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Short Report

Heatwaves and their health risks: knowledge, risk perceptions and behaviours of the German population in summer 2022

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Heatwaves are becoming more common and impact health. We conducted a representative survey in June 2022 in Germany to determine people's knowledge and protective behaviours on heat days. In data from 953 respondents, we found that a large proportion informed themselves about upcoming heat days, but there are considerable gaps in knowledge. While knowledge was not related to taking up protecting behaviour, other predictors were (e.g. risk perception). Health campaigns should therefore not only aim to improve knowledge but also address risk perceptions, facilitate social learning, communicate social norms and remove barriers that prevent protective behaviours.

Introduction

Heatwaves are becoming more common in Europe,[1] and represent one of climate change's more tangible impacts on health.[2] We conducted a survey in Germany to determine the extent to which people knew the basic facts about how heat affects their health and to identify the variables associated with protective behaviours to guide future health communication activities.

Methods

Data were collected on the 22nd/23rd of June 2022, after Germany experienced heat days (18th/19th of June 2022), as part of the Planetary Health Action Survey (PACE), a serial cross-sectional online survey of approximately 1000 individuals. The sample was non-probabilistic and quota-representative for age (18–74 years), gender (crossed) and federal state in Germany (not crossed). Official information and recommendations as well as experts were consulted to develop the items.[3] Items were randomized within each respective block (e.g. knowledge) for each participant.[3]

Participants reported which maximal temperature (°C) they experienced during the heatwave and indicated which sources they used to inform themselves about upcoming heat days on a multiple-choice item ('None', 'German Weather Service (DWD)', 'weather app', 'media', 'social media', 'other'). Having used at least one source was coded as 'informing oneself about heat days'.

Knowledge on heat-related items was measured with 11 single-choice items (one out of four answers correct), which were developed for this study, covering topics from publicly available materials.[3] Questions about heat-related health risks, symptoms and behaviours in case of heat strokes were included. For analyses, a mean score of correct answers (percent) was used.

Risk perception was assessed with two items asking for perceived probability and severity of health consequences due to increasing heat and heatwaves during one's lifetime (1 = 'very unlikely' to 7 = 'very likely'; 1 = 'not harmful' to 7 = 'extremely harmful').[4] Displayed protective behaviours during the previous heat weekend were assessed by asking for 16 different behaviours, e.g. avoiding physical stress (single-choice items; 1 = 'yes', 2 = 'no', Cronbach's alpha = 0.77).

Participants also reported whether they perceive themselves at-risk due to heat (1 = 'yes', 2 = 'no', 3 = 'don't know').

Data analysis was exploratory and performed in R (version 4.2.2). Associations between risk perceptions, knowledge and information behaviour were assessed using Pearson correlations. To identify what relates with health behaviour in a multivariate fashion, the sum of participants' displayed protective behaviours was linearly regressed on knowledge scores, information behaviour, perceived severity and probability of heat risks, local temperature as well as demographic characteristics (age, gender, risk group membership, chronic condition, income).

Results

A total of $n = 953$ respondents took part in the study. The mean age was 47 years (SD = 16 years); 51.4% of the sample identified as female, 48.3% as male, 0.3% as diverse.[3] The majority (91%) stated that they had informed themselves about upcoming heat days: 55% via apps, 36% via news, 59% via DWD, 10% via social media and 5% via other sources.

On average, 72.2% (SD = 18.5pp) of knowledge items were answered correctly; 6% of participants answered all items correctly. Those who consulted information on upcoming heat days showed slightly more knowledge ($r = 0.07$; 95% CI [0.00–0.13]).

Participants perceived heat events in their lifetime as relatively likely ($M = 5.61$, SD = 1.53) and severe ($M = 5.36$, SD = 1.49). Those who perceived a greater likelihood that heat would impact their health estimated the consequences to be more severe ($r = 0.66$; 95% CI [0.62–0.69]). Participants with higher risk perceptions had searched for information about upcoming heat days (probability $r = 0.21$; 95% CI [0.15–0.27]; severity $r = 0.21$; 95% CI [0.15–0.27]) and answered more knowledge items correctly (probability $r = 0.22$; 95% CI [0.16–0.28]; severity $r = 0.15$; 95% CI [0.09–0.22]), yet the effects are small.

On average, participants reported having displayed 64.5% (SD = 20.1pp) of the suggested behaviours (Table 1B).

Linear regression analysis showed that people exhibited more behaviours if they had consumed information about upcoming heat days ($\beta = 0.22$; CI [0.16–0.28]), perceived heat as more harmful to health ($\beta = 0.17$; CI [0.10–0.25]), were older ($\beta = 0.12$; CI [0.06–0.18]) and experienced higher temperatures during the days before the survey ($\beta = 0.22$; CI [0.16–0.28]). Being male was associated with fewer protective behaviours ($\beta = -0.24$; CI [−0.35 to −0.12]). No robust relationship was observed between knowledge and behaviour. While the regression indicated a minor negative effect between heat-related behaviour and knowledge ($\beta = -0.11$; CI [−0.17 to −0.04]), simple correlation between the two constructs did not indicate an association ($r = 0.00$, $P = 0.96$). Other variables in the regression did not show significant associations with heat behaviour.

Discussion

The results show that a large proportion of participants informed themselves about upcoming heat days. Yet, there were considerable knowledge gaps, for example regarding heat day definition or what to do in the event of heat strokes. Knowledge on risk definition was low for those who considered themselves to be at risk.

The study indicates that some simple measures (e.g. using a fan) were not employed by large parts of the sample. While participants who informed themselves about heat and those with higher risk perceptions exhibited more preventive behaviours, no correlation was found between knowledge and behaviour. Thus, interventions that aim to simply improve knowledge about heat, its consequences, and protective strategies may be insufficient to increase preventive behaviours to a significant extent. Health campaigns may be more successful if they also address cognitive risk perceptions as well as affective risk perceptions (e.g. by using narratives),[5] facilitate social learning (e.g. by providing examples of testimonials who care for the elderly on heat days), or communicate social norms (e.g. by describing how people are staying in cold places and cool down) and by removing barriers that prevent protective behaviours (e.g. providing more shade). Such strategies are promising considering theories of

Table 1 Knowledge about heat and heat risks for health (A) and behaviours displayed in the previous heat wave (B)

(A) Knowledge content	**Percent correct**
Typical symptoms of a heat stroke [Hot, red and dry skin, Confusion, extremely high body temperature (above 39°C measured orally)]	89%
Age group for heat-related health risks (65+ years)	88%
How to behave on heat days (two questions) [Darken the apartment during the day (close shutters, draw curtains) and check on people who live alone and who may be at risk]	87% and 88%
Hazards increasing on heat days (Aggressiveness and violence, heart attacks, strokes)	87%
Typical health complaints on heat days (Sunburn, dizziness/fainting, decreasing ability to concentrate)	86%
How to behave if someone has a heat stroke (Emergency services should be called)	75%
Who is considered to be in a risk group (People who are exposed to heat for extended periods of time, people who have certain chronic or acute diseases, people who regularly consume alcohol or drugs)	56%
When is a day considered as a heat day (At least 30°C in the shade at the hottest time)	53%
Knowledge on UV radiation (Radiation may be higher under patchy cloud cover than under cloudless skies)	45%
How people with chronic diseases should behave on heat days (Have the doctor check if medication dose needs to be adjusted)	40%
(B) Behaviour displayed at heat weekend	**Percent applied**
Stayed in the shade as much as possible	88%
Wore light, loose and light-coloured clothing	85%
Made sure to always have a beverage nearby and to drink before getting thirsty	84%
Darkened the apartment during the day (e.g. close shutters, draw curtains)	84%
Avoided physical strain	80%
Made sure to know that heat days are ahead	80%
Sought out cool rooms	80%
Regularly drank non-alcoholic and mostly sugar-free and caffeine-free beverages	77%
Shifted outdoor activities to mornings or evenings	72%
Ate food that is light, has a high-water content, and is low in protein (e.g. fresh fruits/vegetables)	68%
Applied sun protection with a sun protection factor of at least 30	42%
Wore sunglasses with a UV filter	41%
Cooled themselves with cold water (e.g. foot bath with cold water, damp towels, swimming)	40%
Checked on people who live alone and who may be at risk (e.g. asked if they needed anything)	37%
Used a fan to cool down	34%
Wore a hat	28%

behaviour and behavioural change (e.g. the health belief model[6] or the theory of planned behaviour[7]). Furthermore, interpersonal communication between physicians and patients should be addressed, as learning from trusted sources may foster protective behaviours.[8]

A limitation of this study is that social desirability may have prompted some of the high scores in information and protective behaviour. Providing a list with behaviours to tick may yield a higher score than having people name behaviours that they adopted. Future studies could include experience sampling or observations in the field to assess behaviour in real-world settings and avoid such bias.

The results can guide communicators and those responsible for plans to identify relevant population gaps in knowledge and behaviours. Ageing societies need to adapt to increasingly hot environments, and members of a well-informed society can act as multipliers as well as caretakers of those who will be more affected. Thus, awareness is crucial to this important societal adaptation to climate change, even though it may not be directly related to one's own protective behaviours.

Key points

- A large proportion of respondents in the representative survey informed themselves about upcoming heat days, but there are gaps in knowledge about heat and its risk to health.
- While some predictors (e.g. perceiving higher risk) led to more preventive behaviours, no relation was found between knowledge and behaviour.
- Health campaigns should not only aim to improve knowledge but also address risk perceptions, facilitate social learning, communicate social norms and remove barriers that prevent protective behaviours.

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Conflicts of interest: None declared.

Data availability

The data underlying this article are available in OSF at https://osf.io/4uwyd/.

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