



Federal Ministry for the
Environment, Nature Conservation,
Building and Nuclear Safety

Recommendations for Action

Heat Action Plans to protect human health

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Preface

The following recommendations for action were compiled by members of the former BMUB led Federal/Länder Ad hoc Working Group on *adaptation to the impacts of climate change in the health sector (Gesundheitliche Anpassung an die Folgen des Klimawandels (GAK))*.

German federal and state ministries for health and the environment as well as various higher federal and state authorities were represented within the working group. The group was set up in 2012 under the auspices of the German Conference of Environment Ministers, initially for a period of one year. The primary task of the group was to take stock of, communicate and discuss the possible risks to health in Germany arising from climate change. Other Federal/Länder Ad hoc working groups on health and the environment submitted suggestions containing what they considered necessary adaptation measures and actions. In November 2015, the German Conference of Environment Ministers extended the mandate of the GAK Ad hoc Working Group by one year up to November 2016.

Following the last ordinary meeting of the GAK Ad hoc Working Group in March 2016, the team of authors, which was unanimously agreed on during the meeting and headed by the Federal Environment Agency, began its work on drawing up the recommendations for action. The recommendations for action were adopted in March 2017 during the working group's final meeting. Disclaimer: the recommendations for action were published in May 2017 in the Federal Health Gazette (Bundesgesundheitsblatt - DOI: 10.1007/s00103-017-2554-5). The contents have not been changed. These recommendations may be redistributed by interested parties in accordance with the Creative Commons license (<https://creativecommons.org/licenses/by/4.0/>).

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Introduction

Global warming, caused by climate change, has led to more frequent and longer heat events in many regions throughout the world including Germany. Heat can have adverse effects on human health and heat waves can pose a problem for the health sector. Aside from climate action measures, undertaking joint efforts to prevent the impacts of heat on the population can help counteract this [1].

A detailed survey was conducted by the Federal Environment Agency (UBA) in 2014 [2] regarding adaptation to the health impacts of climate change as a task for environment-related health protection. The survey revealed that clear action requirements or concrete adaptation measures are too seldom set out or taken in preparation for heat events.

Action plans would be suitable for this purpose, on the one hand to efficiently communicate the health impacts of climate change, particularly of extreme heat, and on the other hand to achieve a risk behaviour that is appropriate for the situation and establish preventive options for action [3, 4, 5]. The action plans should contain behavioural and setting-based preventive measures in all fields of prevention.

As there have been no harmonised recommendations for heat prevention action plans in Germany to date, the GAK Ad hoc Working Group compiled the following general recommendations for action for drawing up heat action plans to protect human health. These recommendations should be viewed as a uniform basis for drawing up and establishing coordinated and practical heat action plans tailored to the respective regions and are directed first and foremost at the Federal Länder. Implementation will largely be carried out in the individual Länder at municipal level. Drawing up heat action plans can contribute to an overarching climate change adaptation strategy in the health sector.

In many cases, adaptation measures to protect against heat are also suitable for protecting against increased exposure to UV radiation. These recommendations therefore also contain measures to reduce exposure to UV radiation.

Background

The average air temperature in Germany rose by approximately 0.9 degrees Celsius over the course of the last century [1]. The summers of 2003 and 2010 both saw over 40,000 additional deaths in Europe during a number of consecutive heat waves, each lasting several days. These deaths were caused by the impacts of unfavourable meteorological conditions (e.g. due to extremely high temperatures) [6, 7, 8, 9]. The heat wave in summer 2003 led to approximately 7,000 deaths in Germany alone [7] as well as numerous heat-related illnesses caused by dehydration, heat stroke and heart and cardiovascular diseases.

Diseases caused by strong heat lead to high costs which put major strain on the health sector and public welfare [10]. For the periods 2021 to 2050 and 2071 to 2100, average annual temperatures in Germany are expected to rise from 0.5 to 1.5 and from 1.5 to 3.5 degrees Celsius with more frequent heat waves and thus an increase in heat-related deaths [1]. According to projections, the number of heat-related deaths across Germany could be as high as 8,500 per year by the end of this century [11].

Steps to counteract this, alongside global efforts to combat climate change, can only be successful in the form of coordinated activities for the prevention of heat impacts on the population. A suitable approach are heat action plans based on the World Health Organization's recommendations, outlining the need for action and setting out requirements regarding which measures to take at which level and who should implement them. The concrete plans should be tailored to the needs of each region respectively [12].

The objective of a heat action plan is to reduce exposure to heat (where possible with the same measures) and UV radiation, by means of preventive behavioural and setting-based measures to avoid heat- and UV-related illnesses and deaths. Each individual can take preventive behavioural measures. Awareness raising geared to each target group is needed in this context. In addition, setting-based preventive measures need to be taken, which include changes in the living and working environment [13].

At present, there is almost a complete lack of setting-based preventive measures against heat- and UV-related health impacts - despite the fact that such measures can be easily implemented. Particular consideration needs to be given to more vulnerable population groups. These include the elderly, people in need of care, the chronically ill, all of which are particularly effected by a rise in the frequency and intensity of extreme heat events. Infants and small children are also especially vulnerable. Another group particularly vulnerable to heat are people more exposed to heat and UV radiation due to heavy physical work outdoors or to outside recreational activities.

Aside from the strain caused by heat, exposure to UV rays and air pollution caused by UV radiation, such as ground-level ozone, give rise to health problems which are relevant when considering adaptation measures (see info box 1).

Info box 1: UV radiation and air pollution

The number of skin cancer cases has risen massively in recent decades. In 2012, almost 1.6 million people were diagnosed with skin cancer in Germany [14], with numbers expected to go up even further. About 3,000 people in Germany die every year from skin cancer [15].

One reason for the rise in skin cancer numbers is each individual's exposure to UV radiation. Risk factors include sun burn (especially during childhood), intermittent exposure to high levels of UV rays (e.g. sun during annual holiday on skin which is not adapted) and total UV dose received over a lifetime [16].

Climate change further exacerbates this situation:

It is expected that because of global warming, leisure habits will change with more outdoor activities and thus higher levels of exposure to UV radiation. In addition, low ozone events occur in the stratosphere in the first six months of the year in Germany, thus leading to a higher proportion of UV radiation reaching the earth's surface. The higher the exposure to UV rays, the higher the risk of skin cancer.

Ground-level ozone formation occurs during periods of intense solar radiation through complex photochemical processes involving precursor substances - the main ground-level ozone precursors are nitrogen oxides and volatile organic compounds. The impacts of ground-level ozone on health include decreased lung function, inflammatory reactions in the respiratory tract and respiratory problems. These impacts can become worse with physical exertion i.e. increased respiration rate. People who are sensitive or have pre-existing conditions, e.g. people with asthma, are particularly vulnerable.

As recommendations for correct behaviour in heat can, in many cases, prevent adverse health impacts arising from ground-level ozone and its precursor substances as well as from increased UV levels, it is advisable to take these adverse effects into consideration in the recommendations for action.

The following recommendations for action for drawing up heat action plans to protect human health in Germany are based on the World Health Organization (WHO) guidance for compiling heat-health action plans [12] and on the results of the Hesse HEAT study (carried out by the Fulda University of Applied Sciences 2009 - 2012)[17].

In line with the WHO guidance document, the recommendations for action consist of eight core elements. These core elements should not be understood as being in sequence and therefore do not necessarily need to be considered in the order listed.

The following recommendations contain both short-term measures, which can be implemented immediately without large investments, and long-term measures that should generally be considered in a plan.

The eight WHO core elements are:

- I. Lead body and interdisciplinary cooperation
- II. Use of heat alert system
- III. Information and communication
- IV. Reducing heat indoors
- V. Particular care for vulnerable population groups
- VI. Preparedness of the health and social care system
- VII. Long-term urban planning and building sector
- VIII. Monitoring and evaluation of measures

For the implementation of the above listed eight core elements, WHO recommends an approach with five time frames [12]:

- Longer-term development and planning
- Timely preparations before summer (pre-summer)
- Prevention during the summer (summer)
- Specific responses to periods of heat/heat waves
- Monitoring and evaluation

These time frames are depicted in the diagram below.

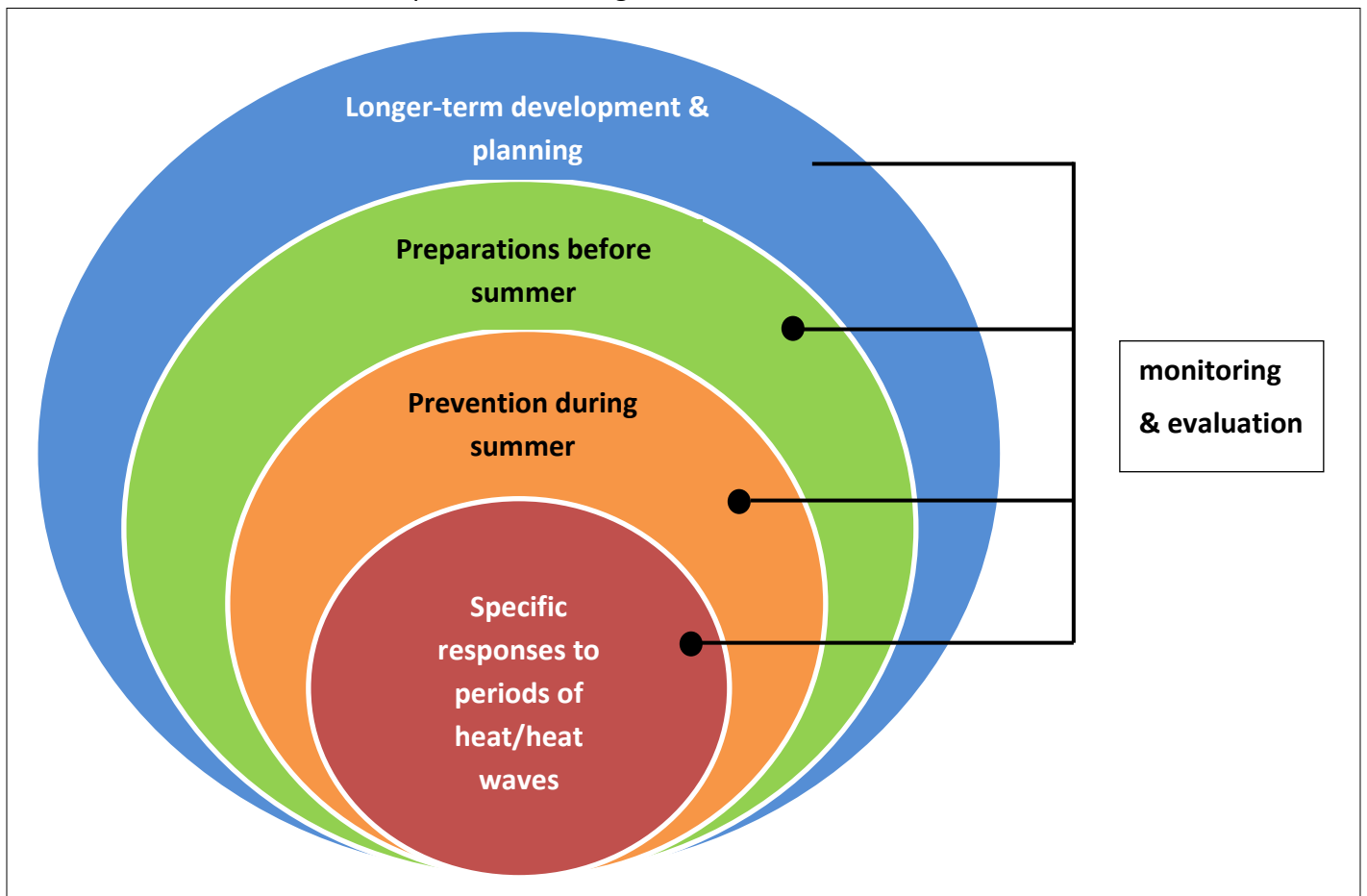


Fig. 1: Schematic representation of time frames set out by WHO for implementing the core elements of a heat action plan.

The organisation, cooperation and communication of information between a lead body/institution and actors involved in a heat action plan can be carried out using the information channels recommended by WHO as presented in figure 2:

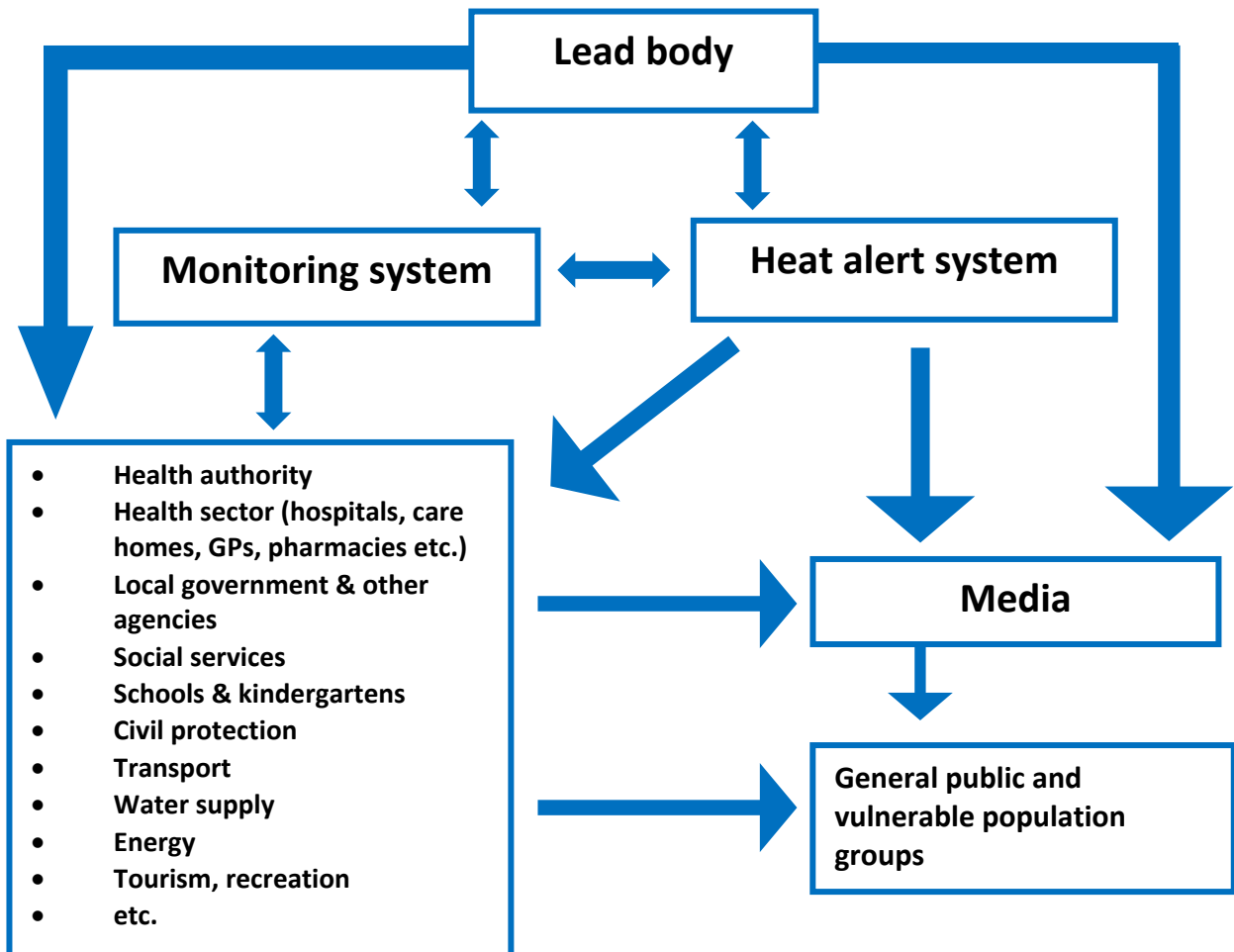


Fig. 2: Potential flow of information between lead body and other actors involved in heat action plans (Matthies et al. 2008, Figure 2, p. 9 [12])

Recommendation for action - Core element I:

Lead body and interdisciplinary cooperation

WHO recommends agreeing on a lead body. As Germany has a federal system in which responsibilities are decentralised or shared, establishing a central coordinating body (lead body) is recommended. This body will have a coordinating function and have inter-agency responsibility for introducing a heat action plan in cooperation with other authorities and institutions with different areas of competence. The body will introduce short- to long-term measures.

1. At Länder level, the lead body should, for instance, be established in a public health authority. Depending on the duration and nature of the heat situation, another public authority could also take on a coordinating role in acute cases.
2. The lead body will hold inter-agency responsibility for coordinating cooperation the relevant authorities and institutions (similar to crisis management in the case of a disaster).
3. It is recommended that lead bodies of the Länder exchange information and ideas.
4. The tasks of the lead body are as follows:
 - Establish a central network of all actors involved in developing the action plan (e.g. health authorities of the Länder, municipal bodies, doctors' associations, chambers of physicians, operators of public facilities).
 - Together with the central network, the lead body identifies the relevant institutions (public and private) which can implement measures locally in their respective municipalities. Examples of such institutions include fire services, emergency and rescue services, hospitals, doctors' practices, pharmacist associations, outpatient and inpatient care facilities, rehabilitation facilities, kindergartens, schools, aid organisations, disabled care organisations and residential home supervisory authorities.
 - Other organisations and interdisciplinary experts can be consulted for more precise situation analysis and planning of specific measures e.g. from the fields of health, nursing, nutrition, social sciences, medicine, health engineering as well the medical services and health insurance.
5. Tasks of the central network:
 - The network tells the municipalities as decentralised coordination centres which institutions are recommended for involvement. Actors at municipal level are responsible for laying down the responsibilities of the institutions concerned locally and for planning specific measures, including their time frames for implementation based on the recommendations for action for core elements II to VIII. A decentralised network will be set up for this purpose. Decisions will be reported to the lead body.

- o Superordinated measures which are deemed necessary and cannot be carried out at municipal level (e.g. regional planning) should be planned by the central network in direct coordination with the relevant institutions.
6. After measures have been implemented, in particular after acute heat events, the lead body, central network and municipal actors will evaluate these measures and processes and adapt coordination, recommendations and implementation on this basis (see also recommendations for action for core element VIII monitoring and evaluation).

Please see figure 3 on the following page for further clarification of the levels of coordination and interdisciplinary cooperation.

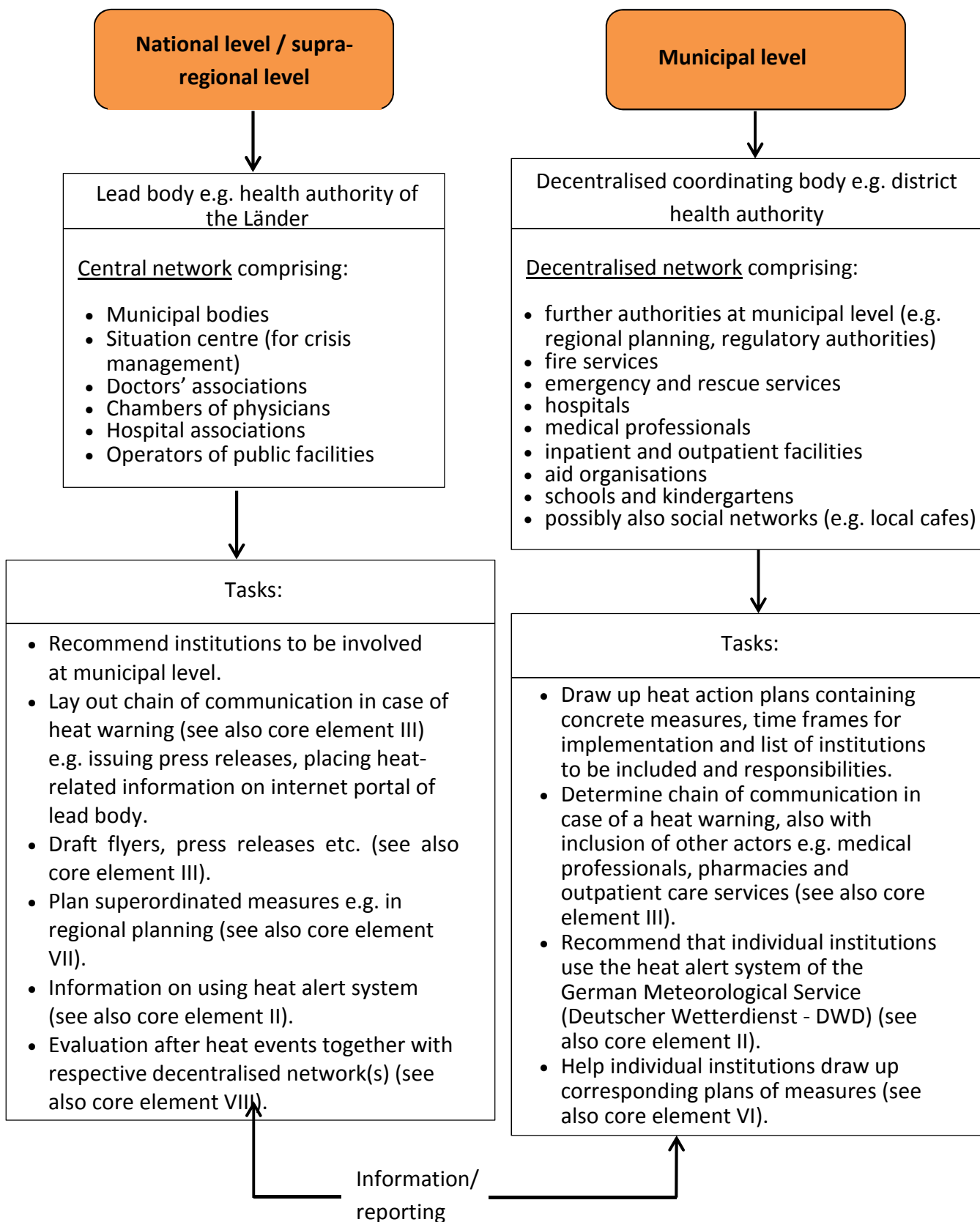


Fig. 3: Diagram of central coordination and interdisciplinary cooperation (core element I, partial consideration of further core elements)

Recommendation for action – core element II:

Use of heat alert system

WHO recommends using a reliable heat alert system to communicate the duration of upcoming heat events, recommendations for behaviour and health risks.

In Germany, the heat alert system is operated by the German Meteorological Service (Deutscher Wetterdienst - DWD) and has been in place for over ten years. DWD issues heat warnings for Germany.

Heat warnings are aimed at the competent bodies and are intended in particular for retirement and nursing homes as well as kindergartens. These warnings are also geared towards other institutions e.g. outpatient and inpatient care facilities and the general public. Warnings are issued district by district.

1. It is recommended that heat action plans are compiled on the basis of the DWD heat alert system. DWD issues heat warnings when high levels of heat are forecast for at least two consecutive days and when adequate night-time cooling in dwellings can no longer be guaranteed. There are two warning levels [18]:

Heat warning level I: Strong heat load (perceived temperature on two consecutive days above 32°C in addition to poor night-time cooling);

Heat warning level II: Extreme heat load (perceived temperature above 38°C in early afternoon).

The warnings generally apply to one full day i.e. including the night. DWD heat warnings are issued through a newsletter (www.dwd.de/newsletter - only available in German) on its website and via apps (available in standard app stores).

Other heat and health related notifications should also be taken into account:

- The Federal Office for Radiation Protection (www.bfs.de/uv-index - German only), and DWD (www.dwd.de/uvindex - German only) provide information on the intensity of UV radiation (UV-Index).
- The Federal Office for Radiation Protection and DWD also provide information on UV radiation intensities via newsletters (www.bfs.de/uv-newsletter - German only) and (www.dwd.de/newsletter - German only) and through apps (available from standard app stores).
- Information on ground-level ozone is provided by the competent Länder authorities (for the most part Länder environment agencies) and broadcast e.g. on radio and television.

Information services/apps for civil protection such as “katwarn” or “nina” also provide information on extreme weather situations.

2. Public authorities and organisations that, according to the heat action plan, are to actively introduce measures should subscribe to the DWD heat warning newsletter. Subscribers should include, at the very minimum, the following authorities and institutions:
 - Health ministries of the Länder
 - Municipal health authorities
 - Associations and institutions involved in health and social care (e.g. schools, kindergartens, emergency services, hospitals and care services and facilities).
 - Social networks and neighbourhood help organisations in order to disseminate heat warnings.
3. It is recommended, as a response to 'heat warning level I', that short-term measures (see recommendation for action - core element IV) are communicated using the established chain of communication (see recommendation for action - core element III) within the relevant public and private institutions responsible for implementing measures locally (see recommendation for action - core element I). In response to 'heat warning level II', it is recommended that the warning and short-term measures are also actively communicated before the forecasted extreme heat event using mass media such as radio and television.

Recommendation for action – core element

III:

Information and communication

WHO recommends compiling and communicating heat-related health information for the population (who communicates what, when and how?).

Anticipatory planning and acute cases of imminent heat events must be considered separately when communicating heat-related health information.

Information kits must be put together for different target groups.

Anticipatory planning

1. The content and channels of communication should be specified independently of upcoming or ongoing heat situations (similar to network structure, see recommendation for action - core element I). Competences and responsibilities for communication need to be defined (chain of communication), ideally in the form of a plan of procedure in the case of a DWD heat warning (comparable with an alarm plan).
2. Key questions here are:

What should be communicated?

In so far as possible, health-related prevention recommendations should be target group-specific.

Examples of general information:

- DWD website:
<http://www.dwd.de/DE/leistungen/hitzewarnung/hitzewarnung.html> (German only)
- UBA and DWD publications containing climate change and health advice:
“Ratgeber: Klimawandel und Gesundheit. Informationen zu gesundheitlichen Auswirkungen sommerlicher Hitze, Hitzewellen und Tipps zum vorbeugenden Gesundheitsschutz” (German only)
<https://www.umweltbundesamt.de/publikationen/ratgeber-klimawandel-gesundheit>
- UBA publication “HitzeKnigge” (heat procedures manual - German only)
https://www.umweltbundesamt.de/sites/default/files/medien/364/dokumente/schattenspender_hitzeknigge.pdf

How should information be communicated?

There are many options available: newspapers, television, radio, social media and other multiplier groups. This will ensure that certain population groups such as the elderly and young people are specifically addressed.

When should information be communicated?

The precise point at which information should be communicated by the above mentioned media following a DWD heat warning should be agreed on. As there is generally limited time available to take action, information for the press (possibly also interviews and other media reports e.g. YouTube video [DWD heat alert system](#)) must be prepared in advance and be readily available and accessible online via links.

3. The Länder and municipalities should always have information on their websites regarding precautionary measures to adapt to heat situations. There should also be a stock of information brochures to download, regardless of the heat situation at the time.
4. Information provided by the Federation, Länder, municipalities and health insurers should be coordinated and consistent.
5. Providing seasonally-relevant information, for example in pharmacy magazines, is another option for reaching the elderly in particular. Furthermore, it may be helpful for some population groups if additional telephone support services are offered (similar to “sonnenschirm” (parasol) telephone hotline service offered by the health authority in the Kassel region).
6. Instructions should also be offered in other languages (e.g. for people with migrant backgrounds and for tourists).

Communication in acute heat events

1. In the case of imminent or ongoing heat events, doctors can also personally pass on information on how to behave during heat events to their patients during consultations. Health risks and protective measures can also be communicated through flyers, TV advertisements in doctors’ waiting rooms or in pharmacies (distributed through chambers of physicians and pharmacists). In addition, relatives of elderly people living alone, or of other groups listed in core element V, should be involved in communicating information.
2. Kindergartens, schools, hospitals and retirement and nursing homes should be actively informed of acute cases and be given information material to distribute. German hotels and restaurants should also be notified of impending heat events and adaptation measures so they can pass on information to travellers.

Recommendation for action - core element IV

Reducing heat indoors

WHO recommends establishing measures to reduce heat indoors (short- and medium-term measures to reduce indoor temperatures during periods of strong and extreme heat).

It is especially important to prevent heat from building up indoors. The measures recommended should be communicated to the relevant target groups (e.g. planners and users of the building/space). The medium-term measures may include structural adaptation or even long-term planning. Long-term measures are listed under core element VII.

1. Short-term measures - recommendations for behaviour and for simple technical possibilities:

- Curtains, blinds, awnings, parasols, tinted windows or shutters are recommended for blacking out or providing shade particularly where there is direct sunlight.
- Moving to cool rooms in houses/apartments.
- Fans can also be an option if tolerated or seen as comfortable.
- Ventilation should be adapted during periods of intense heat. For instance, it is better if windows are only opened during the cooler night and morning hours for ventilation. Depending on the situation and setting, it may be appropriate to install mosquito screens on the windows.
- Use of heat producing devices should be avoided as much as possible as they may lead to additional heat being generated indoors.

2. Medium-term measures - building-relating cooling measures:

- Installing shutters, external blinds, vertical blinds with air ducts, awnings and sun sails.
- Wall and roof insulation not only protects the building from overheating in summer, but also from cooling down in winter.
- Micro-climatic cooling effects can also be achieved indoors by creating green areas on roofs (roof gardens) and facades and by planting deciduous trees on streets, in gardens and green spaces.
- Installing cooling technology (also air conditioning systems) should be considered in all renovations e.g. of hospitals and retirement and care homes

3. Active cooling indoors

- Air conditioning systems (also portable devices) are only recommended in private dwellings when other measures have proved unsuccessful and all other structural and technical measures have been exhausted. Air conditioning systems, with their high electricity consumption and release of heat into the outside air, contribute to climate change and the further warming of the general atmosphere outdoors, especially in urban areas (heat island effect).

Recommendation for action - core element V:

Particular care for vulnerable population groups

WHO recommends providing particular care for vulnerable population groups, which are particularly at risk or particularly vulnerable during heat events.

Particular consideration should be given to certain vulnerable people or population groups when choosing suitable measures. Distinctions should be made when seeking suitable approaches for communicating the health-related risks of heat. This is especially important against the backdrop of an ageing society.

In particular, during heat waves lasting several days, an increase in adverse effects on health e.g. on the cardiovascular system and kidneys, can be expected due to higher levels of heat. Generally, people belonging to these vulnerable population groups need to ensure higher fluid intake i.e. they need to drink a greater volume of fluid than normal. It may also be necessary to adjust medication (in particular diuretics). Furthermore, vulnerable people should wear appropriate clothing during hot weather (loose clothing that ensures adequate UV protection when exposed to sunlight), spend as little time as possible outdoors and stay in cooler indoor areas (see recommendation for action - core element VI).

1. Particular care needs to be given to the following vulnerable population groups:

- The elderly
Generally, this population group has reduced physical ability for thermoregulation and a decreased perception of thirst.
- Isolated people
Particularly elderly people living alone are at high risk of heat-related health impacts due to the lack of social supervision and help services.
- People in need of care
These people often suffer from health-related impairments which in turn can significantly restrict their possibilities for action. Certain illnesses can lead to an increased risk in individual cases.
- People who are severely overweight
Their reactions to higher levels of heat are particularly intense as the body, in addition to existing health strains, is subject to another exceptional burden and the cardiovascular system, for example, does not have any reserve capacity.

- People that are chronically ill
These people's bodies often cannot react to extreme heat events in the same way as healthy people can. In addition, extreme heat events can often make symptoms of chronic illnesses worse.
 - People with febrile illnesses
With febrile illnesses it is important that the body can emit heat. Significant rises in room temperature are therefore problematic for patients and should be prevented by taking appropriate measures.
 - People with dementia
People suffering from dementia have a reduced ability to adequately react to extreme situations. Sufficient intake of fluids in particular is often impossible to ensure without supervision.
 - People taking certain medications
The effects and side effects of medication (especially diuretics and blood pressure lowering drugs) can change due to heat. In some cases, medication may need to be adjusted to avoid decompensation.
 - People with thermoregulation problems
Not all people cope well with heat. For some people, high levels of heat can lead to circulation problems caused by low blood pressure.
 - Infants and small children
Special care needs to be taken of infants and small children as they are particularly sensitive and are especially dependant on their parents or guardians. Without instruction, children cannot be expected to understand or act appropriately when it comes to heat or UV protection.
2. People who are required to be intensively physically active outdoors also need to be taken into consideration (e.g. occupations in construction, agriculture or gastronomy). Despite not belonging to a typical vulnerable population group, particular attention needs to be paid to these people due to their often extreme exposure to heat and UV radiation. Their working conditions should be adjusted by the employer (e.g. changes in working hours and rules on break times).
 3. Homeless people often require individual supervision by social services during extreme heat events.

Recommendation for action - core element VI:

Preparedness of the health and social care system

WHO recommends preparedness of the health and social care system (e.g. through education and training of medical and care personnel).

The health and social care sector play a key role in preventing adverse health effects arising from heat events as these two sectors are a direct interface to the main population groups at risk, in particular, the elderly and sick people. This is especially important against the background of an increasingly ageing population.

Providing employees in the health and social care system with education and training can help communicate important points regarding proper action during heat waves. A review should be carried out to determine what occupation groups should be offered education and training and how the training will best supplement existing information material.

Plans of measures to prepare for heat events should be developed in particular for:

- Retirement and nursing homes
- Facilities for people with physical and mental impairments
- Hospitals, emergency and rescue services
- Rehabilitation facilities
- Schools
- Kindergartens
- Certain workplaces

One example of such measures for inpatient nursing facilities are the recommendations for action published by the Hesse regional residential home supervisory body (see info box 2 and further literature).

Concrete measures for care and supervision in outpatient care may include:

- Adjustment and monitoring of fluid intake
- Dietary adjustments
- Adjustments in clothing e.g. for people in need of care
- Changes in medication
- Changes regarding time spent outdoors in shaded areas and in cooler rooms
- Changes in recreational activities

Heat-related impacts on infrastructure can also affect the care system. It is important to take into account other spinoff effects such as water shortages and power outages. In addition, an intact refrigeration chain may no longer be guaranteed in food supply during periods of extreme heat.

Reviews should be carried out to determine whether medical treatment needs to be adapted.

Potential heat events should be taken into account at an early stage with regard to staffing levels and leave arrangements in the health sector during the summer period. It may be necessary to make changes in staffing during periods of acute heat.

Cooler rooms need to be made available, particularly in health care facilities. It is therefore necessary to identify these areas early on and designate them as such in the plans of measures.

In health care facilities it may be necessary to make structural changes to protect against heat (shading, room ventilation and if necessary air conditioning systems). Further information on these measures can be found in the recommendations for action for core elements IV and VII.

Recommendation for action - core element VII:

Long-term urban planning and building sector

WHO recommends long-term urban planning to reduce the impacts of heat on the building, energy and transport sectors.

Good judgement is required for planning and implementing construction and urban planning measures. Consideration needs to be given to the year-round, regional-specific, climatic situation. For instance, some measures are unnecessary in cooler regions in Germany or may take a different form. Long-term or costly adaptation measures in the area of heat protection always need to be weighed up against other interests and should be tailored to each region.

Building-related measures:

- Develop heat protection requirements for buildings (e.g. thermoglass, integrated lamella blinds in windows, roof overhangs to provide shade, shade on roofs through solar energy installations).
- Technical construction measures, for example, ventilation technology, heating and cooling coils, fans and possibly air conditioning systems especially in sensitive areas.
- Heat appropriate planning of new buildings (consideration e.g. in architecture, width/height ratio, street development, orientation and site) in urban and rural areas.
- Use construction materials that reduce heat and avoid materials that store heat.
- Install drinking water dispensers in buildings and public spaces.
- Establish and use “cooling centres” e.g. public, cool spaces for instance, in government offices, shopping malls, church buildings, bookshops and train stations.

Urban and building planning measures:

- Conserve and create shaded green spaces and parks, preferably with cooling evaporation areas such as bodies of water or water features.
- Set up generous shaded areas (with structural measures such as pavilions, roofing, awnings, sunshades or sails and with landscape planning such as replanting or conserving trees with thick foliage).
- Install humidifiers in outdoor facilities and on terraces.
- Reduce heat by creating or keeping clear air channels and areas where cold air is produced.
- Reduce degree of soil sealing in open and public squares to avoid the building up of heat and UV radiation from reflection.
- Encourage planting of trees and shrubbery as well as setting up roof gardens (taking care to select plants low in allergens that can tolerate heat and dry conditions).
- Install canopies and roof structures that provide shade, preferably using materials which reduce exposure to UV radiation.
- Install fixed drinking water dispensers in public spaces.

Further information can be found on the website of the centre of excellence for climate change impacts and adaptation (Kompetenzzentrums Klimafolgen und Anpassung (KomPass): <http://www.stadtklimalotse.net/massnahmenkatalog/>. - German only)

Recommendation for action - core element VIII:

Monitoring and evaluation of measures

WHO recommends real-time epidemiological monitoring and evaluation of heat protection measures.

Monitoring systems and evaluations are intended to quantitatively measure and evaluate heat events and their impacts and, if necessary, amend and further develop intervention measures. These systems and evaluations are not needed to implement initial important adaptation measures, however, they are very useful in the long run. Under no circumstances should the planning or implementing of any kind of measures be neglected due to monitoring problems.

1. Monitoring: data needs to be available in real-time in order to effectively monitor the health impacts of heat waves. This ensures that adaptation to heat waves and counteractive measures, including better information for the public can be undertaken.

Furthermore, it allows the effectiveness of intervention measures to be evaluated.

The data required for these real-time evaluations comes, for instance, from the following sources:

- Emergency departments and hospital admission records
 - Rescue services
 - On-call doctor services
 - Emergency telephone hotlines
 - Civil registry offices, Länder statistical offices (death records)
2. It is important that data is collected. Data should be collected on daily morbidity and mortality cases which can be further analysed later for correlations to exposure effects, also taking account of the combined impacts on health arising from summer heat and increased air pollution.

Information and data could be taken from the following sources:

- Emergency departments and hospital admission records
 - Emergency services
 - Health insurers
 - Health authorities, civil registry offices, Länder statistical offices
3. Heat action plan measures should be evaluated with a view to further improving the protection of the population's health. To do this, measures implemented need to be documented.
 4. It should be determined whether and how the data can be evaluated and used at different levels throughout the public health care sector (e.g. public health authorities, health authorities of the Länder, Robert Koch Institute).

Conclusion

Heat action plans must be drawn up by the Länder and municipalities individually, as local circumstances need to be accommodated, especially the climatic conditions which form the basis for developing and implementing suitable and useful measures. The recommendations in this document are designed to assist in compiling suitable heat action plans. These recommendations are also supplemented by the suggestions from practical experience which can be found in info box 2 below.

Info box 2: An example of implementation in practice

There are already individual approaches to heat action plans in Germany. For instance, in the state of Hesse a working group for the protection of health during heat waves was set up in response to the hot summer of 2003. The working group draws up recommendations for measures for care facilities (see further literature) and for general tips on behaviour for the Hesse region. Participants included the Hesse state ministry for social affairs, regional councils, some municipal health authorities, DWD, representatives of the health insurance medical service, the AOK (a German public health insurer) and the physicians' association. The working group concluded that an expert body comprising the same authorities and stakeholders must be set up and maintained as per the recommendations for action for core element 1 to ensure sustainable heat action planning.

Based on the results published by the above mentioned working group, an additional warning level was established. "Warning level 2" is declared when DWD warns against extreme heat for a period of at least three consecutive days. The Hesse state ministry for social affairs and integration issues a press release if warning level 2 is declared (see <https://soziales.hessen.de/presse/pressemitteilung/hitzewarnstufe-2-wird-morgen-erreicht>-German only). The press release is aimed not just at inpatient care facilities, but also at the general public including those in need of care and the elderly. The press release also contains tips for behaviour in extreme heat and sun protection measures.

The recommendations for action contained in this document include activities which can be implemented in the short-term (e.g. establish channels of communication, core element III) and in the long-term (e.g. urban planning measures, core element VII). While in some instances, a lot of progress has been made in implementation (e.g. establish a heat alert system, core element II), there are other areas where there is a lot of room for improvement and which constitute a challenge for the future (e.g. establish real-time monitoring, core element VIII).

All competent authorities, even those with low human and financial resources, should be encouraged to advance the development of a heat action plan with the means available to them in order to be better prepared for the next hot summer. Many of the measures can be implemented cost-effectively as they are essentially about raising awareness of this topic and thus changing the behaviour of those concerned.

In addition, many of the building measures can be carried out relatively easily e.g. changes to existing buildings that are needed anyway, urban planning and building projects.

It is important in this context that a consensus is reached among all actors. The goal is to protect the population's health against the negative impacts of extreme heat.

Further literature which may be useful for drawing up regional heat action plans

WHO publications

- Heat Health Action Plan, WHO Regional Office for Europe, 2008
http://www.euro.who.int/_data/assets/pdf_file/0006/95919/E91347.pdf
- Public health advice on preventing health effects of heat. New and updated information for different audiences, 2011
http://www.euro.who.int/_data/assets/pdf_file/0007/147265/Heat_information_sheet.pdf?ua=1
- Improving public health responses to extreme weather/heat-waves — EuroHEAT, 2009
http://www.euro.who.int/_data/assets/pdf_file/0010/95914/E92474.pdf?ua=1

German language publications

- Umweltbundesamt und Deutscher Wetterdienst (2008):
Ratgeber: Klimawandel und Gesundheit. Informationen zu gesundheitlichen Auswirkungen sommerlicher Hitze, Hitzewellen und Tipps zum vorbeugenden Gesundheitsschutz
<https://www.umweltbundesamt.de/publikationen/ratgeber-klimawandel-gesundheit>
- Umweltbundesamt und Robert Koch-Institut (2013):
Klimawandel und Gesundheit — Allgemeiner Rahmen zu Handlungsempfehlungen für Behörden und weitere Akteure in Deutschland.
http://www.apug.de/archiv/pdf/klimawandel/allgemeiner_rahmen_zu_handlungsempfehlungen_klimawandel_und_gesundheit_final.pdf
- Capellaro M, Sturm D (2015):
Evaluation von Informationssystemen zu Klimawandel und Gesundheit
Band 1: Anpassung an den Klimawandel: Evaluation bestehender nationaler Informationssysteme (UV-Index, Hitzewarnsystem, Pollenflug- und Ozonvorhersage) aus gesundheitlicher Sicht — Wie erreichen wir die empfindlichen Bevölkerungsgruppen? Umweltbundesamt (Hrsg.). Umwelt und Gesundheit 03/2015.
Band 2: Anpassung an den Klimawandel: Strategie für die Versorgung bei Extremwetterereignissen. Umweltbundesamt (Hrsg.). Umwelt und Gesundheit 04/2015.
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- **Regierungspräsidium Gießen - Hessische Heimaufsicht (2009):
Außergewöhnliche Hitzeperioden: Vorbereitung und Vorgehen stationärer
Pflegeeinrichtungen**

[http://gesundheitsamt.stadt-kassel.de/imperia/md/content/cms04/gesundheitsamt/hitze - handlungsempfehlungen für die praxis - stationär - version-16_07_2007_1_.pdf](http://gesundheitsamt.stadt-kassel.de/imperia/md/content/cms04/gesundheitsamt/hitze_-_handlungsempfehlungen_für_die_praxis_-_stationär_-_version-16_07_2007_1_.pdf)
- **Hochschule Fulda (2012):
Hessischer Aktionsplan zur Vermeidung hitzebedingter
Gesundheitsbeeinträchtigungen der Bevölkerung (HEAT)**

https://www2005.hs-fulda.de/fileadmin/Fachbereich_PG/Forschung_Praxis/HLUG_heat.pdf
- **Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (2010):
Klimawandel, Extremwetterereignisse und Gesundheit. Bericht der
Internationalen Fachkonferenz vom 29./30. November 2010.**

http://www.bmub.bund.de/fileadmin/Daten_BMU/Pool/Broschueren/klimawandel_extremwetter_konferenzbericht_bf.pdf

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