



**Fact Sheet EURO/04/03
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Extreme weather events: health effects and public health measures

Health effects

Heat-waves

There is evidence that prolonged periods of unusually high temperatures increase morbidity and mortality. Epidemiological studies indicate that, people aged over 65 are the population at greatest risk.

The centres in the brain that regulate body temperature attempt to keep core temperature within healthy limits. At rest, this temperature is around 37 °C, but with exercise it can increase to 38–39 °C without harm to health. To stay within the control range, the body needs to balance its heat production and other possible heat gains (from, for example, solar radiation) with heat loss. The body can lose this heat by convection (warming of air or water around it), by conduction (contact with solids, such as the floor), by respiration (inhaled air is usually cooler and dryer than exhaled air) and by evaporation of sweat.

Classical heat illnesses include, in order of increasing severity, skin eruptions, heat fatigue, heat cramps, heat syncope, heat exhaustion and heat stroke. Most of these (except skin eruptions and heat cramps) are symptoms failures in the thermoregulatory system of varying severity.

A failure to keep up blood pressure and supply oxygen to the brain causes heat syncope. As soon as the affected person is horizontal, the system recovers quickly.

Heat stroke results from a high heat load produced by active muscle pumping due to exercise or climate; if not reduced quickly, the extreme body temperature (above 40.5 °C) will cause damage to cellular structures and the thermoregulatory system, with a high risk of death. Complications of heat stroke include adult respiratory distress syndrome, kidney failure, liver failure and disseminated intravascular coagulation. Deadly heat strokes may be underreported because they are similar to other, more familiar causes of death, particularly coronary or cerebral thrombosis, once the body is no longer hot itself or in a hot environment.

As elderly people are likely to be less fit, they can suffer from heat illnesses at low levels of exercise or even without exercise. Low fitness levels lead to a low cardiovascular reserve and thus to low heat tolerance. Older people may be vulnerable to heat because of changes in their regulatory system or because of the presence of drugs that interfere with normal homeostasis.

With impaired homeostasis, elderly people may not be aware that high temperature is making them ill and therefore may not take action to reduce their exposure.

During a heat-wave, a number of factors might facilitate the start of heat illness:

- dehydration due to reduced food and liquid intake or disease;
- reduction of sodium due to excessive loss of liquid;
- alcohol abuse;
- use of drugs such as diuretics, beta-blockers, anticholinergics, digitalis and barbiturates, especially combined with hypertension;
- acute diseases such as diarrhoea, fever, infections or skin burns; and
- chronic conditions such as mental illness, obesity and hypertension.

Flooding

Direct or indirect health effects can appear during or immediately after flooding, in the first days or weeks afterwards or over a period of months or years.

Direct health effects occur during the flood itself and are caused by the flood-water. Floods can cause deaths from drowning, heart attacks and injuries. The number of deaths is closely related to the life-threatening characteristic of floods (rapidly rising and deep waters and objects carried by rapidly flowing water) and the behaviour of victims. In addition, injuries (sprains/strains, lacerations, contusions, etc.) are likely to occur during and after a flood, as people return to their homes to clean up damage and debris.

Indirect health effects can be the consequence of damage to major infrastructure and property. They include: infectious diseases, poisoning and post-traumatic stress disorder.

Cases of infectious disease (gastrointestinal diseases, dermatitis, conjunctivitis) might occur, but are normally confined to illnesses endemic in the flooded region. Rare cases of vector- and rodent-borne diseases, however, have been observed. The rates of infectious disease may increase because of a reduction in sanitation or overcrowding among displaced people. The rupture of underground pipelines, dislocation of storage tanks, overflow of toxic waste or release of chemicals stored at ground level can cause poisoning. Aside from the trauma caused by the flooding itself, geographical displacement, damage to the home or loss of familiar possessions and often lack of insurance might contribute to causing post-traumatic stress disorder, resulting in anxiety, depression, psychosocial disturbances and sometimes suicide. Mental health problems may continue for months or even years after the flood.

The effects of flooding can be particularly devastating to already vulnerable populations, such as children, elderly and/or disabled people, ethnic minorities and those with low incomes.

Public health measures to prevent and manage health effects

Heat-waves

Preventing harmful effects requires measures taken by individuals, the inclusion of heat-waves in emergency planning and the reduction of heat stress in the indoor and outdoor environments.

For individuals, the prevention of heat-related illnesses should directly address the functioning of relevant systems in the body. People can act immediately to reduce the heat load (through

appropriate clothing, a cool environment, etc.), but the ultimate goal is to maintain the body's natural defence systems through rehydration, fitness, acclimatization and reduction of excess weight.

Current evidence indicates that government services and health agencies might underestimate the health risks of heat-waves, and should include them in planning to cope with emergencies at the local and national levels. The authorities need knowledge on social factors, such as the size and living conditions of vulnerable groups, such as people who are elderly or mentally ill, and on the capacity of hospitals and other health facilities to treat patients with heat-related illness. In many cities across the world, the meteorological services provide a "heat warning" when the temperature and/or humidity crosses a certain threshold. A survey in the WHO European Region showed that only two cities have comprehensive heat health warning systems: Lisbon, Portugal; and Rome, Italy. They use a synoptic approach that identifies air masses that have been associated with adverse effects on mortality in the population. Similar warning systems are under development in Barcelona, Spain; Budapest, Hungary; London, United Kingdom; and Paris, France.

At home and at work, people in the European Region spend the vast majority of their time indoors. The indoor environment has been investigated for indices of thermal comfort: in temperate climates, the optimum indoor temperature is 18–24 °C.

Temperatures are higher in urban areas, owing to many factors, including increased heat production through heating, reduced loss of heat in the urban canopy layer, lower wind velocities and increased exposure to radiation. Heat-waves present special problems in urban areas because buildings retain heat at night if ventilation is inadequate. During heat-waves, city dwellers may experience sustained thermal stress both day and night, while people in rural areas often obtain some relief from thermal stress at night. Urban planning is therefore assumed to play an important role in the primary prevention of heat stress.

Flooding

The probability of an increase in frequency and intensity of floods is a strong argument in advocating preparedness as the chief reaction to the risk of flooding. The emphasis is shifting from disaster response to risk management. Early warning of the risk of flooding and an appropriate response by the population have been shown to reduce the threats to health.

Local and central authorities can organize and coordinate relief activities, including:

- initiatives to ensure water quality, food safety, sanitation and hygiene;
- precautions during clean-up activities;
- immunization when appropriate;
- protective measures against potential vector-borne diseases and chemical hazards; and
- measures to ensure mental health and well-being, such as stress reduction and counselling for both the people affected by the emergency and those who respond to it.

Important tasks to carry out both during and after floods include monitoring and surveillance of flood-related diseases, mapping of potential risks, estimating the vulnerability of communities, making an inventory of existing resources and implementing national and regional coordination mechanisms, to ensure an appropriate response to any unforeseen development. Risk management should include appropriate land-use planning to ensure safety; for example,

kindergartens, schools, hospitals and other health care institutions should be out of flood-prone areas.

Annual national campaigns can raise the public's awareness of flood risks. Flood hotlines have been launched in some countries. Self-help measures to reduce the damage to property and the stress caused by flooding are increasingly encouraged. These measures include flood proofing properties, developing community preparedness initiatives and the making of family flood plans by households living in flood-prone areas. Each member of the family or household should be familiar with the plan and know what action to take in the event of a flood, such as contacting other family members, evacuating the family and applying precautions at home (such as turning off power supplies).

Further information on the WHO Regional Office for Europe **global change and health programme** (<http://www.euro.who.int/globalchange>) is available on the Regional Office web site.

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