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Are European countries prepared for the next big heat-wave?

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Background: Heat-waves present severe dangers to populations' health. Due to climate change, an increase in the frequency and intensity of heat-waves is to be expected. Public health measures to prevent negative health effects have been developed in several member states of the World Health Organization (WHO) European Region over the past decade. **Methods**: This study presents the first comprehensive assessment of the development of heat preparedness planning in WHO European Region member states, using a unique methodology based on criteria developed and pre-tested by the WHO. This indicator-based approach is based on eight core elements that are crucial components of heat-health action plans. **Results**: Of 53 member states of the WHO European Region, 51 countries were included in the evaluation. Results show that 18 countries have developed heat-health action plans, whereas 33 others have not. The plans developed so far vary in the degree of comprehensiveness with regard to the core elements. Gaps in terms of plan coverage have predominantly been identified in the areas of (intersectorial) long-term measures, surveillance and plan evaluation. **Conclusions**: For better preparedness, it can be advocated for further improving, developing and implementing heat-wave preparedness planning and response in European countries. A focus should be placed on developing all elements and strong intersectorial coordination and cooperation as well as the successful implementation of surveillance and evaluation measures.

Introduction

Public health agencies and researchers in Europe intensified their interest into the prevention of the health effects from heat after the 2003 heat-waves that claimed more than 70 000 lives across 12 European countries.[1] Extreme weather events such as heat-waves are projected to increase in intensity, duration and frequency alike.[2] Adverse health effects include excess mortality from a variety of causes. The elderly, young children, chronically or individuals being exposed to socio-economic or environmental risk factors are more vulnerable.[3] Climate change together with demographic, land-use and socio-economic changes will contribute to the increase in heat exposure and vulnerability at the same time.

In the frame of the EuroHEAT project, the World Health Organization (WHO) together with partners collected evidence to inform policymakers[4] and developed guidance for public health interventions.[5,6] These have become the basis for heat-health action preparedness planning and response in the WHO European Region. To our knowledge, heat-health action plans can save lives,[7] if they are implemented, although this is methodologically difficult to prove.

Heat-waves cost lives, and heat-health action plans can serve in the preparation of saving lives but how far are we yet? Is Europe prepared for the next heat-wave? This is the leading research question we address in this article, assessing the level of development of heat-health action plans in WHO European Region Member States and identifying a number of gaps that might affect the countries' heat-wave prevention, preparedness and response, thereby highlighting the importance of coordinated reinforced public health measures in view of the next summers' developments.

Methods

For the purpose of this review, we retrieved heat-health action plans from the WHO European Region member states. Data were collected by directly contacting national agencies, national representatives of the European working group on climate change and health (HIC), the WHO country offices and scientists in the respective field, as well as consulting the literature and websites. The information retrieval was performed between 1 August and 30 October 2012 and partly included the use of Google Translator or official translation. In case of doubts in language or interpretation, national representatives or the WHO country offices were asked to clarify.

A plan was defined as a heat-health action plan, when (i) it was specified in the title that it was specifically addressing a heat-wave response, and (ii) it was approved as a formal national or subnational document.

One of the aims within the WHO/EC EuroHEAT project was to identify core elements of heat-health action plans that are essential to prevent health effects from heat-waves.[5,6] These core elements were developed by scrutinizing existing heat-health response the scientific literature, and grey literature (e.g. Centers for Disease Control and Prevention website). Eight core elements (Table 1) were identified through a series of expert meetings of national representatives from WHO member states, within the EuroHEAT project.

The retrieved plans were assessed on the inclusion of those core elements and their subelements. For this purpose, the WHO/EC climate change environment and health action plans and information systems (CEHAPIS) indicator methodology was

Table 1 Eight core elements of heat-health action plans and their subelements

Core element	Subelements
1. Agreement on a lead body and clear definition of actors' responsibilities	Clearly defined lead body Involvement of >1 other agencies Regular meetings and/or reviews Inclusion in national disaster preparedness Cross-border cooperations
2. Accurate and timely alert systems	Threshold definition scientifically sound Regionally adapted definitions Warning is issued well in advance Different alert levels for different levels of action Alert is communicated following a clear plan
3. Health information plan	Clearly defined actors/recipients/contents Effective dissemination of information (>1 channel) Quality of advice Public & professionals addressed Appropriate timing of information campaign
4. Reduction in indoor heat exposure	Giving advice Providing cool rooms/spaces Provision or use of mobile coolers Planning or support for increased albedo or shading Planning or support for better insulation
5. Particular care for vulnerable groups	Identification of relevant groups (>1) Activation of a telephone service Specific measures (buddies, neighbours…) Regular re-assessment of vulnerable population groups Information and training for caregivers
6. Preparedness of the health/social care system	Increase of capacity of health services Heat reduction in healthcare facilities Special precautions in nursing homes Special resources for patients/public Improving health-care networks
7. Long-term urban planning	Increased green & blue spaces Changes in building design (albedo, insulation, passive cooling) Changes in land-use decisions Energy consumption reduction Individual and public transport policies
8. Real-time surveillance	Less than 48-h interval Involving data from >1 region/city Involving data from >1 health effect Use for adjustment of measures Use for evaluation of effectiveness

Adapted from[6,8].
Score: 0 = not specified; 1 = one or two subelements specified; 2 = three or more subelements specified.

revised, adapted and consequently used.[8] The indicator on policies to prevent adverse health effects of heat-waves had been developed to cover two primary policy measures: the degree of policy comprehensiveness and the extent of its development. The first is defined via a set of pre-defined core elements, and the latter measures whether the policies are developed. The indicator design was that of a composite index reflecting the distance from an ideal situation of policy development and using the simplest model (linear, equal-weighting):

$$Partial\ score = Development\ level\ of\ the\ eight\ core\ elements\ (0-2)^{*}8$$

The resulting score can range between 0 and (2 * 8) = 16. For each core element, we assign either 0 points (not specified or not developed), 1 point (partly developed; up to two subpoints identified) or 2 points (fully developed; three or more subpoints identified).

A bonus system (25%) has been used to mirror the importance of the formal evaluation measures for the putting into effect, functioning and on-going improvement of the heat-health action plan as a whole, making the maximum score 16 + (0.25 * 16) = 20:

$$Sum\ score = Partial\ score + 25\%\ if\ evaluation\ takes\ place$$

This analysis allows both to be interpreted per country by using the distance to the ideal situation (the maximum score) of the composite index and across the countries by looking at the distribution of '0', '1' and '2' for each of the core elements, thereby identifying gap areas in need of further improvement.

The results of the assessment were synthesized in a tabular form, with grey shades expressing the level of development.

Results

Overall, 18 of 51 included countries have developed a heat-health action plan [for 2 of the 53 WHO Member States (Israel and Lithuania), no data could be obtained]. When analysing the elements covered across the countries, Table 2 allows for some general observations: of the 18 plans assessed, there are variations between the plans in terms of spatial coverage (national/subnational), the range of measures taken and the existence of evaluation procedures.

Three countries based on federal systems have developed federal plans. Their scores have to be interpreted cautiously, as preventive measures may not cover all parts of country.

Only three countries have described in detail all eight core elements, and only two of them also included measures for evaluation. Another 12 European countries have developed most parts of the core elements. According to the definition of core elements, it is not surprising that several of them actually are represented fully or

Table 2 Heat-health action plans in WHO European member states

Countries / Indicators	Year	Lead body	Alert system	Information plan	Indoor heat reduction	Vulnerable groups	Health care preparedness	Urban planning	Realtime surveillance	Evaluation	Sum Score
Austria*	2011							**			13.75
Belgium	2005							**			11
Croatia	2012										16
France	2012							**			16.25
Germany*	2008							**			10
Hungary	2007										12
Italy	2012										15
Luxembourg	2006				**			**			12
Monaco	2012							**			10
Netherlands	2007							**			15
Portugal	2010							**			17.5
Republic of Moldova	2010										12
Romania	2008										8***
Serbia	2012							**			4***
Spain	2012				**			**			12
Switzerland*	2007							**			11
The former Yugoslav Republic of Macedonia	2010										18.75
United Kingdom *	2012										20

* regional level plans
** in other documents
*** plan to be considered non-functional

partly in most (core elements 'alert system', 'vulnerable groups', 'healthcare preparedness'), if not all ('lead body' and 'information plan'), of the identified heat-health action plans (Table 2).

The core elements 'indoor heat reduction', 'urban planning' and 'real-time surveillance' are fully or partly included in only 22–72% of the heat-wave policies or related documents, potentially indicating the highest gaps in the development of intersectorial measures. However, often housing policies and measures as well as urban planning are covered by other agencies and sectors and may thus not necessarily be described in the heat-health action plan: when related documents and national climate change adaptation strategies were taken into account, a substantial proportion of countries revealed measures in the case of 'urban planning'. However, heat-health action plans did not refer to those measures. Another gap in coverage, yet considerably smaller, could also be stated for 'indoor heat reduction'. This underlines the need for stronger intersectorial linkages and collaboration in preparedness and response planning for heat-waves.

The component (real-time) surveillance system is lacking in 44% of the countries reviewed.

Evaluation was only mentioned in 7 of 18 countries; this is an important finding, as evaluation is crucial for determining the functionality, effectiveness and improvability of existing heat-health action plans. This is especially true for plans recently developed, where responsibilities, communication and coordination are likely to benefit from evaluation measures.

From the documents reviewed, it can be stated that two countries do not include an alert system and therefore their heat-health action plans have to be seen as non-functional.

Thus, our results show not only the elaboration of core elements in preparedness and response planning but also indicate potential targets for improvement.

Discussion

We see our study as a methodologically guided alternative and complement to the recent study by Lowe et al.[9] This study identified 12 online accessible plans, and rather concentrated on the description of the details of the plans than the analysis of their coverage in terms of comprehensiveness of heat-health action. In contrast, we applied a pre-tested stringent indicator approach to assess 18 plans retrieved from various sources. To our knowledge, this is the first complete detailed description of European heat-health action plans' functional elements.

It has to be highlighted, that several heat-health action plans reviewed during this analysis were highly sophisticated and fulfilled the highest level of completeness found so far in contrast to other plans, with potential for more elaboration. It is especially the long-term intersectorial measures, surveillance and evaluation that have to be considered in this regard.

The importance of long-term measures like improved urban planning and reduction in indoor heat exposure is self-explanatory. It can only be hypothesized that their underrepresentation in the heat-health action plans is due to their inclusion within other sectors' policies. However, as a reduction in exposure—both outside and inside—is a crucial part of any protective strategy, it would be very important in heat-health action plans to refer to the existing measures in other sectors or to highlight additional developments.[10]

The need for a (real-time) surveillance system that enables monitoring health impacts of heat-waves at a high temporal and geospatial resolution has to be highlighted. Establishment and maintenance of such a system is among the primary functions and responsibilities of the health sector; yet, it is lacking in many of the plans reviewed. Potential reasons include infrastructural issues—both in setting up and maintaining such a system[11]—financial reasons, as well as uncertainty on which information to include.

One of the most crucial points is the evaluation of heat-health action plans. In general, the evaluation of the effectiveness of public health measures has to be seen as mandatory.[12,13] However, the methodology for assessing effectiveness and efficiency of heat-health action plans is complex and not generally agreed on.[14] There are studies comparing the health impacts (usually mortality) of heat-waves before and after the implementation of a plan.[7,15] However, these studies are very heterogeneous, and overall evidence for the effectiveness of heat-health action plans as a package as well as the effectiveness of individual measures remains to be further developed.

Our methodology does allow to measure the availability and completeness of heat-health action plans. With regard to the dynamic process of heat-health action plan development, implementation and refinement, it can serve as a snap-shot, ideally being applied periodically to capture the evolution in the planning, preparedness and response policy actions over time.

A major limitation of any review of this kind is the lacking control of actual putting into practice—only the inclusion in plans and the comprehensiveness of these as well as the provision of all necessary tools for evaluation can be observed and used to gauge some evidence about the real situation. Therefore, as a next step, the process, implementation and effectiveness of the plans developed need to be evaluated.

Although every effort was made to find any heat-health action plan in the WHO European Region, it cannot be guaranteed that all existing plans have been included in this review. It is also to be noted that in some countries, heat-health action plans undergo regular revisions, and what at a certain moment in time was available, has been revised and updated in the meantime. Related documents and national climate change adaptation strategies were also scrutinized for containing parts of the core elements; however, a complete inclusion of all potentially relevant documents cannot be guaranteed.

It is also important to note that heat is not equally relevant for all countries; depending on the general climate, some countries are more vulnerable than others.

Conclusions

When returning to the question 'Are European countries prepared for the next big heat-wave?', the answer is: partially. Eighteen of 51 countries have developed heat-health action plans; on the other hand, 33 countries have not. For two countries, no information on heat-health action plans could be obtained. In few of the 18 countries the plans are almost complete, while in most of the countries a pattern versus a gap in long term measures and a need to strengthen surveillance and evaluation can be observed.

Therefore, in view of projected changes in frequency and intensity of heat-waves in Europe, the implementation, improvement and upgrade of heat-health action plans are encouraged in line with this analysis and results of respective heat-health action plan evaluations.

Our study identified three main areas for further elaboration and improvement: long-term measures in the context of intersectorial coordination, surveillance of the effects of heat and the evaluation of the effectiveness of the plans implemented.

Exchange of experiences and lessons learnt can accelerate and improve this process substantially. National risk and vulnerability assessments in view of climate change may indicate the urgent need for the development and implementation of heat-health action plans in various countries that do not yet have such a plan. We aim at contributing to this process by providing a methodologically sound framework, evaluation methodology, and periodic assessment of heat-health action plans in the WHO European Region, as a starting point for periodic updates and re-evaluations in this highly relevant and dynamic field.

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Key points

- Systematic and harmonized evaluation of effectiveness is essential to improve existing plans and provides urgently needed evidence for the development of new plans.
- Improved mortality and morbidity surveillance systems that include heat-related deaths and health problems contribute toward monitoring the adequacy and adaptation of public health measures during a heat-wave and can provide important information for the evaluation of effectiveness.
- Particularly the inclusion and implementation of long-term measures (e.g. urban planning and housing) needs to be stressed and underlines the importance of intersectorial collaboration for these plans.

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