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Content

Content 2

Introduction 3

A. Requirements for the preparation of a heat action plan 3

1. Why create a heat-health action plan? 3

2. Resources: Time, staff and funding 4

3. Building the HHAP on the basis of existing concepts and strategies 5

4. Building (political) support 6

B. Steps to develop a heat action plan using the example of the city of Worms 6

1. Overview on the state of knowledge and experiences regarding heat-health action plans 7

2. Identification of heat-vulnerable areas in Worms (heat hot spots). 7

3. Stakeholder participation and networking 9

4. Preparation of the heat-health action plan 10

5. Establishment and continuation of the heat action plan 15

6. Public relations 17

7. Evaluation of the project implementation 18

Literature 18

Annex 1: Possible structure of a heat-health action plan 19

Annex 2: Checklist for assessing the state of development and implementation of a heat-health action plan 20

Annex 3: Further links 21

Annex 4: Collection of heat protection measures 22

Introduction

As part of the project "Hitze Sicher/Worms" (Heat Safe/Worms), a heat-health action plan (HHAP) was developed for the city of Worms in cooperation with the University of Applied Sciences Fulda, the University Hospital Munich (LMU), Climate Alliance and the Rhineland-Palatinate Competence Centre for Climate Change Impacts. In this document, we would like to share with you our experiences and insights gained during the drafting and implementation process.

All municipalities have their own structures, organisational units and circumstances. Therefore, approaches in one municipality may lead to success, while in another a different strategy is necessary to achieve the desired result.

This guideline describes key points of the path Worms has taken, reflects on the steps taken and presents the lessons learned.

In general, it is important to get to know the local structures in the municipality before introducing a HHAP and to involve actors at different levels (politics, administration, associations, institutions etc.).

The HHAP of the City of Worms, which was adopted by the city council in July 2022, was translated into English and made available to the Ready4Heat project partners.

In the first part, we address points that we see as important prerequisites for the creation of a heat action plan in a municipality; in the second part, we present the cornerstones of the process in Worms.

A. Requirements for the preparation of a heat action plan

1. Why create a heat-health action plan?

The increase in hot days and more frequent and longer-lasting heat waves will lead to an increase in the health risk to the human organism. There will be an accumulation of heat-related illnesses and deaths. While many people suffer from heat stress, certain groups of people are particularly vulnerable. Heat-vulnerable groups include the following:

- Elderly people, chronically ill, as well as physically and mentally impaired people
- Infants and children
- Pregnant persons
- Homeless people and people with inadequate housing (including shared accommodation)
- Economically and socially disadvantaged people
- People who work outdoors
- Outdoor sportspersons

A heat-health action plan aims to,

- ensure the protection of the population during heat events and thus reduce morbidity and mortality rates,
- relieve the burden on the health system,
- sensitise the population to the health effects of heat and show preventive possibilities for heat protection
- and thereby increase the heat resilience of the population.

⏩ **Our advice**: When developing a heat-health action plan, we recommend a special focus on heat vulnerable groups.

2. Resources: Time, staff and funding

If you as a local administration want to address the issue of "heat and health" or are asked by your political bodies to prepare a HHAP, you may find that the issue is more complex than first assumed. The vulnerable groups are diverse and the access to the groups is possible through many different structures and channels.

In order to develop a comprehensive HHAP that involves local actors and includes activities for the different target groups, a structured approach is recommended. This requires an investment of time, human and financial resources. Human and financial resources can be scarce, especially in small and medium-sized or financially weak municipalities. The preparation of a heat action plan also requires both technical and methodological know-how.

Check funding opportunities

In recent years, the topic of adaptation to climate change has been increasingly included in public funding programmes. We therefore recommend to at first examining funding opportunities, e.g. for the promotion of an adaptation manager or specifically for the preparation of a HHAP. For this purpose, it makes sense to contact the relevant advisory centres and institutions, as well as funding agencies.

External support

When preparing a HHAP, we recommend seeking external support for technical and methodological assistance throughout the entire process of preparing the HHAP. In the context of the project "Hitze Sicher/Worms", the City of Worms received technical and methodological expertise and support from the project partners in all phases of the preparation and the initial implementation of the plan. We recommend contacting municipalities that are already working on the preparation of a HHAP or have prepared one already and ask them about experiences with external offices or institutions to support the preparation. In order to be able to conduct various on-site events and workshops during a comprehensive preparation of a HHAP, it is useful that the external support is not located too far from the municipality. Although many events are now conducted online or hybrid, in our experience it is valuable to hold on-site meetings to enable personal contact and exchange with the actors involved.

Define clear responsibilities

At the municipal level, a project leader for the preparation of the plan is needed. This can be a person from the environmental sector (e.g. from the climate protection or adaptation management) or from the health sector (e.g. from the health department). It also makes sense to have a joint project management in order to use synergies between the departments of climate adaptation and health.

The HHAP project manager is (as "caretaker") responsible for the preparation of the plan, keeps track of the concept and the details, maintains contacts with the actors, both within the city and externally, takes care of public relations, invites to workshops and events and is in charge of the (potential) steering committee described below. The project manager answers e-mail enquiries, is available for telephone enquiries and much more. Without such a caretaker, a HHAP cannot be created and successfully implemented in the following years. It is recommended that the project management is located within the administration in order to be able to for example send out official municipal invitations, to be accessible etc. In this way, the different actors and the population can gain more confidence in the organisation and implementation of the HHAP.

The creation and implementation of a HHAP also requires the support of local politics, including the political will of the local parliament.

⏩ **Our advice**: Check funding opportunities, look for external support and define clear responsibilities. *More detailed advices on how a heat-health action plan can be structurally anchored in a city can be found below.*

3. Building the HHAP on the basis of existing concepts and strategies

Integration into / building on existing concepts or strategies that already exist in the city

For the preparation of a HHAP, it is recommended that there is a municipal climate change adaptation strategy or concept, which in the best case has already been adopted by the municipal council. In the city of Worms, the creation of the HHAP was one of 48 measures of the climate change adaptation concept, which was already adopted by the city council in 2017. It is also useful for the municipality to already have an urban climate analysis, which can be used as a basis for the identification of "heat hot spots" (see below).

Use existing literature and guides

There is already quite some (international) literature that deals with the preparation of heat-health action plans, sets standards, provides guidelines and offers assistance. The WHO in particular has published several documents. Additionally, there are also publications in national languages in different countries – some of it based on the WHO publications.

One basis for the preparation of the Worms HHAP was, among others, a German-speaking guideline (GAK 2017), published by a federal-state working group. It lists eight core elements of a heat-health action plan – from the use of a heat warning system and special attention to risk groups to long-term urban planning, construction and monitoring, as well as evaluation of implemented measures. These recommendations for action are based on the WHO (2008) guidelines. Table 1 lists the basic (international) documents for the preparation of heat-health action plans.

Editor and Title	Year	Content
WHO Europe: Heat-Health Actions Plans - Guidance	2008	This (core WHO) document "explains the importance of the development of heat-health action plans, their characteristics and core elements, with examples from several European countries that have begun their implementation and evaluation."
WHO Europe: Public Health Advice on preventing health effects of heat	2011	"This publication offers detailed information for various target audiences (e.g. health authorities and city planners), and on medical advice and treatment practices. It builds on the WHO publication Heat-health action plans – guidance (2008) and contains new information on vulnerable population groups, vegetation fires, occupational health and housing."
WHO Europe: Heat and health in the WHO European Region: updated evidence for effective prevention	2021	This publication is another update of the WHO 2008 guidance document. It "collates and summarizes the most relevant evidence published since 2008 (..). Findings are organized around the elements the original guidance document identified as 'core' to a comprehensive heat-health action plan, and these are complemented in each chapter with the results of a WHO survey of heat-health action planning in 2019, where relevant to the topic covered.
International Federation of Red Cross and Red Crescent Societies: Heatwave Guide for Cities	2019	"This guide is intended to help city staff take the first steps to understanding the heat risks they face, develop an early-warning system, work with partners to consolidate heat-action plans, and adapt urban-planning practices."

Tab. 1: Basic (international) documents for the preparation of heat-health action plans

Our advice:
- If possible: Build on existing concepts or strategies that already exist in the city
- Familiarise yourself with existing literature, guidelines and experiences.

4. Building (political) support

From the intention to develop a HHAP to its binding implementation, (political) support from different actors is needed. If there is not yet (sufficient) support in your city, the Fulda University of Applied Sciences (2023) has put together some arguments that can be used to convince decision-makers and others of the need for a HHAP.

- Heat is a relevant health issue (for an overview of studies on this issue in different European countries see for example WHO (2011)).
- A HHAP is a recommended instrument: In 2018, WHO Europe issued the advice to create heat action plans. In 2021, WHO Europe criticised a mismatch between clear evidence of the health burden of heat and slow implementation of heat-health action plans.
- A HHAP is feasible: International examples show, that the development of HHAPs is feasible, be it at the national, federal or municipal level. WHO Europe (2021) has compiled evidence on this from the European countries.
- A HHAP is an effective instrument: There are promising findings on the reduction of heat-related mortality after the introduction of a HHAP (see for example Niebuhr/Siebert/Grewe (2021).

Our advice:
- We recommend using maps and illustrations to highlight that your municipality has a problem with heat extremes.
- We recommend referring to the arguments and recommendations of national and international expert bodies in the argumentation for a heat action plan.

B. Steps to develop a heat action plan using the example of the city of Worms

The city of Worms was one of the first German cities that established a comprehensive heat-health action plan. The following steps were taken in the case of Worms. Each municipality can check which steps are useful for creating its own plan.

1. Overview on the state of knowledge and experiences regarding heat-health action plans
2. Identification of heat-vulnerable areas
3. Stakeholder participation and networking
4. Preparation of the HHAP
5. Implementation of the HHAP
6. Public relations
7. Evaluation of the project implementation

1. Overview on the state of knowledge and experiences regarding heat-health action plans

Researching the current state of knowledge on heat-health action plans before creating the own one is inevitable and very helpful. This will give you an overview of how other cities have proceeded and you can benefit from their experiences. It might make sense to look at municipalities that have a similar structure, size (number of inhabitants) or comparable climatic conditions. For some years now, the number of municipalities that have prepared their own HHAPs (or which are in the process of doing so) has been increasing strongly (usually HHAPs can be downloaded from the municipal websites).

Our advice:

- Use general (inter)national guidelines, recommendations and other supporting documents (for the core international documents, see Table 1).
- You don't always have to reinvent the wheel: Just look at what others municipalities have done before and copy examples that work well.
- We recommend entering into exchange with suitable municipalities and gaining experiences in the implementation of HHAPs. Maybe one of your partner cities has already implemented a HHAP.

2. Identification of heat-vulnerable areas in Worms (heat hot spots).

In Worms, we have identified **areas of the city that are particularly vulnerable to heat**, taking into account demographic and climatic data. These are streets and building complexes where the municipality should act as a priority.

The maps were created by combining climatope maps with socio-demographic data (especially the number and geographical distribution of vulnerable groups of people). Ideally, the necessary data is already available in a municipality. If no climatope maps exist in a municipality, data on the temperature distribution in the urban area can be produced relatively inexpensively with drone flights or the evaluation of publicly accessible satellite data.

In addition, the climatic development of the urban area from the past to the present was taken into account, as well as a projection into the future (until the end of the century). Current climate data and data on future developments are available in Germany from the German Weather Service (DWD), where they are made available free of charge. It is useful to make climate projections up to the year 2100 about the future temperature development in a municipality.

Forecasts of population development in Germany are usually available until the year 2050 or 2060. Corresponding figures are available from the state statistical offices and can be used to look at the structure of the resident population in the coming decades. However, we advise cautious use, as the publicly available figures in Germany do not show any details.

Methodological knowledge is required for combining the data. For this, the city of Worms has received support from the Rhineland-Palatinate Competence Centre for Climate Change Impacts, which has proceeded as follows:

The determination of the affectedness of individual groups of people was based on the action guide for municipal climate adaptation in Hesse (HLNUG 2019). The following sensitive groups of people were considered:

- Children ≤ 5 years
- Older 65-79 years
- Very old people ≥ 80 years
- Recipients of social aid
- People with assistance for subsistence/basic income support

The data on the groups of people came from a social area analysis of the city of Worms and are available on the spatial basis of the statistical districts. Climatope maps of the city of Worms (prepared by an external architecture and engineering bureau) and a map of residential buildings served as further data bases.

In a first step (sensitivity analysis), it was determined how high the density of the individual group of persons is in the statistical districts. For this purpose, the number of persons was set in relation to the residential building area. The distribution was divided into 10 equally sized classes (deciles), as there is no definition of generally applicable thresholds due to the lack of reference values for sensitivity. Classes 8, 9 and 10 were assessed as sensitive to extremely sensitive districts. All other classes were disregarded.

In a further step, the affectedness was determined. For this purpose, the results of the sensitivity analysis were intersected with the map of climatopes. Following this, the inner city climatope was assessed as highly stressed, the urban climatope as stressed and the settlement climatope as slightly stressed. Other climatopes were not taken into account, as the urban climatic effects in the corresponding residential areas generally do not reach a degree of stress. As a result, urban areas were identified in which priority action is needed.

In addition, further data were available, which were individually mapped or inserted as additional information in the maps of affected areas:

- Kindergartens
- Primary schools
- Playgrounds
- Care facilities
- Community accommodation
- Relief areas (park, forest and water climatopes)

Such an assessment matrix can be used to identify urban areas with a very high level of affectedness, high level of affectedness and medium level of affectedness. For example, statements can also be made about which primary school, which day-care centre, which playground, which care facility and which community accommodation is located in which climatope – both in the present and forecasted for the future. A municipality can thus identify the areas with the most urgent need for action. More detailed information on the procedure for creating the maps can be found in the Worms Heat Action Plan.

Additionally, **inspections or walk-troughs** were carried out in particularly heat-vulnerable areas of the city in order to examine the areas for various criteria (seating, shading, greening, access to drinking water in general, on paths, squares & bus stops etc.) and to identify possibilities to redesign spaces. The results of surveys like these can be used to initiate a redesigning measure or be introduced to respective working groups that are in charge of city development issues.

Furthermore, a **citizen participation action** on the topic of “heat islands and climate havens” was carried out. Worms inhabitants were asked to enter heat islands and climate havens on a digital map, along with the corresponding reasons why this place is classified as such. The aim of the participation was to sensitise the citizens to this topic, to underline the importance of green places, as well as to identify places with a need for action. The result was a map with a large number of heat islands and climate havens, which can be used as a basis for argumentation in the planning of further projects or in redesigning approaches.

Our advice:

- We recommend commissioning an external bureau to create heat hotspot maps.
- For German-speaking cities, we recommend the “Handlungsleitfaden zur kommunalen Klimaanpassung in Hessen“.
- *For Ready4Heat pilot cities, heat hot spot maps will be created within the project.*

3. Stakeholder participation and networking

The development and implementation of a HHAP requires close cross-sectoral and cross-institutional cooperation between many stakeholders. Therefore, it is important to involve many actors already in the preparation process of the HHAP and to organise formats of stakeholder participation.

In Worms, stakeholder participation was carried out at the beginning of the process of developing the HHAP. In a first step, all municipal and private institutions dealing with heat-vulnerable groups were identified and invited by e-mail or letter post to a kick-off event and a subsequent series of workshops.

It is necessary to identify relevant actors in your municipality who are in contact with the respective heat-vulnerable groups. In this way, you can get to know structures that are already in place in the area of heat prevention and identify needs for action. It should be noted that the actors can be different with regard to the different target groups as well as with regard to short-, medium- and long-term measures.

In Worms, stakeholders from the following areas were invited to the participation process: Health care sector (doctors, medical association, association of general practitioners, association of panel doctors, clinic, support services, nursing homes, homes for the elderly, health office, mobile care services, midwives, children's clinics, counselling centres, pharmacies), kindergartens, schools, higher-level institutions: State offices, employers' liability insurance associations, chambers, associations, (sports) clubs, organised leisure activities, honorary offices, church communities, local administrations, municipal actors from various fields, disaster control, property developers, companies, housing associations.

In order to enable a practical, needs-oriented preparation of the heat-health action plan, target group-specific workshops were held after the kick-off event. Two workshops were held on each of the following groups:

- Older people, physically and mentally vulnerable people, people in need of care
- Pregnant persons and children
- Community shelters and homeless people
- Outdoor workers

The workshops served to pass on information on the topic of heat and health as well as to exchange, get to know each other and network. Their aim was

- to raise awareness about the climatic situation in the city of Worms and the health risks of the respective groups due to heat,
- to find out about the affectedness in the respective person's field of work,
- to gain an overview on heat-related activities that are already in place in the municipality,
- to collect already established tools and instrument that could be used and built upon,
- to collect proposals for heat adaptation measures,
- to explore the willingness for future cooperation in the implementation of the HHAP,
- and to create the basis for a stakeholder network.

The implementation of a HHAP requires a large number of actors in the municipality that are willing to carry out activities in their field of work. The network of actors required for the implementation of heat protection measures on site can be generated from the participants of the stakeholder workshops, among others. Such a process also serves to raise awareness about heat and health.

It could be helpful to precede such broad-based workshops with internal city meetings of various departments of the city administration (for example the social office, city planning, health, environment and civil protection) (or bilateral talks) in order to involve them in the process at an early stage, to increase the driving forces of the process and to start defining the roles and responsibilities of the different departments. This did not happen in Worms, but was reflected on afterwards as a missed opportunity.

In addition to workshops, there are also other ways to involve citizens and to gather voices, for example neighbourhood walks, attendance of other (related) meetings and events, surveys or interviews with selected stakeholders.

Our advice:

- We recommend involving citizen participation processes in the development (and also later in the implementation) of a HHAP, especially target group specific stakeholder workshops, to which many actors are invited.
- We furthermore recommend holding bilateral conversations with departments, advisory boards and offices within the city administration, which are relevant for heat-protection measures.
- If time allows, we suggest conducting interviews with external stakeholders, to collect experiences, needs and ideas.

4. Preparation of the heat-health action plan

On the basis of the stakeholder workshops, conversations and interviews, the development of the HHAP can begin. In the following, experiences from the preparation process are shared. Afterwards, the main elements of a HHAP will be introduced.

Preparation process

In our experience, it makes sense to work in a small group to develop a first draft of the HHAP. The preparation of the plan requires a lot of (online) meetings to agree on procedures at short notice, to write and discuss parts of the text and to coordinate activities quickly. This can practically only be done in a small working group of, for example, 3-4 people, who all have a certain time budget available and of whom at least one person should come from the city administration (project management). This “driving force” should have good knowledge of the local conditions and of the people to be involved. A good connection to politics, to superior departments up to the mayor also seems to us to be an advantage.

For the compilation of the measures for Worms, the suggestions from the stakeholder workshops and from interviews were used, combined with ideas from already existing heat-health action plans as well as impulses from the scientific support. These were then transferred to the local conditions of Worms. From the multitude of measures compiled in the process, 12 priority short and medium term measures were defined. Care was taken to ensure that appropriate measures were included for all risk groups particularly affected by heat. In addition, there were more general measures, such as the establishment of structures and an information system.

The long-term measures were developed in close cooperation with the city planning department. Since the city of Worms already has various concepts in which measures are described that are supposed to lead to heat-sensitive urban planning (concept for adaptation to climate change, climate protection and energy efficiency concept, climate check for draft legislations, guideline for water-sensitive urban development), the corresponding measures were only taken up again in the heat action plan in order to give them an appropriate status with regard to the topic of heat.

Main elements of a HHAP

The main elements of a HHAP include:

- The presentation of the most heat-vulnerable areas in the city
- An alarm system and risk communication (to the population and support systems/multipliers)
- A catalogue of measures (including measures to manage acute heat events, medium-term measures to raise awareness, as well as long-term measures mainly related to city planning activities)

- Defining structures and responsibilities
- Monitoring and Controlling

An exemplary outline of a HHAP can be found in Annex 1. The identification of heat-vulnerable areas was described in chapter 2. The alarm system and the catalogue of measures will be described in the following. Structures and responsibilities then are subject of chapter 6, the evaluation concept will be dealt with in chapter 7.

Alarm system and risk communication

Risk communication addresses on the one hand the population, which is advised to adapt their behaviour to the climatic conditions, and on the other hand support systems, which have to implement binding heat protection measures (defined in the HHAP). Therefore, an alarm system is the prerequisite for triggering acute measures in the event of heat. The aim of an alarm system is to inform all actors that are supposed to carry out measures. An alarm system includes

1) the definition of different alarm levels,

2) an alarm triggering body and its accessibility,

3) the contents of the warning,

4) determining who is to be informed,

5) as well as the communication channels.

Especially at the beginning of a HHAP implementation it probably makes sense to link the alarm levels to the levels of the national weather warning system (please see Tab. 2 for an overview of the existing warning systems in the Ready4Heat pilot city countries). For Worms, it was agreed (for the time being) to follow the heat warnings of the German Weather Service (DWD). The following alert levels were defined for Worms:

- Pre-warning stage (valid from May-September): Measures are prepared, ready to start and may already be underway
- Alarm level 1 (triggered at DWD warning level 1: 32 degrees perceived temperature): Acute measures of alert level 1 are carried out by the respective actors.
- Alarm level 2 (triggered at DWD warning level 2: 38 degrees perceived temperature): Acute measures of alert level 2 are carried out by the respective actors.

In addition, it was discussed to introduce a 3rd alert level, which is triggered at 42° Celsius, for example, and is also linked to the carrying out of measures (the topic of evacuation could be discussed here, for example). Whether this will be implemented and what temperature would make sense for warning level 3 still needs to be examined.

The temperature curves of the last few years, the curves of the maximum temperatures and/or the average frequency of alarm levels triggered could be used as a decision-making aid for determining the alarm levels.

It has not yet been decided in Worms which body will trigger the alarm levels – and therefore the alarm system has not yet been implemented in practice. One conceivable possibility is that the alarm levels are triggered by the HHAP coordination during office hours and all actors involved in the plan are informed accordingly. For all other times, i.e. in case of vacations, illness or weekends, a solution must be found, for example in the form of a stand-by service or an automated alarm triggering. In addition, it is recommended that the actors themselves subscribe to the weather services' warnings. Another possibility would be to locate the body in the fire and disaster control department.

In the best case, the body is also available for queries (seven days a week, at least during the day) in order to be responsive to the following issues:

- Information about the heat warning
- Health tips, behavioural tips, municipal support offers
- Coordination of the measures
- Referral to other actors and agencies
- Replying to enquiries from actors who implement measures themselves
- However, not in charge of health emergencies (referral to ambulance service).

The content of the warning should be as follows (and must be ready pre-formulated):

- Information about the date, duration and intensity of the heat wave
- (Target group-specific) behavioural tips and possibilities to act (incl. overview of measures initiated by the city and other actors)
- Contact option for queries and to pass on to affected people
- Additionally: Reminder to responsible actors of the HHAP that the acute plan (see below) lists all steps and activities that should be performed according to the alarm level (which measures to take, whom to inform etc.). The updated version of the acute plan will be send to all actors before each summer.

In addition, it must be determined who is to be informed. This should be recorded in a constantly updated table. In any case, actors who have committed to implement concrete measures at one or both of the alert levels must receive the warning. Who exactly is informed per organisation must be discussed internally and communicated in advance of the summer. In addition, actors who have not (yet) developed any measures but for whom the information is nevertheless relevant (e.g. schools, day-care centres, care facilities, sports clubs, employers' associations etc.) can receive the warning as well.

In addition, the communication channel (and thus the reachability of the actors) must be clarified. It probably makes sense to send (pre-formulated and easily to modify) e-mails in order to reach many actors quickly. Following up by phone, especially with important actors, could be very useful. The establishment of a communication cascade (e.g. within the municipal administration) could also be a good idea. Furthermore, it seems to make sense that all actors involved are strongly recommended to subscribe to the weather services' warnings themselves.

Austria	
Warning thresholds/ alerts levels	PT > 35 °C for at least 3 days without night cooling below 20 °C. Thresholds are subject to modifications depending on weather in preceding days.
Target groups	Nursing facilities, hospitals and health resorts, childcare facilities (kindergartens, schools, etc.), mobile nursing services, medical chambers and emergency organizations
Notification System to Target Groups	Website
Notification System to Stakeholders	Internally, all warnings above a certain category are subject to a certified process, which determines which bodies have to be informed and in which form. Email-Newsletter with detailed forecasts, tips, links etc. to nursing homes, kindergardens, hospitals, civil protection, firefighters, red cross.
Website	https://warnungen.zamg.at
Literature	Leitfaden Hitzemaßnahmenplan Gesamtstaatlicher Hitzeschutzplan

Germany	
Warning thresholds/ alerts levels	Thresholds are region-specific and consider acclimatization (previous 30 days). Benchmark: Level 1: 20 °C < PT < 26 °C Level 2: 26 °C < PT < 32 °C Level 3—Strong heat stress: 32 °C < PT < 38 °C & Tmin ≥ 17 °C Level 4—Extreme heat stress: PT ≥ 38 °C & Tmin ≥ 17 °C *Only Levels 3 and 4 are relevant for heat warnings.*
Target groups	General public, health system, elderly, people living socially isolated, people needing care, obese persons, chronically ill, working people outdoors, homeless, babies and infants.
Notification System to Target Groups	Email-Newsletter, website, Apps, radio, internet, newspaper, television
Notification System to Stakeholders	Email-Newsletter
Website	http://www.dwd.de/DE/wetter/warnungen_gemeinden/warnWetter_node.html
Literature	The heat health warning system of the German Meteorological Service

Hungary	
Warning thresholds/ alerts levels	Yellow: 25 °C > Tmean > 27 °C Orange: 27 °C > Tmean > 29 °C Red: Tmean ≥ 29 °C
Target groups	National Public Health and Medical Officer Service
Notification System to Target Groups	Website, mobile app (Meteora)
Notification System to Stakeholders	E-mails to the National Public Health and Medical Officer Service
Website	http://www.met.hu/en/idojaras/veszelyjelzes/
Literature	Heatwave Early Warning Systems and Adaptation Advice to Reduce Human Health Consequences of Heatwaves

Slovenia	
Warning thresholds/ alerts levels	Yellow: Tmax > 31 °C Orange: Tmax > 34 °C and/or Tmean > 26 °C Red: Tmax > 37 °C and/or Tmean > 28 °C Tresholds are regionally-based
Target groups	Public (general population), civil defense in case of orange or red warning
Notification System to Target Groups	ARSO web pages, Twitter, Facebook, radio, TV
Notification System to Stakeholders	Website, Twitter, Facebook, radio, TV. Civil defense by E-mail.
Website	http://www.meteo.si/met/sl/warning
Literature	Steps Towards Comprehensive Heat Communication in the Frame of a Heat Health Warning System in Slovenia

Tab. 2: Overview of existing national heat-health warning systems in Austria, Germany, Hungary and Slovenia (Source: Casanueva et. al (2019); Legend: Tmax: daily maximum temperature. Tmin: daily minimum temperature. PT: perceived temperature (combination of temperature, radiation, wind, humidity)

Measures

There are countless measures that serve heat protection in the municipality, both quick-to-establish interventions as well as more time- and resource-consuming activities. There are different ways to categorise measures. In the preparation of the Worms HHAP, we have opted for the primary categorisation of acute measures, medium-term measures and long-term measures. The time specification does not refer to the duration of implementation, but to the effects of the respective measure:

- **Acute measures** are those that take immediate effect during heat events and are intended to ensure heat protection: These include, for example, both targeted and broad communication of heat warnings and corresponding behavioural tips, the operation of a heat telephone, everyday support (e.g. a shopping service), visiting or contacting risk groups and patients, opening cool places, free admission to swimming pools, distributing water, fruit and heat protection articles, rescheduling school excursions or adjusting school and working hours. Since there are different alarm levels, it is important to indicate which measure should be triggered at which alarm level. It is advisable to collect all measures (including information about who carries out the measure when and how) in an acute plan that is made available to all involved actors.
- **Medium-term measures** primarily serve to raise awareness, especially among multipliers – i.e. people who are in direct contact with vulnerable people (e.g. relatives, educators, teachers, early childhood intervention structures, care personnel and employees of social organisations, e.g. in collective accommodations). Central measures include training and the distribution of information material and guidelines.
- **Long-term measures** mainly relate to city development and construction activities: The renovation and greening of buildings, the creation of climate oases and the reduction of sealed surfaces, shading through trees and awnings and the installation of drinking water fountains as well as sprinkler systems. This also includes measures that prevent, for example, that air corridors are being built over or that areas are being sealed. Since motorised individual transport must be massively reduced in the course of climate neutrality targets, this turns out to be a good starting point for transforming grey to green or blue infrastructures.

Measures can also be categorised according to their target group. While some measures address all residents (or no specific target group; for example the communication of the heat warning, the opening of cool places or some of the urban development measures), others focus on specific risk groups (e.g. the heat telephone targets senior citizens or the distribution of water and heat protection items targets children (in day-care centres, schools and playgrounds) and homeless people). Furthermore, measures can also be spelled out differently for certain target groups: For example, it is crucial to create cool places where the respective target groups primarily spend their time in everyday life.

Of course, urban development measures are intended to serve all residents, but they are primarily beneficial for the people who live in the vicinity of the respective intervention. Therefore, it can be important to implement measures first in neighbourhoods where socially disadvantaged people live (e.g. measured by the square metre of living space, the buildings condition, the green space ratio etc.).

There are measures that can be implemented relatively quickly and thus right at the beginning of a process (the so-called “low-hanging fruits”). These include, for example, the compilation of already existing cool places in a city (e.g. some museums, open churches, parks and swimming pools, air-conditioned shopping centres and cinemas) on the website and/or the geoportal of a municipality, or as city map in paper form. It is important to note, however, that this can only be a first step and should not stop there.

Furthermore, measures can be differentiated according to whether they can be implemented by the local administration (e.g. offering a heat telephone) or whether other actors are primarily responsible for the implementation of measures (e.g. the creation of a cool room in a shopping centre that can be used free

of charge or the contacting of risk groups by the health services). In the second case, the municipality can play different roles: It can initiate or promote ideas (materially and non-materially), network actors, provide infrastructure, and support the promotion of the measures as well as the contact with the target groups.

For some measures it also makes sense to define at which alarm level they take effect. For example, it may make sense for many measures to be activated already at a lower temperature (e.g. from 32°C), but others only at higher temperatures (e.g. 36°C). Others could be active throughout the whole summer.

Our advice:

- A HHAP must contain both an alarm system with corresponding responsibilities, an acute plan, as well as various types of measures.
- We recommend using the national weather service's heat warning system as a basis for the alarm levels.
- We recommend focusing on the most vulnerable groups, institutions and urban areas, especially in the beginning of the implementation, while ensuring that actions can be scaled up to other groups and areas.
- We recommend ensuring that the implementation of measures is also secured on weekends and public holidays.
- A broad collection of measures and best practice examples can be found in Annex 4. For other compilations see also Annex 3.

5. Establishment and continuation of the heat action plan

Various framework conditions are decisive for a successful implementation of an HHAP, above all political support and commitment, human and financial resources, as well as clear structures and responsibilities.

Municipal Council / City Council Resolution

The draft plan prepared by the working group must be adopted by the municipal council or city parliament as a prerequisite for the implementation of measures in subsequent years. However, before it is submitted to the municipal parliament for a vote, it should be discussed and, if necessary, adapted in various departments that have not been included in the drafting process. As a matter of principle, we recommend a comprehensive inclusion of all affected departments already in the drafting of the plan. This will later become also relevant in the implementation phase.

The draft plan should (or must) also be submitted to the relevant bodies and committees of a municipality at least for information – or for discussion and voting. In Worms, these were the environmental committee, the building committee, as well as the main and finance committee. In this way, concerns and wishes from the political side can be taken into account. Only after the HHAP has been dealt with in the various committees, it makes sense to submit it to vote on in the city parliament. The time required for this internal discussion process should not be underestimated. In the case of the city of Worms, it took about 6 months.

Continuity: human and financial resources

After adoption in the city parliament, the implementation of the plan can begin. Implementation requires both human and financial resources. The municipality should allocate a certain amount of money each year in its budget for the implementation of the HHAP. An annual budget for the operation of the structures and the implementation of measures is required.

Creating clear structures and responsibilities

Both the creation and the implementation of an HHAP require a coordination office within the city administration. There are various options as to where this is located and it can vary from municipality to municipality where it makes sense to locate it. Since heat protection is an inter-agency task, it could make sense to place the central coordination of the HHAP directly with the management of the city administration.

In addition to the coordination office, it seems useful to establish of a cross-agency steering group in which several people from different departments contribute expertise and experiences from their respective areas.

The Worms HHAP includes the setting up of a steering committee to coordinate the development, implementation and evaluation of the heat protection measures. Since at the time of writing the steering group had already been established but had only met once, only a few experiences can be reflected on here. The following section therefore focuses on the arguments for establishing a steering group.

The central argument for the establishment of a steering committee was the insight that heat protection is a cross-cutting issue that affects various offices and departments within a city administration and that a joint discussion on prioritising and implementing measures as well as a joint review after the summer (what went well, what went less well, what needs to change etc.) is therefore crucial. This should create a good basis for decisions to be made. Another goal is to involve the different departments on the way to better heat protection, to coordinate activities with each other and to distribute the responsibility for the process among several shoulders.

The steering committee in Worms consists of central municipal actors who are supposed to meet in regular intervals to implement, adapt and further develop the HHAP. The steering committee is responsible for the coordination and implementation of the HHAP in the different areas. This means concretely:

- Development, discussion and prioritisation of measures
- Initiation and coordination of the successive implementation of the measures formulated in the HHAP.
- Decision for which measures funds are used
- Setting up working groups on specific topics (e.g. on the creation and opening of cool places) with other actors as needed.
- Quality assurance: evaluation and adaptation of measures, as well as annual inclusion of new measures
- Evaluation (and, if necessary, adaptation) of the heat warning system (alarm levels, communication chains etc.) and the composition of the steering committee.

It is planned that the steering group will meet at regular intervals (approx. every 2-3 months). The coordination, preparation and invitation to the meetings is done by the HHAP coordination (located in Worms in the Department of Environmental Protection and Agriculture).

In Worms, the steering group should first be made up of actors who are mainly involved in the implementation of short and medium-term measures. It is planned to set up a separate working group for the long-term (especially urban development) measures. Whether this will be a separate working group or integrated into the steering group is still open.

In addition, the steering committee can be expanded at any time if necessary and other actors or departments can be included on a topic-related basis. In Worms, the following departments have been designated for the steering group so far: Environmental Protection and Agriculture, Press and Public Relations, Fire and Disaster Prevention, School Administration, Specialist Office for Senior Citizens and Inclusion, Urban Development (Integration and Migration), Municipal Waste Management Company, Health Department, Worms Hospital.

In Worms we experienced that at the first steering group meeting many of the people present had questions about what role they could/should take in the process. This experience has shown that it can be useful to develop a relatively clear idea in advance of what possible roles (and tasks) the respective departments could have in the process. If necessary, it may be helpful to hold bilateral discussions with the relevant departments before the first steering committee meeting.

Our advice:

- We recommend having the HHAP officially adopted by the city parliament in order to gain political support and to ensure it is legally binding.
- We recommend providing the necessary resources (in the various departments) to be able to implement the HHAP.
- We recommend establishing a central coordination office and a steering group.
- In addition, it can be helpful if each department involved appoints a person as a multiplier who is trained in heat and health issues and who represents the respective department in the steering group.

6. Public relations

Public relations work is central for two reasons in particular. On the one hand, to reach as many departments, institutions and organisations as possible, and on the other hand, to increase general awareness of the effects of heat:

1) Involvement: A HHAP cannot be implemented by the local government alone. Rather, it is dependent on cooperation with non-municipal actors. Therefore, it is important to address and involve these actors in a targeted way, including serious participation opportunities (see actor participation above), as well as general public relations work that keeps the topic present and motivates actors to participate in the process or to implement heat protection measures in their own institution.

2) Raising awareness: General public relations work also contributes to raising awareness of the issue and educating people about (individual) protective measures. The target group is the entire urban population, but especially the risk groups and their relatives and multipliers.

This can be implemented through the following measures, among others:

- Production of information material (general flyer, tips for behaviour specific to risk groups, if necessary flyers and posters regarding specific measures etc.) and displaying it at various locations in the city.
- Dedicated section on the city's own website (incl. heat warnings).
- Information tables at street festivals or other events, possibly own awareness-raising events (before summer).
- Formulating press releases during the different steps in the process (stakeholder participation, plan development, implementation of first pilot measures etc.).
- Establishment and maintenance of contact to the local press (if necessary, seek active dialogue, reach agreements, inform about measures, formulate proposals for articles etc.).
- Involving the city's public relations department (e.g. to publish heat warnings on the website, contacts with the press, heat briefing etc.).
- In the event of a heatwave: Have a pre-formulated press release (heat warning, tips on how to behave, support offers from the city etc.) ready that only needs to be slightly adapted (in the best case, the city's public relations department have been briefed in advance).

Our advice:

- We recommend developing a public relations concept together with the public relations department of the city (and possibly other departments or within the steering group).

7. Evaluation of the project implementation

Any concept is only as good as its implementation and must be measured by its results. Therefore, it is of great importance to record and evaluate the implementation of the measures of the HHAP in a controlling system. This is to ensure that the concept is regularly reviewed, if necessary, goals and priorities are adjusted and new fields of action are integrated. The aim of the evaluation is thus to check whether and to what extent the measures have achieved the intended goal or what needs to be changed in order to achieve the goals.

An evaluation can therefore serve both as a success control of implemented measures and as an indication of improvements or changes in the approach. By comparing the goals of the measures with the results actually achieved, the success of the implementation of a measure can be assessed and, if necessary, controlled.

In the city of Worms, a concept is currently being developed to introduce an appropriate monitoring. The aim is to develop and implement a procedure for surveillance of the heat-related burden of disease in the city of Worms based on the evaluation of heat-related emergency contacts of the regional hospital provider. The object of the project is the monitoring of the case volume in the central emergency room of the hospital in Worms, as it can be assumed that the data will provide indicators for an evaluation of the results of the municipal HHAP that was drawn up in parallel.

This will determine,

- how health burdens of the population due to heat are reflected in the emergency contact data of the local hospital provider,
- how these data can be processed for surveillance of the heat-related burden of disease; and
- how timely distribution to relevant actors can take place.

Literature

Casanueva et. al (2019): Overview of Existing Heat-Health Warning Systems in Europe. In: Int. J. Environ. Res. Public Health, 16(15), 2657.

Fulda University of Applied Sciences (2023): Arbeitshilfe zur Entwicklung und Implementierung eines Hitzeaktionsplans für Kommunen. [Working aid for the development and implementation of a heat action plan for municipalities.]

GAK (Bund/Länder Ad-hoc Arbeitsgruppe ‚Gesundheitliche Anpassung an die Folgen des Klimawandels) (2017): Handlungsempfehlungen für die Erstellung von Hitzeaktionsplänen zum Schutz der menschlichen Gesundheit.

Niebuhr D, Siebert H, Grewe HA (2021): Die Wirksamkeit von Hitzeaktionsplänen in Europa. UMID, 1: 7-16.

WHO Europe (2008): Heat-Health Actions Plans - Guidance.

WHO Europe (2011): Public Health Advice on preventing health effects of heat.

WHO Europe (2021): Heat and health in the WHO European Region: updated evidence for effective prevention.

Annex 1: Possible structure of a heat-health action plan

The WHO[1] suggests a possible structure for a heat-health action plan. Taking these recommendations into account, the Fulda University of Applied Sciences (2023) suggests an outline as follows for German municipalities (slightly modified and translated by the authors of this concept paper):

1. Purpose and context of the document
2. Coordination of the heat-health action plan / steering committee
3. Relevance of the issue of heat extremes for the respective municipality
4. Effects of heat extremes on mortality and morbidity, effectiveness of heat-health action plans
5. Vulnerable groups
6. Warning system / warning levels
7. Information channels / cascade and responsibilities
8. Measures and responsibilities

   a. Acute measures + acute plan
   b. Medium-term measures
   c. Long-term measures

   OR

   a. Measures to prepare for the summer
   b. Measures during the summer months
   c. Measures at warning level 1
   d. Measures at warning level 2
   e. Measures for long-term adaptation

9. Ensure implementation (trainings, management, funding, documentation)
10. Evaluation: responsibilities and procedures

Annex: Information materials for target groups.

[1] Source: WHO Europa - Weltgesundheitsorganisation Regionalbüro für Europa (2019): Gesundheitshinweise zur Prävention hitzebedingter Gesundheitsschäden: Neue und aktualisierte Hinweise für unterschiedliche Zielgruppen. WHO, Kopenhagen. Online: https://apps.who.int/iris/handle/10665/341625

Annex 2: Checklist for assessing the state of development and implementation of a heat-health action plan

The Fulda University of Applied Sciences (2023) suggests the following checklist for German municipalities (slightly modified and translated by the authors of this concept paper):

Structure

- Central coordination office appointed
  - for the development of the heat action plan
  - for the implementation of measures (incl. triggering of alarms)
  - for the further development, monitoring and controlling of the measures
- Relevant actors and target groups for measures sensitised, involved and responsibilities defined.
  - 1st step: Cooperation within the administration
  - 2nd step: Cooperation with external actors
- Citizens involved to raise awareness and for activation
- Heat-health action plan legitimised by municipal representation (city parliament)

Preparation

- Affectedness of the city and city areas visualised
- Vulnerable population groups defined
- Heat warning system developed and activated
- Needs calculated and budget for heat-health action plan created in municipal budget

Action plan

- Management of acute heat waves prepared
  - Type of access to vulnerable groups defined
  - Responsible persons and institutions identified
  - Type of tasks defined according to heat warning level
  - Action-triggering criterion (temperature level) defined
  - Weekend and public holiday preparedness ensured
- Means and ways of risk communication prepared
  - Communication channels defined according to heat warning level
  - Information materials developed
  - Information distribution list set up
  - Qualification of support systems organised
  - Degree of accessibility of the target groups identified
- Measures for long-term adaptation defined
  - Measures are systematically anchored in administrative actions

Monitoring and controlling

- Concept for monitoring and controlling developed
- Documentation of implemented measures ensured
- Acceptance of measures reviewed by target groups
- Frequency of public reporting defined

Annex 3: Further links

Editor and Title	Content
Climate ADAPT: National heat-health warning systems and action plans	"Overview of existing heat-health action plans and heat-health warning systems in Europe based on information collected in 2019 by the WHO Regional Office for Europe."
Climate ADAPT: Heat health action plans	"In order to improve the public health response to extreme temperature and heatwaves, the EuroHEAT project has quantified the health effects of heat in cities in the WHO European Region and has identified options for improving the preparedness of health systems and their responses to protect health."
WHO: Heatwaves and health: guidance on warning-system development	"This Guidance has been developed jointly by WMO and WHO to outline for practitioners in both NMHSs and National Health Services (NHSs) the issues surrounding the general heat-health problem and present how an understanding of the biometeorology, epidemiology, public-health and risk-communication aspects of heat as a hazard can be used to inform the development of an HHWS as part of a wider HHAP. The Guidance places emphasis on the practical aspects of HHWSs at a generic level and is not intended to be prescriptive."
C40 Cities: How to adapt your city to extreme heat	A collection of measures and experiences from different cities around the world.
C40 Cities: Urban Heat & Equity	"This report provides case studies from 12 cities that are working to reduce the inequitable distribution of heat risks across populations and urban areas. The case studies look at how cities are: integrating inclusivity and equity in heat actions; bringing the voices of the most heat-vulnerable to the decision making table; and tailoring responses to heat to meet the needs of the most at-risk residents. Recommendations for inclusive planning and delivering heat actions emerge from these cities' experiences."
C40 Cities: Neighbourhood Level Cooling	"This report sets out ways that cities can understand and monitor local urban heat island effects, and involve local people in implementing cooling solutions. It draws from the experience of nine cities in the C40 Cool Cities Network – Austin, Buenos Aires, Lisbon, Los Angeles, Melbourne, Milan, Philadelphia, Quito and Tel Aviv."

Annex 4: Collection of heat protection measures

Content and objective of Annex 4:

This annex includes a collection of measures and ideas that serve heat protection and that can be used for the development of own heat-health action plans. It is divided into three sections:

- **Acute measures** are triggered during heat events and are intended to achieve direct effects and protect people
- **Medium-term measures** primarily serve to build capacities and raise awareness, especially among multipliers who are in direct contact with vulnerable groups
- **Long-term measures** mainly relate to city development and construction activities

Main sources include:

- Worms Stakeholder Workshops and Worms Heat-Health Action Plan
- Working aid for the development and implementation of a heat action plan for municipalities (by Fulda University of Applied Science, 2023, see above)
- The HeatService Portal hitzeservice.de (on behalf of the German Ministry of Health)

Acute measures

All target groups

Monitoring	
Morbidity and mortality monitoring	During the summer, morbidity and mortality rates are observed and analysed. This enables an overview of the current situation and supports efficient action planning. ***Example:*** • Worms

Warning / Communication	
Communication of the heat alarm + recommendations	The public is informed about the upcoming heatwave (and how to protect themselves and others) via various information channels, for example: • The city's website • A press release (for radios, newspapers, TV, etc.) • Social media channels • Displaying the warning on screens in the city (for example at train/bus stations) • Per e-mail/newsletter send to registered persons • Furthermore, multipliers/institutions receive target group-specific information and pass on the heat warning and recommendations to the specific target groups.

Shade and cooling down		
Cool places	Opening up and communicating cool places (indoors and outdoors). Cool places allow people to take a rest from the heat stress, especially in areas of the city with high climatic stress. In the best case, water, fruits and heat protection articles are available at the cool places. Furthermore, cultural activities, consultations, etc. can be offered and might lead to a higher attractiveness of a place. *Compilation of existing cool places:* • Outdoors: Parks, urban forests, shady green areas, cemeteries, public pools and lakes, fountains, water playgrounds • Indoors: city-owned buildings such as libraries, schools or administration buildings, public or private museums and community centres, churches and religious institutions, senior centres, private businesses such as air-conditioned shopping malls or movie theatres etc. *Increase accessibility of cool places:* • Make arrangements with the localities to extend opening hours during a heat wave • Initiate the availability of water/fruits etc. and activities/programme • Free or discounted admission to public pools and air-conditioned cultural facilities (museums etc.), free public transport *Create new (temporary) cool places:* • Indoors: Air-conditioned cooling centres, for example within shopping malls, in shops or sports halls (free and without compulsion to consume) • Outdoors: Climate oases (benches under trees/sunshades etc.) and temporary water elements (for example spray showers and perforated spray hoses) in public spaces	
	Examples: **Compilation of cool places (Website):** • Worms • Erfurt **Compilation of cool places (Maps/GIS):** • Washington D.C. • Toronto • Vienna • Mannheim • Karlsruhe	**Cooling centres (indoors):** • Barcelona: Climate Shelters Network • Vienna: Cooling Centre • Berlin: "Hitzehilfe" shelter for homeless people • New York: Cooling Centres **Climate oases (outdoors):** • Vienna: Climate oases • Vienna: “Spray showers”

Cool routes and heat-friendly rest and waiting areas	Cool routes and heat-friendly rest and waiting areas shall make it easier to move around the city. Possible measures are: • Mobile greening systems for sealed surfaces (e.g. green parklets) that provide evaporative cooling and an increased quality of stay in the street space • Additional shade and seating in the shade (using tress, sunshades, pavilions, etc.), for example in frequented places, at public transport stops, in supermarkets, in front of restaurants, etc. • Stationary or mobile drinking fountains to enable people to drink enough fluids.

Drinking water distribution in the public space	For example through: • Distribution of water bottles in public places (in trains/busses, stations, playgrounds, etc.) • Water dispensers in public buildings and waiting areas • Possibility to fill up bottles in shops, restaurants, public buildings, etc. • Communication and information campaign

Structural measures

Adjusting opening hours	Opening hours (e.g. of authorities, medical and healthcare institutions, social welfare offices, senior citizen and youth centres, day-care centres, educational institutions, and facilities for people with disabilities) are adjusted according to the heat.

Elderly and/or physically and mentally vulnerable people (living alone)

Support services for people living alone

<table>
<tr><td rowspan="2">Heat phone
and
home visits</td><td colspan="2">Regular contact to elderly people and/or physically and mentally vulnerable people, especially people living alone and who might be restricted in their self-care and risk perception – to enquire about the current state of health and to communicate the heat warning as well as measures for heat protection.

Heat phone:
• Via a heat phone, registered citizens are warned about upcoming heat waves and informed about general tips on how they can protect themselves.
• During the call, attention is also being paid to indications of a possible health impairment. If necessary, relatives or the doctor in charge can be informed.

Home visits:
• To support people in implementing heat protection measures (e.g. ventilation and shading, clothing, diet and drinking, visiting cool places)
• To enquire about the current state of health (e.g. through temperature measurement)

This could probably be organised through:
• (In the best case) the health care system / doctors
• A buddy system (at-risk persons, if they agree, are cared for by (volunteer) caregivers during a heat wave by means of visits and telephone calls.)
• Neighbourhood assistance

Also expandable to the following measures (shopping assistance, driving service).</td></tr>
<tr><td>Examples:

Heat phone:
• Worms
• Kassel
• Metz
• Bologna</td><td>Home visits / Buddy system
• Lausanne
• Zurich</td></tr>
</table>

Using existing structures to inform	Existing structures could be used to inform elderly people (on health tipps, cooling centres, support structures etc.) before/during a heat wave and if necessary involve other support structures or call an ambulance. For example: Janitors/building supervisors, meal delivery workers, post employees, as well as places like pharmacies, cafes, bakeries and hairdressers.
Shopping assistance	During heat waves, people are accompanied during their shopping activities or the shopping is done for them.
Driving service	A driving service is set up to either carry out important errands (e.g. a doctor's visit) or to reach cool places.
⏩ Ambulant care	
Adjustments in ambulant care	Developing a specific heat-health action plan for ambulant care settings (by the respective provider). Such a plan could include for example: • Measurement of room and body temperature / check for signs of dehydration • Initiation of simple measures to cool down (ventilation at night, shading) • Offering drinks / establishment of a summer menu • Especially during warning level 2: Increased contact with the target group, in case of acute danger to life: evacuation • For the staff: Adjustment of the break regulation, implementation of shorter tours
⏩ Stationary care	
Adjustments in stationary care settings	Developing a specific heat-health action plan for stationary care facilities (by the respective provider). Such a plan could include for example: • Measurement of room and body temperature / check for signs of dehydration • Improving and controlling ventilation situations in facilities / shading • Offering drinks / establishment of a summer menu • Open cool places within facilities • For the staff: Adjustment of the break regulation, establishment of cool break rooms

Pregnant persons and babies

Expanding early help services	*Alarm level 1:* • Temperature check (flat and child) • Checking for signs of dehydration *Alarm level 2:* • Visit all participating families • Initiate further measures if necessary (change of location etc.)

Children

Adjustment of school and day care routines	Adjustments of the daily routines of schools and day care centres (potentially developing a specific heat-health action plan for the respective institution): • Pass on heat warnings and tips (to institutions, children and parents) • Provide ventilation at cool times of day (in the best cast during the night), wet wipes if necessary • Provide water and liquid fruit / Plan fixed and more frequent drinking breaks • Check the interior temperature regularly • Putting up sunshades or sunsails • Provide sunscreens and sun hats • Cancel outdoor (sunny) trips • Find cool places (inside or outside the facility) • If necessary, shift lessons to cooler times of the day (by starting earlier, having a longer lunch break and ending later).

⏩ Homeless people	
Handing out water and heat protection items and raising awareness	Distribution of heat protection items (sunscreen, headgear, hand sanitizer) and water bottles at known counselling points and day stays. Furthermore, raising awareness of heat protection and communicate shower options and "cool places".
Creation of temporary shady places	Creating temporary shade spaces through pavilions, awnings and water elements near counselling centres, day stays and known meeting places. Opening of frequented facilities also during day times (with the greatest heat load).
Opening cold rooms	Establish and open (air-conditioned) places to cool down, including the availability of water, fruits, heat protection articles, etc.
	Examples: • Berlin: "Hitzehilfe" shelter for homeless people
Allow access to cool places	(Re)enable access to cool places where homeless people potentially stay / would like to stay (counteract exclusion and discrimination), for example train stations.
Create shower facilities	Creating shower facilities, for example in public pools, social service facilities; shower cubicles
Outreach work	Visiting homeless people to raise awareness and provide water and heat protection items

Outdoor workers	
Shifting working hours	Adjusting working hours and break times accroding to the heat.
Heat protection at the workplace	Possible heat protection measures at the workplace: • Adapt work activities • Adapted work clothing • Ensure drinking water supply • Set up cool, shady places for breaks • Role model function of supervisors • Information materials in different languages
Expansion of the “on the road” offers	Expansion of an offer of "cool places" (with toilets and drinking water points) for outdoor workers who are on the move (waste disposal companies, green space maintenance, etc.)

Medium-term measures (awareness raising, capacity building)

▸▸ All target groups	
Awareness raising through broad public relations work	Raising awareness among the inhabitants about the consequences of heat, preventive measures and possibilities for heat protection. For example thorugh: • Banner and poster campaigns • Press releases at the beginning of the summer • Social media activities • Maintenance of the heat section of the website • Public events / information booths at festivals • Distribution of information materials to vulnerable groups
Distribution of information material to multipliers	Target group-specific public relations work: raising awareness among multipliers who work with vulnerable groups (regarding the effects of heat and heat protection). For example through information materials (poster, flyer, brochures, guidelines, etc.). Following, dissemination of information and tips by the multipliers to the respective target group.
Education and training	In-depth sensitisation and knowledge building of multipliers who work (in the healthcare sector) with vulnerable groups (regarding heat effects and heat protection), e.g. • Nursing and housekeeping staff • Family caregivers (e.g. in the context of care trainings) • Integration in first aid courses • Volunteers in welfare/social services organisations • Staff of schools and day care centres • Early help services and pregnancy counselling

Network activities and events for outdoor workers	Round tables and information events to • sensitise employers (regarding heat impacts and protection for outdoor workers) • pass on information and tips from employers to employees

Awareness-raising campaigns for sports clubs	Inform sports clubs about heat and heat protection measures and encourage them to develop their own heat protection concept.

Long-term measures (city development / construction measures)

All target groups

Analysis	
Urban climate analysis	In order to find out which areas of a municipality are particularly affected by heat, it makes sense to prepare an urban climate analysis that records, analyses and evaluates the climatic conditions of a city. The two main results of an urban climate analysis are a climate function map and a planning information map.

Buildings	
Green roof register	Document green roof inventory / find potential areas
	Examples: • Mein Gründach (green roof register for several German municipalities)
Roof and façade greening	Green roofs and façades help to reduce the heat island effect in cities and ensure moderate temperatures inside buildings.
	Further informations / Examples: • European Federation of Green Roof & Wall Associations • New York City: CoolRoofs • Barcelona: Guide to living terrace roofs and green roofs
Heat-adapted construction of buildings	Making sure that planning of residential buildings takes heat stress into account, for example through: • Optimised orientation of sunlit building surfaces, especially building openings (windows) • Use of solar control glazing • Solid building materials to increase heat storage capacity: brick, limestone • Light colour design of the buildings by exploiting the albedo effect • Ventilation concepts, optimal night ventilation • Probably establishment of guidelines and regulations for the construction of new buildings / districts.

Heat-adapted building renovation	Implementation of construction measures such as cooling systems, external shading through trees, façade and roof greening, facade and roof insulation.
Keeping indoor spaces cool	Establishment of passive measures for heat protection: • Exterior sun protection: folding and sliding shutters, roller shutters, awnings, Venetian blinds, sun sails • Exterior shading through deciduous trees • Interior sun protection: interior blinds, vertical and horizontal slats, foil pleats • Ventilation concepts, optimal night ventilation • Bright colour design of the buildings by exploiting the albedo effect
Critical buildings	Keeping buildings cool in which vulnerable groups stay (retirement homes, care facilities, schools and day-care centres, shelters for homeless people, container accommodations, etc.) • Indoors: Shading, ventilation options, passive cooling, air conditioning, easy access to drinking water • Outdoors: Shade through trees and awnings, water, etc.
Outdoor areas: Green and blue infrastructures	
Preservation and planting of urban trees	On hot summer days, trees are an effective means of cooling the ambient air through their evaporative capacity. ***Further information:*** • C40: How to expand your city's tree canopy cover
Green spaces	Green spaces serve the recreation of the population and cool neighbouring residential areas. Green structures should be interconnected as far as possible.
Irrigation infrastructure for urban green	Create cisterns and irrigation systems, collect rainwater from roofs and surfaces and use it to irrigate green spaces. Manual irrigation only if necessary.

Blue infrastructures	Open water areas have a cooling effect due to evaporative cooling and at the same time increase the quality of stay and the recreational value of public facilities. There are different possibilities, for example fountains, fountain fields, water playgrounds, or near-natural water areas.
	Examples: • Vienna: Spray showers • Cape Town: Spray parks / water playgrounds
Drinking fountain	The non-commercial provision of drinking water in public spaces through drinking fountains is of high importance for the health protection of the urban population.
Infiltrative / cool surfaces	Infiltrative surfaces contribute to local cooling through increased evaporation. Also the sponge city approach should be considered.
	Examples / Further informations: • Paris: Cool & Low Noise Asphalt • C40: Cool surfaces: Experiences from C40's Cool Cities Network • C40: A Practical Guide to Cool Roofs and Cool Pavements
Unsealing	Asphalt, concrete slabs and even granite, which reflects some of the sun's rays, are very good heat accumulators and radiate heat at night. This contributes significantly to high night-time temperatures and thus to tropical nights. For example, public squares, parts of traffic areas (e.g. parking spaces) or courtyards could be considered for being unsealed.
Create and preserve fresh air corridors	Fresh air corridors are important for urban air exchange and can reduce the effects of the heat island effect in cities. Large green areas such as meadows, fields, fallow land, garden land and forests are considered important cold air production areas.

Outdoor areas: Shade	
Shade in public spaces	Creation of rest areas through trees, greenery or awnings, e.g. along frequented routes, including the covering of bus stops etc.
	Examples: • Tel Aviv: Shade Planning Guidelines

Long-term measures: Resources / Further readings
• **ClimateADAPT database** • **C40: Beating the heat: A sustainable cooling handbook for cities** • **C40: Urban Cooling Toolbox** • **C40: Collection of several examples from municipalities around the world**