmful air pollutants and extreme weather and climate events; in harmonizing episode analyses; and in evaluating the effectiveness of heat-related public health interventions. There is ongoing debate on whether and how to develop heat health warning systems, provide space cooling in particular locations and develop public advice and community-based activities that support the social and medical welfare of the elderly and other high-risk groups in order to reduce their vulnerability to temperature extremes. Cost-effectiveness analyses will be needed.

11. The vulnerability of European populations to extreme weather and climate events depends on the type of natural hazard, the geographical location, the capacity to anticipate the risk, the capacity to intervene and resist, and the ability to recover from the impact of the events. For example, although risk of flooding is clearly confined to coastal and mountain and riverbed areas, very little systematic knowledge is available on certain groups within communities at risk (e.g. the elderly, the disabled, children, women, ethnic minorities, those with low incomes and

² EM-DAT: The OFDA/CRED International Disaster Database. Brussels, Université Catholique de Louvain (<http://www.cred.be/emdat>, accessed 27 February 2004).

those living alone) or on public and health care infrastructure at risk. This is aggravated by the increasing populations in flood-prone areas and major economic and industrial activities carried out there. Flood protection is based on structural and non-structural measures. The level of available structural measures depends on the flood return periods. There is a need for more, better quality, epidemiological data before vulnerability indices can be used operationally to minimize the effects of flooding. With better information, the emphasis in disaster management could move from post-disaster improvisation to pre-disaster planning. A comprehensive, risk-based emergency management programme of preparedness, response and recovery would have the potential to reduce the adverse health effects of floods.

12. While public health authorities have begun to respond to heat-waves, cold-waves and floods, and in some cases have initiated programmes to prepare their populations and increase their capacity to tolerate extreme weather events, more work needs to be done to describe these responses and to evaluate their effectiveness.

Recommendation C

We urge ministries of health and other ministries, as well as research institutions, to improve the understanding of the regional and national burden of disease due to weather and climate extremes and the identification of effective and efficient interventions, such as early warning systems, surveillance mechanisms and crisis management.

Risk management and communication

13. The health crisis in France caused by the heat-wave in 2003 was unforeseen and was only detected belatedly. Health authorities were overwhelmed by the influx of patients; crematoria and cemeteries were unable to deal with the influx of bodies; and retirement homes were under-equipped with air-conditioning or space cooling environments and manpower. The crisis was compounded by the fact that many elderly people were living alone without a support system and without proper guidelines to protect themselves from the heat. The heat-wave highlighted several problems in public health systems, including the limited number of experts working in the area of environment and health and the need for a significant improvement in the exchange of information between several public organizations and agencies, as well as a clear definition of responsibilities in this area.

14. Fortunately, other countries were affected to a much lesser extent. We therefore do not know how other countries or federal health systems would have managed with this level of crisis. However, there are some commonalities that are important to consider. First, the population of Europe is ageing and more elderly people are living alone. Second, the health and environment surveillance mechanisms needed to rapidly detect an “epidemic” due to a heat-wave do not exist. Finally, there is a lack of definition of responsibilities.

15. In 2002, the Council of Europe assessed the level of implementation of the Yokohama Strategy for the EUR-OPA Major Hazards Agreement.³ The Yokohama Strategy stressed that more attention should be paid to prevention. The results of the 26-country assessment showed that there is a complex distribution of competences in the management of natural and man-made

³ Member States signatory to the EUR-OPA Major Hazards Agreement: Albania, Algeria, Armenia, Azerbaijan, Belgium, Bulgaria, Croatia, Cyprus, France, Georgia, Greece, Lebanon, Luxembourg, Malta, Republic of Moldova, Monaco, Morocco, Portugal, Romania, Russian Federation, San Marino, Spain, The former Yugoslav Republic of Macedonia, Turkey, Ukraine.

hazards. There is also a lack of coordination; poor rehabilitation mechanisms; and poor sanction and control mechanisms. Most attention is focused on crisis management and relief interventions in case of a disaster; these are designed to address the most urgent needs of the affected population. It is certainly positive that much has been invested in improving the speed and efficiency of relief intervention, but it should not be forgotten that many interventions could be avoided through better risk prevention and much human suffering could be reduced with structural compensation mechanisms.⁴

16. Flood risk management has been carried out for many years by a variety of organizations, commissions and agencies at international, national, river-basin and local levels. However, with larger vulnerable populations and more complex infrastructures, consideration must be given to including health aspects in (national) flood prevention plans. The possibility of climate change in decades to come further emphasizes the need for early warning and flood forecasting. A major risk in operating early warning systems lies in the possibility of false alarms, due to either under- or over-prediction of the hazard. An effective early warning and forecasting system that extends reaction time should be supported by meteorological information and the earliest possible warning of extreme weather conditions. A European Flood Alert System (EFAS) and a European Flood Forecasting System are being developed for a large part of Europe.⁵ These forecasting systems should be used by the major health care providers and emergency managers.

17. So far, little information has been provided to the general public on how best to protect themselves from extreme weather and climate events. For this to be done, consensus needs to be built throughout Europe on the most effective measures and educational tools. Public participation in decision-making is a cornerstone of the successful implementation of integrated intervention plans. Important public information includes guidance on public health measures before, during and after floods, and on behavioural measures before, during and after heat-waves and cold-waves.

Recommendation D

We urge effective and timely coordination and collaboration among public health authorities, meteorological agencies (national and international), emergency response agencies and civil society in developing local, regional, and national monitoring and surveillance systems for rapid detection; developing civil emergency and intervention plans, including activities to prevent morbidity and mortality due to weather and climate extremes; and in improving public awareness of extreme weather and climate events, including actions that can be taken at individual, local, national and international levels to reduce impacts.

International cooperation

18. Weather and climate do not have borders, and so the entire European Region is at risk from the health impacts of extreme weather and climate events. Preventive measures, policies and strategies must therefore be part of a coordinated international effort to enhance and protect human well-being today and tomorrow.

⁴ *Comparative study of the regulations concerning major risk management in the 26 Member States of the Council of Europe's EUR-OPA Major Hazards Agreement*. Strasbourg, Council of Europe, 2003 (document AP/CAT (2003) 39).

⁵ *Best practices on flood prevention, protection and mitigation*. Discussion paper for review by the Water Directors of the European Union (EU), Norway, Switzerland and Candidate Countries at their meeting in Athens on 17 and 18 June 2003 (http://www.floods.org/PDF/Intl_BestPractices_EU_2004.pdf, accessed 1 March 2004).

19. There are many ongoing international activities, such as the UNECE guidelines on sustainable flood prevention and those for flood follow-up described in the European Water Directors' best practices guide. The World Meteorological Organization (WMO) and its national meteorological offices have a primary mandate to provide quick and reliable weather and climate information. Currently they are developing weather "indices" for human well-being and are involved in flood forecasting and weather forecasting activities, as well as in the development of showcases on "heat health warning systems". EEA is developing indicators, including some to express the impacts of heat-waves and floods on the environment and human health.

20. As indicated earlier, there is a need to develop guidelines to estimate the burden of disease due to weather and climate extremes, as well as to develop indicators for intra- and intercountry comparison and monitoring of progress. WHO and other organizations should provide guidance in this and set up international scientific teams. With the help of WMO, it may be possible in the future to provide timely information on the health impacts of weather and climate extremes at European level. It is very important to learn from lessons experienced at national and local levels. International cooperation might help to make this information available more widely and assist other countries in the development of similar measures and strategies. Civil protection agencies, the International Committee of the Red Cross and other organizations have long experience in risk preparedness and response, and could share that experience with national and local authorities. There is a particular need to develop optimal techniques for monitoring the health of populations during extreme weather events; monitoring sentinel health conditions may be one approach to the early recognition of effects on population health.

Recommendation E

We call on the World Health Organization, through its European Centre for Environment and Health, in collaboration with the World Meteorological Organization, the European Commission, the European Environment Agency, the International Committee of the Red Cross and other relevant organizations, to support these commitments and to coordinate international activities to this end. In particular, there is a need to develop guidelines for estimating the burden of disease due to weather and climate extremes; to develop indicators for intercountry comparison and monitoring of progress; to coordinate the development of new methods, including sentinel systems for monitoring and surveillance, to provide timely information on the health impacts of weather and climate extremes at European level; to develop and evaluate more effective and efficient interventions, such as early warning systems, to reduce negative impacts; and to harmonize interventions across regions and countries to facilitate the sharing of data and lessons learnt.

Conclusion

21. Based on this document, it is recommended that ministries of health and other ministries commit themselves to taking action to reduce the current burden of disease due to extreme weather and climate events. We call on the World Health Organization, through its European Centre for Environment and Health, in collaboration with the World Meteorological Organization and other relevant organizations, to support these commitments and to coordinate international activities to this end. We also recommend that progress should be reported on at the intergovernmental meeting in 2007.