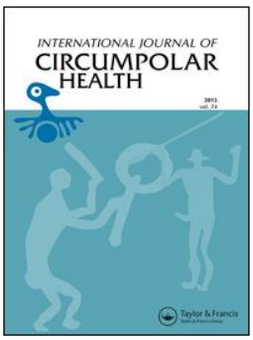

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ORIGINAL ARTICLE

PREVENTION AND MANAGEMENT OF HEALTH HAZARDS RELATED TO HEATWAVES

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ABSTRACT

Objectives. The general aim of the EuroHEAT project was to improve public health responses to weather extremes and, in particular, to heatwaves.
Study design. The public health responses were developed on the basis of the overall results from the two-year project, "Improving Public Health Responses to Extreme Weather – EuroHEAT," co-funded by the European Commission (DG Sanco).
Methods. A literature review was carried out and a questionnaire was administered to health officials in charge of heat-health action plans in 2005 to survey existing heat–health action plans in Europe, and to identify models of the good practices for national/local preparedness planning.
Results. The adverse health effects of heatwaves are largely preventable. Prevention requires a range of actions at different levels: from health system preparedness coordinated with meteorological early warning systems to timely public and medical advice and improvements to housing and urban planning. These actions can be integrated in a defined heat-health action plan. Guidance for the development of heat–health action plans has been made available through EuroHEAT and is being used in various countries in the European Region.
Conclusions. EuroHEAT recommends developing and implementing heat-health action plans at the national and regional levels in Europe to prevent, react upon and contain heat-related risks to health.
(Int J Circumpolar Health 2009; 68 (1):8–22)

Keywords: climate change, heatwaves, mortality, public health interventions, heat–health action plans

INTRODUCTION

Climate change is projected to lead to an increase in the frequency and intensity of extreme weather events, including heatwaves (1). In the WHO European Region, many countries experienced major heatwaves, floods and droughts that have led to deaths and human suffering, social disruption and a substantial burden on health systems. More than 44,000 additional deaths were recorded in August 2003 in 12 European countries (2). The city-specific exposure-response functions have a V-shape, with a change-point that varies among cities. The temperature level corresponding to the minimum mortality rate (threshold) varies from city to city, and across different latitudes according to the local climate. The meta-analytic estimate of the threshold was 29.4°C for Mediterranean cities and 23.3°C for north-continental cities (3). In 9 European cities analysed in EuroHEAT (Athens, Barcelona, Budapest, London, Milan, Munich, Paris, Rome and Valencia), the estimated increase in mortality ranged from 7.6% to 33.6% during heatwave episodes (Fig. 1). The impact of longer heatwaves on mortality (i.e., more than 4 days) was 1.5 to 5 times higher than that of short heatwaves. The heatwave effect was stronger in the elderly, and the highest increase was observed in Athens, Budapest, London, Rome and Valencia in persons over 75 years of age. Some people are less able to cope with heat stress than others. A wide range of chronic diseases and medical treatments, social isolation and some types of occupation increase the risk of heat stress in individuals (4,5). Across Europe, housing and socio-economic conditions showed varying influence on the impacts of heat on health in the populations. Studies showed that – apart from heat-related causes such as heatstroke, hyperthermia and dehydration – the greatest excess mortality during heatwaves was attributable to cardiovascular, cerebrovascular and respiratory diseases, as well as diseases of the nervous and endocrine system (3,6–10). Hospital admissions due to respiratory disease, particularly in the age group older than 75 years, increased with high temperatures, while changes in admissions due to cardiovascular disease did not reach statis-

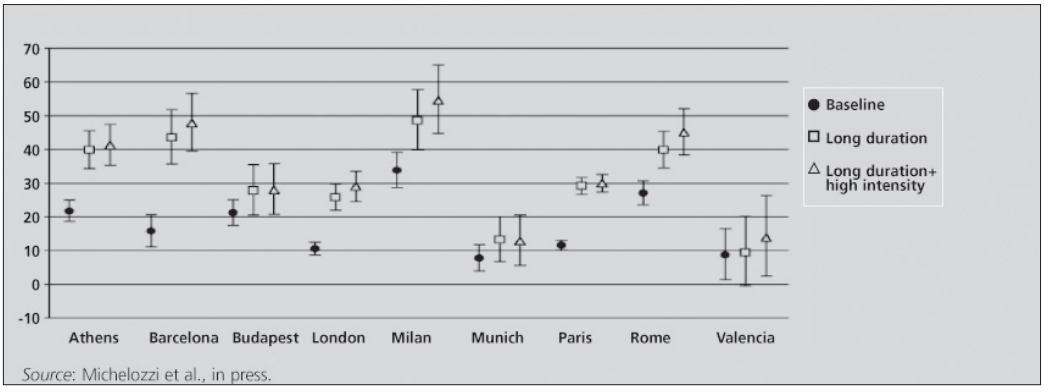

Figure 1. Effect of heatwaves from 1990–2004 with different characteristics on total mortality among people aged 65+ (% increase and 90% confidence interval). Duration was classified as: short duration <4 days and long duration >4 days; intensity was classified as: low intensity for temperature values lower than 95th percentile and high intensity for temperature values higher than 95th percentile of its monthly distribution (Matthies et al., 2008; WHO, in press).

tical significance in the 12 European countries investigated (11). A time-series analysis in 10 European countries showed a linear association between ambient temperature and the number of reported cases of salmonella infections, many of them due to inappropriate storage and preparation of food (12).

For heatwave deaths in the elderly in England and Wales, excess mortality was similar for deaths occurring at home, in hospital or in care homes (nursing and residential), and no effect of the heatwave was apparent for deaths in "other places" or deaths in hospices. Although case-control studies have identified socially isolated individuals who live alone as being at very high risk of heatwave mortality, it could not be assessed (13) whether deaths at home were mostly occurring among people who live alone. In France, mortality in retirement homes increased by 100% during the more extreme August 2003 heatwave (14). Similarly, mortality in nursing homes in northern Italy increased by 150%, and increases in heat-related morbidity as well as failures in care were reported (15).

EuroHEAT followed up on the growing evidence that the combined effect of heat-waves and peaks of ozone or particulate matter smaller than 10 μm (PM_{10}) increases mortality, particularly among the elderly (75–84 years) (16–18).

The adverse health effects of heat-waves are largely preventable. EuroHEAT recommends developing and implementing heat-health action plans at national and regional level in Europe, to prevent, react upon, and contain heat-related risks to health.

This paper describes the common elements of European heat-health action plans and the resulting practical tool to inform decision-makers and to support health authorities in developing and improving heat-health action plans. This guidance was developed on the basis of the overall results of the 2-year project "Improving Public Health Responses to Extreme Weather – EuroHEAT," co-funded by the European Commission (DG Sanco).

MATERIAL AND METHODS

A literature review was carried out and a questionnaire was administered to health officials in charge of heat-health action in 2005 to survey existing heat-health action plans in Europe and to identify models of good practice for national/local preparedness planning.

Search strategy

In a search of publicly available heat-health action plans, Web pages of ministries of health were scrutinized for respective documents with the following keywords: heat, heatwave, hot temperatures, heat plan, heat action plan, preparedness, public health interventions and public health response. The choice of Web pages was based on previous surveys of existing heat-health warning systems (19).

The questionnaire was sent through the EuroHEAT network to Catalonia (Spain), The United Kingdom, France, Germany, Greece, Hungary, Israel, Italy, Lithuania, Portugal, Slovakia, Slovenia, Switzerland and the Netherlands. All countries replied; however, only a selection of them could complete the questionnaire fully for a functional heat-health action plan: Catalonia (Spain), England, France, Hungary, Italy, Portugal and 10 Federal States of Germany. The Netherlands developed a plan during the course of the

EuroHEAT project, and the information from Belgium and Luxembourg could be obtained only after data collection had been finalized.

An expert meeting was organized to further discuss core elements of heat-health action plans and an expert group – supported through a network of stakeholders from different disciplines, such as health care, public health, epidemiology and meteorology who have been involved in the assessment of the past heatwaves and the development of public health responses – subsequently developed the guidance for heat-health action plans from all available results (20).

RESULTS

Heat health early warning and protective public health measures can be integrated in a defined heat-health action plan. Some of the main characteristics of heat-health action plans in Europe can be drawn from the results of the questionnaire survey (18):

Lead agency and administrative level for heat-health action plans

The majority of the existing heat-health action plans are organized on a national level (England, France, Portugal and Hungary) with regional components; however, several are implemented on a regional and local level (Catalonia, Spain; Lazio, Italy; Federal States of Germany). Almost all systems were initiated and designed by the ministry of health (lead agency) and all had an official link to the national meteorological service. The systems in Italy, France and Hungary had a legal basis (law), and Hungary, England and Catalonia described a link to the national disaster plan.

Actors for the implementation of heat-health action plans

Most heat health warnings are issued by the national meteorological office. The communication campaigns are mostly the responsibility of the ministries or departments of health, or institutes of public health, in collaboration with the health services. Behavioural and medical advice is launched through health services, general practitioners (GPs) and pharmacies. Hospital and care home managers, as well as their staff, ensure the implementation of specific measures in their facilities. General practitioners and health centres, as well as social services, are often the main partners responsible for the care of people at risk.

Interventions

Raising awareness and providing information through the media can be identified as a part of most heat health plans, offering behavioural as well as medical advice. Specific information to actors within the health system (GPs, hospitals and nursing homes) as well as medical (and behavioural) advice via medical professionals and help lines is a part of many heat-health action plans. Active contact to risk groups is established in the frame of the heat-health action plan in Rome/Lazio as well as in Catalonia and England.

Target population

According to the questionnaires, consensus exists in defining the elderly, (> 65 and > 75 years of age, respectively) people with pre-existing diseases and people taking medication as target population groups (Table I). Athletes and workers at risk are only specifically considered by France and Portugal and small children (< 3 years of age and newborn

Table I. Adverse effects of drugs during hot weather (Matthies et al., 2008).

Mechanism	For example
Drugs can • directly affect the central and peripheral mechanisms of thermoregulation; • affect afferent and efferent pathways, sweating, cutaneous vasodilatation; • affect cardiac output and thereby heat elimination.	Drugs with anticholinergic effects are potent inhibitors of sweating. Antipsychotic drugs may in addition interfere with the central control of the body temperature.
Drugs can aggravate heat illness.	Vasodilators including nitrates and calcium channel blockers can worsen hypotension in vulnerable patients.
Heat exposure can increase toxicity and/or decrease the efficacy of drugs.	Toxicity of drugs with a narrow therapeutic index, such as digoxin or lithium, may be enhanced.
Dehydration and changes in blood volume distribution associated with excessive heat exposure and the thermoregulatory response can influence drug levels, their kinetics and excretion and hence their pharmacological activity.	

respectively) in Portugal and Catalonia. Various ways of including social factors in defining target population groups (such as social isolation) are reflected in a few heat-health action plans.

Communication

A structured communication strategy is an essential part of a public health response plan. Printed leaflets (disseminated throug health facilities, general practitioners or pharmacies) and mass media (e.g. TV, radio or news papers) are the most common communication channels used to inform the public. The Internet is often used to inform medical professionals or institutions (e.g., in England). Some heat-health action plans do not describe how the GPs, medical and social professionals practically receive the information. A distinction between information given for the summer in general and information given on particularly hot days is made in some heat-health action plans (Catalonia, France, Portugal and Rome/Lazio). In most countries the advice and information is available in the national language only, raising questions with regard to the accessibility for foreigners and tourists.

Real-time health data

In the survey, real-time health data are reported to be used in 5 EU countries (Portugal, France, Italy, Spain and the United Kingdom) for the monitoring of the health impacts of the heat-wave and the effectiveness of the interventions (Table II). In most cases mortality data, hospital admissions and emercency calls (calls to helplines and ambulance calls) are used. The lag time for these data was registered to be between 1–3 days.

Evaluation

At the end of every summer, some European countries assess whether the heat-health action plan has worked according to defined criteria and present a report (for example, 21–23). In Italy, for example, the heat-health warning system

Table II. Use of real-time data in European public health response plans (Matthies et al., WHO, in press).

Data	Lag Time	Country
Mortality	7 days	England
	1 day	Catalonia
	1–3 days	Rome/Lazio
Morbidity		
Hospital admissions	1 day (data series of 3 weeks for analysis)	France
	1–3 days (4 big hospitals)	Catalonia
Phone calls	1 day	England
	Available daily	Catalonia
Ambulance calls	1 day	Hungary
Activities of emergency departments	1 day (data series of 3 weeks for analysis)	France
Fire brigade interventions	1 day (data series of 3 weeks for analysis)	France
No use of real-time data		Portugal

(HHWS) has been assessed for its sensitivity and specificity of forecasting a meteorological condition that is linked to excess mortality (24). Hungary has carried out a telephone survey in 5 cities among 2,500 responders to evaluate the communication campaign of its system (25). Results show that TV was the medium consulted most often for information (by 78% of the respondents), while the Internet was used least for information on heat and health. The Health Protection Agency (HPA) in England found a very high level of awareness amongst actors of the health system through telephone interviews and questionnaires (23).

Main barriers to implementation of public health responses identified in the questionnaires were (1) lack of funding for specific activities; (2) difficult communication on the heat plan level and within other organizational units; and (3) limited access to mortality and morbidity data.

Cost

According to the EuroHEAT survey in 2005, France spent €0.14 per protected person (=children <1 year and adults >75 years), while Catalonia invested €9.2 per vulnerable person (€921.763 in total for the public health component of the heat-health action plan, plus €3,415,700 for additional medical personnel and €3,025,047 for the department of welfare). In England €214,912 were spent for printing information materials; no other additional costs for the health system were calculated. As each system was assessed in a different way, considering different costs, a comparison is very difficult. The cost of inaction, however, can be very high. For Rome, for example, the cost of inaction (should the city fail to prepare for and respond to projected heat - waves) in terms of monetized mortality damage has been calculated to amount to €281 million in the year 2020 (2004 Euro) (26).

The adverse health effects of heatwaves are largely preventable

Prevention requires a broad range of actions at different levels: from health-system preparedness coordinated with meteorological early warning systems to timely public and medical advice and improvements to housing and urban planning. From the survey results and the overall findings of the EuroHEAT work packages, a team of experts developed a guide for

the development of heat-health action plans in a consultative process. The following elements have been identified as core elements of heat-health action plans (20):

- Collaboration between administrative bodies and identification of a leading one to coordinate responses (Fig. 2). This includes the definition of roles and responsibilities for actors at the national/regional level. Exploring synergies with existing national disaster preparedness plans and the International Health Regulations 2005 (27), legislation and possible financial incentives is advisable.
- Availability of accurate and timely alert systems.

Heat-health warning systems (HHWS) should be developed in collaboration with meteorological services to trigger warnings, determine the specific national threshold for action and communicate the risks. The first step to develop a HHWS is to identify weather situations that adversely affect human health in the respective local context. As the onset of heat mortality varies from city to city and region to region (3), temperature thresholds for triggering heat alerts and public health measures need to be identified in relation to the local context in order to prevent heat-related mortality and morbidity, and be adjusted over time. A HHWS can use various methods for forecasting, an effective system is targeted to the local needs, is accurate and timely (17,18).

As part of EuroHEAT, the German Weather Service has developed an online tool providing medium-term forecasting of heat (http://www.euroheat-project.org/dwd;18). This tool, which maps the probability of a forthcoming heatwave, can support health services in planning and in making decisions in connection with the national weather forecast.

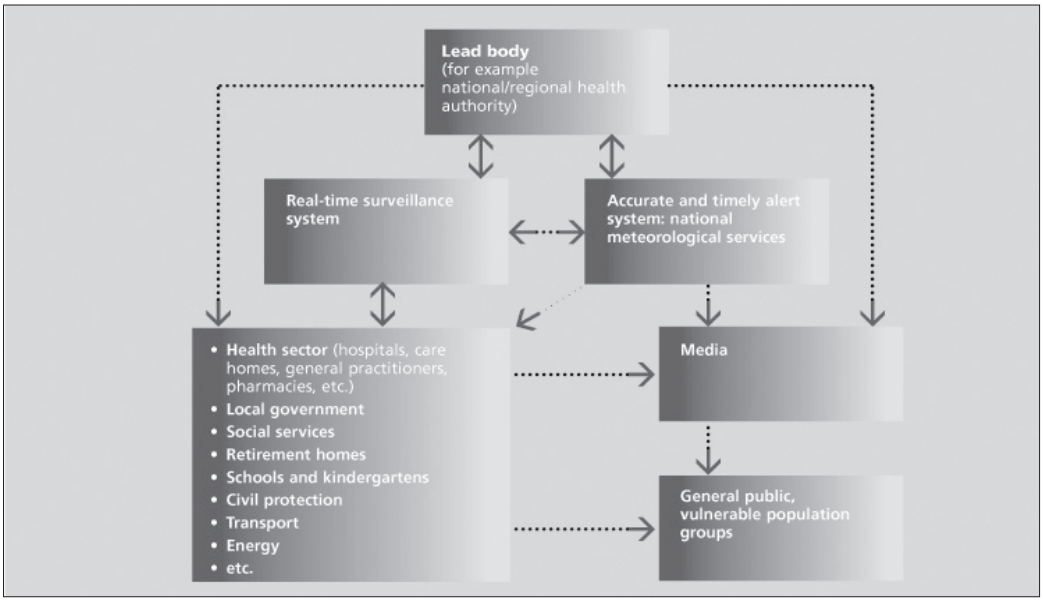

Figure 2. Possible flow of information between lead agency and other actors in heat-health action plans (Matthies et al., 2008).

- Avoidance or reduction of heat exposure.

As part of a heat–health action plan, measures to reduce heat exposure should be taken, such as adaptation of individual behaviour, short-, medium- and long-term modifications to buildings to reduce indoor temperatures and long-term improved urban planning, as well as transport and energy policies. Medium- and short-term options for cooling buildings without power consumption (passive cooling) are available, such as cool paints, external shading, radiant barriers and insulation of buildings (Table III) (17,18).

Table III. Summary of recommendations and options for urban planning and housing (Matthies et al., 2008).

Measures	Examples	Advantages	Disadvantages
Short-term measures	Advice on behaviour Access to cool spaces Mobile evaporative coolers Room air conditioners	Cheap, immediate benefit Can be implemented by individuals	Inherently inequitable increase in energy use and greenhouse gas emissions May be of limited public health benefit Potential adverse health impacts of room air conditioners, e.g. airborne infections
Medium-term measures	Increased albedo of building envelope External shading Insulation Decreasing internal heat load Passive cooling technologies Efficient active cooling	Can be designed without increase in energy consumption and implemented at building or city scales Synergetic effects throughout the year	Advance planning needed Selection of measures at the building scale needs to consider local circumstances Moderately expensive Potential risk to "design buildings for the heatwave" forgetting the rest of the year
Long-term measures	Building regulations Urban planning Land-use changes Mitigation of climate change	Reduced energy consumption and greenhouse gas emissions Can be combined with active mobility and air pollution reductions Inherently equitable, with major potential health benefits	Costly Long lead times Requires political will (in the case of climate change mitigation, even at international level)

Source: Hales et al., in press.

Advice on how best to reduce indoor temperatures should be included in information to the public. Possible electricity shut-offs and reduced water availability need to be considered in heat-health action plans and public advice.

- Particular care for vulnerable populations.

It is important to identify groups and individuals at high risk before the summer and plan and target specific interventions (advice, follow-up and care) accordingly. Community and social care organizations, medical practitioners and care providers play an important role in actively reaching population groups most at risk (4,20) (Fig. 3). Careful advice should be given by medical doctors tailored to the individual older person or patient, including possible adjustments in drug prescriptions.

Doctors should:

- understand the thermoregulatory and haemodynamic responses to excessive heat exposure
- understand the mechanisms of heat illnesses, their clinical manifestations, diagnosis and treatment
- recognize early signs of heatstroke, which is a medical emergency
- initiate proper cooling and resuscitative measures (for early signs and out-of-hospital treatment please see the separate information sheet (9) on treatment of heatstroke and other mild heat related illnesses in Matthies et al., 2008)
- be aware of the risk and protective factors in heat-wave-related illness
- identify the patients at risk and encourage proper education regarding heat illnesses and their prevention; education of guardians of the old and infirm and infants is also important
- include a pre-summer medical assessment and advice relevant to heat into routine care for people with chronic disease (reduction of heat exposure, fluid intake, medication)
- be aware of the potential side-effects of the medicines prescribed and adjust dose, if necessary, during hot weather and heat-waves
- make decisions on an individual basis, since there are – according to current knowledge – no standards or formal advice for alteration in medications during hot weather
- be aware that high temperatures can adversely affect the efficacy of drugs, as most manufactured drugs are licensed for storage at temperatures up to 25 °C; ensure that emergency drugs are stored and transported at proper temperature
- be prepared to monitor drug therapy and fluid intake, especially in the old and infirm and those with advanced cardiac diseases

Education and counselling of patients

Advice to patients should stress the importance of adhering to the recommendations spelt out in the leaflet for the general public. In addition, individual adjustments of behaviour (particularly for patients with chronic diseases), medication and fluid intake may be necessary according to clinical status. Contact details of social and medical services, helplines and emergency services should be made available.

Source: Adapted from Bouchama, 2007.

Figure 3. A proactive approach by GPs – What GPs should know and do (WHO, 2008; Matthies et al, 2008).

- Provision of health care, social services and infrastructure.

In order to ensure the provision of health care (continued and heat specific) during heatwaves, it is necessary to train health personnel and other interest groups and to plan summer staffing. Treatment protocols for the management of heat-related illnesses and heatstroke need to be made available (28). Emergency departments of hospitals could be alerted to heatwaves to better manage a possible increase in patient admissions. It is advisable that care homes and hospitals meet the EU criteria for the thermal indoor environment to prevent heat-related illness in patients and staff.

- Heat-related health information.

As heatwaves are likely to occur every summer (although in different locations in Europe), it is advisable to establish a communication plan before the summer. This plan should include advice to the population on how to protect themselves and others, how to reduce heat exposure indoors and outdoors and how to recognize heat-related symptoms (Table IV) (20). To reduce the risk of salmonella infections during periods of hot temperatures, public advice should include messages on food-handling behaviour (12). Targeted information to particular groups, such as health care institutions and caregivers, should also be provided (20).

- Real-time health surveillance.

Real-time surveillance of mortality and/or morbidity is important to detect early health impacts of hot weather, to potentially modify interventions and to inform about abnormal outbreaks or clusters of health impacts. In the case of a heatwave, the most useful real-time data seemed to be all cause mortality, emergency calls, emergency department visits, calls to hotlines and the records of general practitioners (18). These data should be available no later than within 1 to 2 days.

- Monitoring and evaluation.

In general, high quality evaluations can support decision-makers with information about the types of programs that can be developed and implemented to ensure the most effective use of resources. Such evaluations are generic in that they draw on the general principles used to evaluate any public health intervention. In process evaluations, the focus is on whether the plan was implemented to the expected standards. Mortality is one outcome variable for which the impact of heat has been extensively observed and documented and could be used to evaluate impacts as a response to prevention programs and adaptation strategies. Non-fatal effects of heatwaves are mostly reported through increases in emergency hospital admissions or ambulance calls (18,29–32). Key questions to be addressed in process and outcome evaluation have been suggested (Table V) (20).

These elements of heat-health action plans are not sequential, though some activities can be defined as longer-term development and planning, preparation before the summer (pre-summer), prevention during the summer (summer), specific responses to heatwaves and monitoring and evaluation.

Table IV. Recommendations for the public during heatwaves (Matthies et al., 2008).

Keep your home cool

During the day, close windows and shutters (if available) especially those facing the sun. Open windows and shutters at night when the outside temperature is lower, if safe to do so.

If your residence is air conditioned, close the doors and windows.

Electric fans may provide relief, but when the temperature is above 35 °C, fans may not prevent heat related illness. It is important to drink fluids.

Keep out of the heat

Move to the coolest room in the home, especially at night.

If it is not possible to keep your home cool, spend 2–3 hours of the day in a cool place (e.g. air-conditioned public building).

Avoid going outside during the hottest time of the day.

Avoid strenuous physical activity.

Stay in the shade.

Do not leave children or animals in a parked vehicle.

Keep the body cool and hydrated

Take cool showers or baths.

Alternatives include cold packs and wraps, towels, sponging, foot baths, etc.

Wear light, loose fitting clothes of natural materials. If you go outside wear a wide brimmed hat or cap and sunglasses.

Drink regularly and avoid beverages with sugar or alcohol.

Help others

If anyone you know is at risk, help them to get advice and support. Elderly or sick people living alone should be visited at least daily.

If the person is taking medication, check with the treating doctor how they can influence the thermoregulation and the fluid balance.

If you have a health problem:
- keep medicines below 25 °C or in the fridge (read the storage instructions on the packaging),
- seek medical advice if you are suffering from a chronic medical condition or taking multiple medications.

If you or others feel unwell:
- try to get help if you feel dizzy, weak, anxious or have intense thirst and headache; move to a cool place as soon as possible and measure your body temperature;
- drink some water or fruit juice to rehydrate;
- rest immediately in a cool place if you have painful muscular spasms, most often in the legs, arms or abdomen, in many cases after sustained exercise during very hot weather, and drink oral rehydration solutions containing electrolytes; medical attention is needed if heat cramps are sustained for more than one hour;
- consult your medical doctor if you feel unusual symptoms or if symptoms persist.

Δ If one of your family members or people you assist presents hot dry skin and delirium, convulsions and/or unconsciousness call the doctor/ambulance immediately. While waiting for the doctor/ambulance move him/her to a cool place and put him/her in a horizontal position and elevate legs and hips, remove clothing and initiate external cooling, such as with cold packs on the neck, axillae and groin, continuous fanning and spraying the skin with water at 25–30 °C. Measure the body temperature. Do not give aspirin or paracetamol. Position unconscious person on their side.

For service providers:

Information on helplines, social services, ambulances, cool spaces and transport should be provided on the information material!!

Provide access to cool spaces and ensure active assistance for those most at risk.

Table V. Questions to be addressed in process and outcome evaluation of heat-health action plans (Matthies et al., 2008).

Process evaluation should assess	Outcome evaluation should assess
• whether key messages were provided to the population	• mortality – daily temperatures and deaths before, during and after heatwave periods, mortality in different settings such as care homes
• if the population was aware of the plan and its messages	• morbidity
• whether warnings were issued at the right time	• health care utilization
• whether the organizations and professionals acted appropriately and if they followed the plan	• non-health-related outcomes such as productivity and work absence
• whether the organizations and professionals found the plan helpful	• an assessment of the temperature–mortality function
	• health behaviour changes related to heat

DISCUSSION

EuroHEAT recommends developing and implementing heat-health action plans at national and regional levels in Europe, to prevent, react upon and contain heat-related risks to health. General applicability of the described requirements and recommendations is limited, as only selected examples from existing heat-health action plans in Europe have been taken up in the study. Ways to ensure provision of special and routine health and social care during heatwaves and adaptation of facilities and infrastructure to hot temperatures need to be developed according to national and local needs and possibilities.

Information about the effectiveness of interventions is important for decision-makers and health authorities. It is, however, difficult to systematically evaluate the effectiveness of heat-health action plans for several reasons (20,33):

- they vary widely in structure, partner agencies and specific interventions
- they change from year to year in response to events
- heatwaves are rare events and the impact of each heatwave is different, and
- heat-related deaths are non-specific and can be difficult to identify

The development of the methodology to systematically evaluate the effectiveness of heat-health action plans, including their cost effectiveness, is encouraged. Several national annual "end of summer" reports on heat-health action plans, reviewing the implementation of the alert system and the public health responses, gave positive indications for the effectiveness of such heat-health action plans. Apart from these national reports (21–23), there has been some analysis comparing excess mortality occurring during the summer of 2003 and during subsequent heatwaves in years when protection measures were in place. The identified reduction in heat-

related mortality in France, for example, was ascribed to several factors, such as a reduction in the population's vulnerability, increased awareness of the risks and the implementation of preventive measures and early warning systems (34).

Apart from the methodology for the systematic evaluation of heat-health action plans, specific components and measures need to be further investigated and developed:

- Further review and strengthening of the evidence base for educational messages.
- Investigation of heat-health risk perception in the public, in order to develop more effective and targeted communication strategies.
- Further development of treatment recommendations for heat illnesses, particularly heatstroke, into official guidelines.
- Development of specific training modules for health professionals.
- Improvement of real-time surveillance systems.
- Development of policy advice and options for the reduction of air pollution during very hot weather and heatwaves.
- Update of the climate information decision support tool on the basis of first experiences.
- Analyses of costs and benefits of heat-health action plans.
- Intensified advocacy for implementation of long-term measures to reduce heat exposure (e.g., in urban planning and housing) and for promoting health in other sectors.

The effects of climate change have the potential to put additional stresses on health systems and vulnerable population groups and exacerbate inequities within and among countries. Current health care, health facilities, public health measures and equipment may need to be reviewed and strengthened to address extreme weather events and changing health outcomes as projected with climate change (35).

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