



Gaps in public perceptions of extreme heat highlight UK's lack of preparedness

Candice Howarth^{a,*}, Heidi Zamzow^a, Niall McLoughlin^{a,b}, Ganga Shreedhar^a

^a London School of Economics and Political Science, Houghton Street, London, UK

^b Independent Consultant, UK

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ABSTRACT

Under a changing climate, heatwaves are expected to become more frequent, prolonged and extreme, posing substantial risks to populations around the world. Public perceptions of extreme heat are chronically under-researched, despite being important precursors to heat protective actions, policy acceptance and community heat resilience. We present and discuss findings from a nationally representative survey of 1750 UK residents conducted in summer 2023, where we identify gaps and contradictions in heat perceptions concerning national and individual-level preparedness, heat behaviours and communication. We find that firstly, whilst heat is viewed as life-threatening, the public believes the UK is not prepared; secondly that increasing risks of heatwaves and hot weather to other people are acknowledged, however few individuals see themselves at risk; and thirdly underlying vulnerabilities and geographies are important factors in perceptions of heatwaves and hot weather. The findings make an important contribution to the literature and particularly highlight that proactive, people-centred measures must bear in mind the gaps discussed in this paper to minimise the impacts of extreme heat and safeguard those most vulnerable in the UK and beyond.

1. Introduction

Extreme heat has become a significant concern to the United Kingdom (UK). During summer 2022, the UK experienced five periods of extreme heat, and a maximum temperature of 40.3°C was recorded for the first time in England, beating the previous record of 38.7°C recorded in 2019 (Met Office, 2022a). The record-breaking temperatures led to a national emergency being declared following the Met Office's first ever red extreme heat warning, meaning there would be a risk to life due to the heat. Maximum daily temperature records were also broken in Wales (37.1°C), Scotland (34.8°C) and Northern Ireland (31.2°C), the latter being 0.1°C above the national record set in 2021, and a minimum temperature record (25.8°C) was also recorded for the UK (Met Office, 2022b) posing even greater threat to human health (He et al., 2022). Just under 3000 heat-related deaths occurred that summer, a number of wildfires took place, and road and rail infrastructure were affected, along with damage and destruction of plant and animal life. Yet, with heat being a relatively new (and largely invisible) risk for the UK, citizens, communities, businesses and governments, and media outlets have typically made positive associations between heat periods and experiences (e.g. spending time at the beach) (O'Neill et al., 2022). This

representation may have led people to discount the seriousness of warnings and act in ways which exposed them to greater heat risk (Clayton, 2024).

Perceptions of heat risk matter. Public perceptions about heat are influenced by a range of contextual and individual-level factors, from policies and geographies to socio-demographic characteristics, past behaviours, and experiences of heat (McLoughlin et al., 2023) that can determine human vulnerability to heat. The conceptualisation of vulnerability to heat varies widely within the literature and it is primarily discussed in regard to one's ability to thermoregulate, adapt to, and cope with extreme heat. For example, it is often defined as vulnerability to direct risks associated with heat exposure such as heatstroke, as well as the exacerbation of chronic conditions (Valois et al., 2020). Whilst others emphasise socioeconomic factors, such as income inequality, infrastructure, access to technologies such as air conditioning, and housing quality (Suldovsky et al., 2024). Building on this, risk perception is known to affect an individual's exposure and (behavioural) response to heat (Hass et al., 2021) with some individuals perceiving extreme heat as a minor inconvenience. On the other hand, others—particularly vulnerable groups such as the elderly, children, low-income households, those with underlying health issues, and those whose work

* Corresponding author.

E-mail address: c.howarth@lse.ac.uk (C. Howarth).

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exposes them directly to the heat - are at higher risk of adverse health impacts and/or social isolation, as heat can limit one's ability to access support, receive heat warnings, or to take necessary precautions during periods of extreme heat (UKHSA, 2023). Despite this, research has found that people over 65 years of age tend not to self-identify as vulnerable (British Red Cross, 2021) leading to an increased likelihood that they will not adopt important safeguarding measures. Geography can also influence perceptions, e.g. those living in urban environments can have a greater sense of vulnerability (Howe et al., 2019).

Historically, the UK has not experienced extreme high temperatures like those seen in 2022 and is not prepared for such hazards (Howarth et al., 2024). What is particularly problematic is that over half of the UK's building stock is already at high risk of overheating, even outside heatwave periods, and is not equipped to withstand the impacts of extreme heat. Moreover, efforts to keep buildings and homes warm in the winter can lead to unintended overheating impacts even outside winter months (Bouhi et al., 2022). The impacts of heat are widespread, and they can also cause damage to vegetation, trees and natural habitats, potentially leading to wildfires and affecting their ability to cool local environments (Haase and Hellwig, 2022). Heat affects productivity (Romanello et al., 2023) and educational attainment (Park et al., 2021) with the current costs of heat exposure to the UK economy estimated at £ 260–300 million per year, projected to increase to up to £ 950 million per year by 2050 (Watkins et al., 2021).

Most heat-related deaths are preventable yet many simple behavioural measures that can reduce the impacts of heat, are not taken up (Erens et al., 2021). Communities are becoming more attuned to the importance of coping behaviours, such as staying hydrated and seeking shade, and to the need to understand the risks associated with prolonged exposure to high temperatures. However, preparing for and responding to heat is complex, and social inequalities further exacerbate the effects of extreme heat. For example, low-income communities tend to experience higher temperatures during heatwaves, leading to increased health risks (Alizadeh et al., 2022), marginalised and vulnerable communities face disproportionate risks and limited access to resources for passive (that rely on natural cooling solutions such as green infrastructure or cool roofs) or active (that require energy to minimise the impacts of heat, such as air conditioning) heat adaptation, and the adaptive capacities and challenges faced by vulnerable populations varies considerably (Smit and Wandel, 2006).

Institutional responses to extreme heat such as policies, early warning systems, and adaptation strategies play an important role in shaping knowledge, awareness, and perceptions. The role of communication is key to bridge the gap between policy intentions and public responses and perceptions as research has shown that while people may be aware of extreme heat events and related impacts, their perceptions often do not lead to substantial behaviour changes, even when heat-related warnings are issued (Semenza et al., 2008). Similarly, while warning systems can be widely disseminated in certain contexts (e.g. countries that have extensive historical experience of responding to heat risk), their uptake can vary significantly depending on the trust in the source of information and the cultural relevance of the messaging (Williams et al., 2019).

Public perceptions of extreme heat in the UK are under-researched (McLoughlin et al., 2023) leaving a gap in understanding relating to how the public will respond to this growing threat. Assessing how the public perceives extreme heat, its impacts on individuals and those around them, who and what they perceive as trusted sources of advice, and behavioural measures required to reduce the impact of heat, addresses an important gap in understanding how to shape national and targeted approaches for heat preparedness. At the same time, understanding the differences in perceptions is an increasingly important avenue of research, exposing mismatches, inequalities, contradictions and differences within and between groups. A recent study shows perception gaps around climate change exist at a global level (Andre et al., 2024), however, such gaps have not been examined in relation to

heat perceptions. We explore this in more depth through a survey of 1750 UK residents carried out in August 2023 to understand the specific gaps that exist in public perceptions of heat.

2. Methods

2.1. Sample and data collection

We conducted a nationally representative survey, via online provider Qualtrics, of 1750 UK residents over the age of 18 to assess their views on extreme heat and very hot weather. Survey respondents were recruited via quota sampling with nationally representative quotas assigned according to age, gender, ethnicity and region to ensure representation according to those criteria. The survey was designed based on key insights relating to hot weather and heatwave perceptions (as discussed above) and contained 42 questions. Topics covered in the survey included a mix of socio-demographic, closed and open questions and covering perceptions of heatwaves and very hot weather, experiences of heat risk, understanding of vulnerability to heat and perceptions of action to respond to extreme heat (see [Supplementary information](#)). All questions required a response and thus only respondents that completed the entire survey were included in the sample and there was no missing data. The survey had an average completion time of 11 minutes and was distributed online, via Qualtrics, in August 2023, with respondents receiving a small compensation for completing the survey. Ethical approval for the research was obtained by the LSE Research Committee on 21/06/2023, ref. 236107.

The sample was representative of the UK population with 47 % male and 53 % female, 86 % White British in ethnicity, and approximately half (48 %) between the ages of 18–44. About a third (35 %) had a university degree or higher, with another third (31 %) having completed secondary school. The majority owned the property where they lived (55 %) and were employed full-time (45 %). Over half (57 %) earned less than £ 40,000 per annum. Three-quarters of the sample were evenly divided between Northern, Mid and Southern England, with another 13 % living in Greater London. Respondents from Wales, Scotland, and Northern Ireland together made up 16 % of the sample. Suburban residents comprised the largest proportion of the sample (48 %), followed by urban residents (35 %), and 17 % coming from rural areas ([Table 1](#)).

2.2. Statistical Analysis

We used SPSS Version 29.0.1.0 statistical software for all analyses. We first ran descriptive analyses on the full sample and then for each of the subgroups as listed below (Area, Region, Vulnerability). We then performed exploratory analyses with planned contrasts to investigate differences between subgroups. For comparisons between three or more groups, i.e., Area (urban, suburban, rural) and Region (Northern England, Mid England, Southern England, Greater London, Scotland, Wales, Northern Ireland), we conducted a one-way ANOVA with post-hoc *t*-tests using Tukey corrections, or Games-Howell corrections where the assumption of equal variances was violated. For comparisons between two groups, i.e., vulnerable versus non-vulnerable, we conducted independent samples of two-tailed *t*-tests. We report effect sizes as Cohen's *d* for *t*-tests and η^2 for ANOVA. The standard $p < .05$ criterion was used for all inferential analyses, and we report 95 % confidence intervals (CI) for the difference in means.

We based our classification of vulnerable participants on the *Lancet* Countdown's heat vulnerability index (van Daalen et al., 2024). Respondents fell into the vulnerable category if they met any of the following criteria: ethnicity = non-white British, age = 65 or over, medical conditions (one or more) = heart disease, respiratory disease, kidney disease, diabetes, or other long-term/chronic health condition not otherwise specified. Although populations living in urban areas are also considered to be more vulnerable to heat, we did not include this criterion because we account for this effect in other analyses where we

Table 1
Socio-demographic descriptives of population sample.

Variable	% of total
Gender	
Male	46.46 %
Female	53.03 %
Nonbinary/third gender	0.46 %
Prefer to self-describe	0.06 %
Age	
18–24	11.20 %
25–34	18.57 %
35–44	18.63 %
45–54	19.37 %
55–64	17.20 %
65 +	15.03 %
Ethnicity	
White British	86.06 %
Asian/Asian British	7.54 %
Black/African/Caribbean British	3.14 %
Mixed/Multiple Ethnic Groups	2.23 %
Other Ethnic Group	1.03 %
Education	
Some primary school	0.34 %
Completed primary school	0.51 %
Some secondary school	2.91 %
Completed secondary school	31.43 %
Vocational or similar	21.43 %
Some university but no degree	7.09 %
University bachelor's degree	25.31 %
Graduate or professional degree	10.11 %
Prefer not to say	0.86 %
Income	
Less than 20,000 pounds	22.17 %
20,000–39,999 pounds	34.80 %
40,000–59,999 pounds	20.29 %
60,000–99,999 pounds	14.06 %
Over 100,000 pounds	3.31 %
Prefer not to say	5.37 %
Employment	
Full-time employment	44.97 %
Part-time employment	14.91 %
Unemployed	9.49 %
Prefer not to say	0.80 %
Student	3.20 %
Retired	16.34 %
Other	4.34 %
Self-employed	5.94 %
Household	
Own the property	54.57 %
Rent the property	39.66 %
Live here rent-free	2.91 %
Prefer not to say	0.69 %
Other living arrangement	2.17 %
Party	
Labour	41.54 %
Conservative	19.20 %
Would not vote	11.26 %
Liberal Democrats	5.83 %
Green	4.97 %
Reform UK	4.51 %
Prefer not to say	4.23 %
Scottish National Party (SNP)	2.51 %
UK Independence Party (UKIP)	2.34 %
Other	2.17 %
Plaid Cymru	0.80 %
Democratic Unionist Party (DUP)	0.63 %
UK Region	
Northern England	24.11 %
Mid England	24.11 %
Southern England	23.09 %
Greater London	12.74 %
Wales	4.86 %
Scotland	8.46 %
Northern Ireland	2.63 %
Area	
Urban	35.14 %
Suburban	48.17 %
Rural	16.69 %

Table 1 (continued)

Medical Condition	
A mental health condition	19.4 %
Another long-term/chronic health condition	11.3 %
Lung condition (e.g., asthma, lung disease)	10.8 %
Diabetes	9.9 %
Heart condition (e.g. coronary heart disease/stroke)	5.1 %
Severely limited mobility	4.5 %
Drug and/or alcohol condition	2.9 %
Kidney disease	1.4 %

compare urban, suburban, and rural areas.

3. Results

3.1. Threat-preparedness gap

Three-quarters (75 %) of the UK public agree and strongly agree that heatwaves can be life-threatening, and two-thirds (66 %) believe they are becoming more extreme because of climate change. A majority of those surveyed perceive that their local climate feels hotter (55 %) and hot weather days are becoming more frequent (62 %). Over half (58 %) say they experience discomfort during heatwaves and very hot weather, and over a third (37 %) have personally suffered poor health as a result in the last five years.

Despite this, we find a strong consensus (68 % *agree* or *strongly agree*) that both national (68 %) and local (67 %) governments in the UK are not prepared for heatwaves and hot weather events, and a similar number (65–67 %) do not feel that transport, infrastructure and build-ings are prepared. Respondents have slightly more confidence in the National Health Service (NHS), care providers, workplaces and em-ployers, yet still only 15–22 % agree that these entities are prepared for future extreme heat events (Fig. 1).

3.2. Vulnerability gaps

Respondents tend to see themselves as less vulnerable than others, with only 19 % saying they feel it is very or extremely likely their own health will be impacted by heat events in the next five years versus 29–30 % when estimating future health impacts to their local commu-nity or social network. This is striking considering 37 % (see above) state they have personally experienced health-related impacts of heat. Moreover, only a minority in the UK anticipate heatwaves will be a very or extremely serious threat to themselves (17 %), where they live (17 %) or where they work (19 %) over the next five years. A larger proportion of respondents (28 %) perceive the impacts of heatwaves and very hot weather to be not at all serious or harmful to themselves, where they work, or where they live (24 %, 19 %, 28 % respectively) (Fig. 2). In addition, over half (56 %) agree or strongly agree they are coping well with heat generally.

People with certain demographic characteristics which may make them more vulnerable to extreme heat (e.g. age (i.e. over 65 years old), ethnicity (i.e. non-white British), medical conditions; see Online Methods) have significantly higher concern regarding heat risk in the UK compared to those who do not have these characteristics ($t(1747) = -3.24, p = .001, d = -0.16, 95\% \text{ CI } [-0.28, -0.07]$), yet they are more likely to say that heat in the UK will be a problem in the future rather than now ($t(1748) = -2.22, p = .027, d = -0.11, 95\% \text{ CI } [-0.23, -0.01]$). They are also more likely than those from non-vulnerable groups to have experienced negative health impacts linked to heat-waves and very hot weather ($t(1703) = -4.66, p < .001, d = -0.22, 95\% \text{ CI } [-0.28, -0.12]$) and to believe they will continue to experience them in the future ($t(1735) = -4.72, p = .001, d = -0.23, 95\% \text{ CI } [-0.37, -0.15]$). Those from the vulnerable groups are less likely to feel they are coping well ($t(1742) = 2.24, p = .025, d = 0.11, 95\% \text{ CI } [0.02, 0.23]$), and they anticipate more severe heat-related impacts personally (t

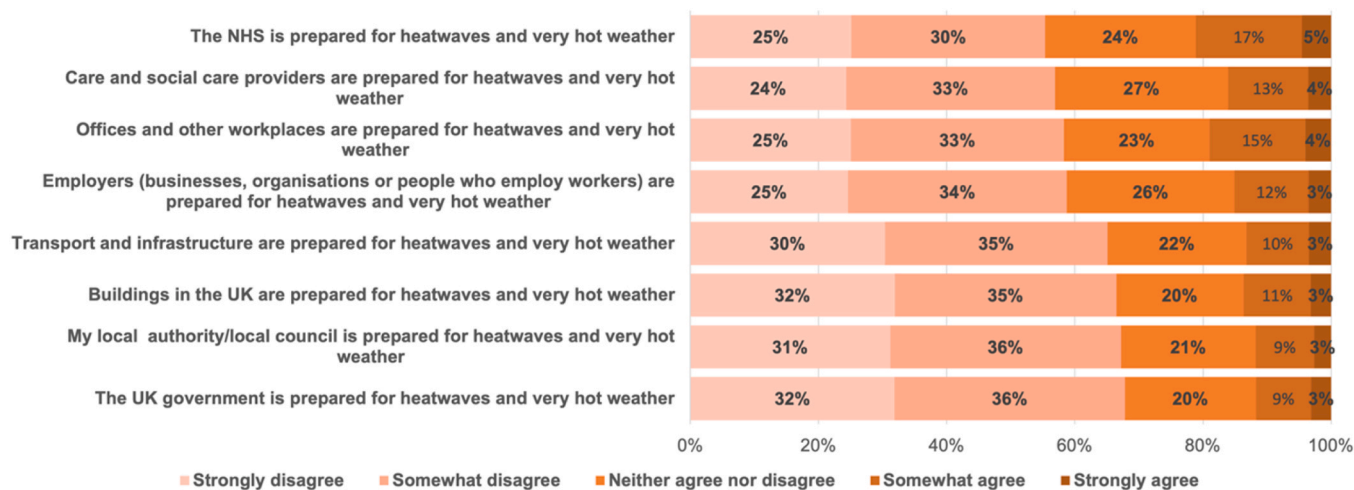
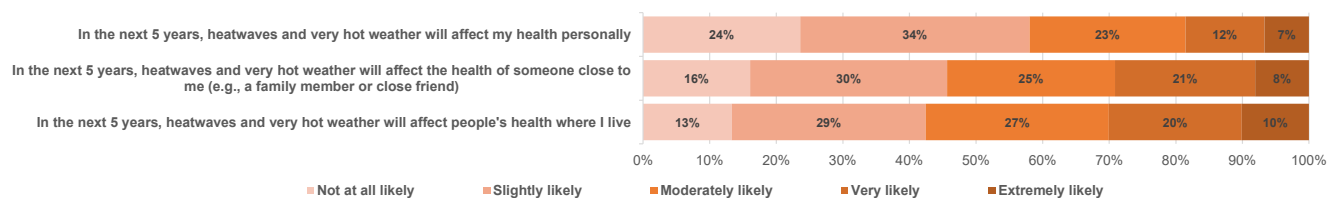
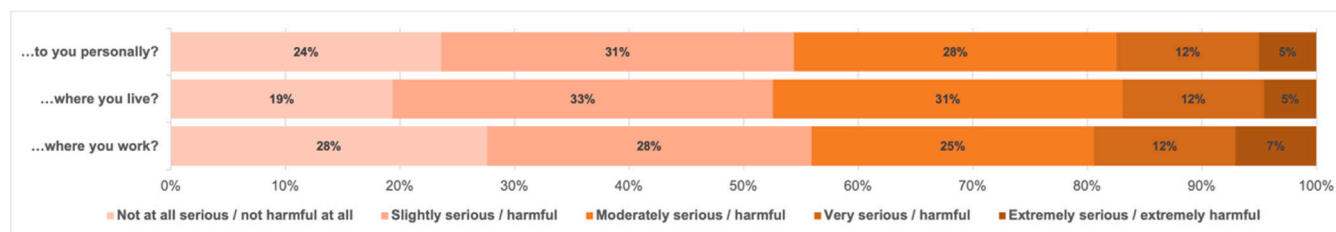


Fig. 1. Views on readiness of UK institutions to prepare for heatwaves and very hot weather.



(a) Answers to question: “How likely or unlikely do you feel the following statements are?”



(b) Answers to question: “In the next 5 years, how serious/harmful do you feel the impacts of heatwaves and very hot weather could be...”

Fig. 2. Perceptions of (a) how heat will affect the health of respondents personally, family members of close friends, and people where they live in the next five years and (b) how serious/harmful the impacts of heatwaves and hot weather will be on respondents, where they live and where they work.

(1748) = -4.47, $p < .001$, $d = -0.21$, 95 % CI [-0.35, -0.13]), where they live ($t(1748) = -2.29$, $p = .022$, $d = -0.11$, 95 % CI [-0.22, -0.02]) and where they work ($t(1230) = -2.79$, $p = .005$, $d = -0.16$, 95 % CI [-0.33, -0.06]). Respondents from vulnerable groups are more likely than nonvulnerable respondents to say they will change jobs to reduce their risk from heat exposure ($t(1145) = -3.74$, $p < .001$, $d = -0.21$, 95 % CI [-0.47, -0.15]).

Geographical gaps

We find evidence of an urban-rural divide with respect to experiences of heat, with 60 % people in urban and 59 % in suburban areas stating they suffer from heat discomfort compared to 49 % of those living in rural areas. In urban areas, 43 % have had their health impacted by heat events recently versus 30 % of people in rural areas. As might be expected, urban residents are more likely to think it is very or extremely likely they will suffer from future health impacts due to extreme heat events, relative to those who live rurally (22 % versus

16 %). People in urban areas also foresee more severe impacts to themselves, their communities and their workplaces within the next five years, with 20–24 % believing these effects will be *very* or *extremely serious*. In contrast, only 13–15 % of respondents from rural areas are concerned that heatwaves and very hot weather will be so harmful in the future.

Yet urban residents are also more likely than people from suburban or rural areas to think that the UK is prepared for heat, which is interesting considering those residing in urban areas state they suffer more from the impacts of heat and anticipate more severe future impacts. This could be in part due to availability bias where urban residents are more likely to be in closer proximity to buildings, healthcare services and supportive heat governance thereby affecting their understanding of measures in place to mitigate the impacts of extreme heat. This finding applies to perceptions of national government ($p = .005$, $\eta^2 = .009$, 95 % CI [.002, .020]), council ($p = .006$, $\eta^2 = .012$, 95 % CI [.004, .023]), care

and social care providers ($p < .001$, $\eta^2 = .013$, 95 % CI [.004,.025]), the NHS ($p = .010$, $\eta^2 = .009$, 95 % CI [.002,.019]), transport ($p = .017$, $\eta^2 = .008$, 95 % CI [.002,.018]), buildings ($p < .001$, $\eta^2 = .010$, 95 % CI [.002,.021]), offices and other workplaces ($p = .002$, $\eta^2 = .010$, 95 % CI [.002,.020]), and employers ($p = .002$, $\eta^2 = .010$, 95 % CI [.002,.021]). Likewise, those from Greater London report greater confidence overall relative to people in other parts of England, though their evaluations of care providers and the NHS are similar.

Countries within the UK are also not homogeneous regarding perceptions of very hot weather, and regional differences emerge. Respondents in England are more likely to say they feel uncomfortable indoors during extreme heat (58–64 %) compared to those in Scotland (39 %), Wales (42 %) and Northern Ireland (41 %). Greater London residents in particular report suffering negative health impacts linked to heatwaves (47 %) and consequently are more likely to anticipate *very* or *extremely severe* impacts to themselves (22 %) and their community (21 %) in the future. In contrast, only 26 % of respondents from Northern Ireland, 31 % from Wales, and 33 % from Scotland say their health has been affected. Overall, people in Northern Ireland have significantly lower perceptions of vulnerability compared to respondents from Scotland and England, with those from Wales reporting the highest perceptions of vulnerability.

Communication gaps

We identify another gap in public perceptions relating to the communication of heat risk. Whilst almost three-quarters (72 %) of people report seeing more media coverage related to extreme heat events, just under half of respondents (46 %) say they feel well-informed about the risks of heatwaves and very hot weather. At the same time, 20 % of the UK public lack confidence in the accuracy of media coverage and a further 37 % are unsure about this. A quarter of respondents (26 %) perceive heatwaves as framed in a positive way by the media, especially those from Greater London (34 %) or Northern Ireland (39 %). When it comes to communication, not all sources are viewed as equal: two-thirds (64 %) consider weather services to be proficient in communicating these risks, compared to national (27 %) or local (18 %) governments (Fig. 3).

3.3. Inconsistent behavioural intentions

We find that respondents are willing to make behavioural and life-style changes to better adapt to the heat. Over half of respondents (52 %) say it is *somewhat* or *extremely likely* they will change their lifestyles in the coming year to help minimise risks from heatwaves and very hot weather. Almost half (49 %) intend to change their indoor home

environment, with fewer (40 %) planning to make outdoor changes to their households (Fig. 4). Most believe taking action before (66 %) and during (74 %) extreme heat events will be effective at reducing health impacts.

People in the UK are likely to engage in a range of coping behaviours, especially staying hydrated (88 %), wearing lighter clothing (85 %), avoiding direct sunlight (79 %), using fans (75 %) or opening windows at night (73 %), or cooling down by accessing greenspace (56 %). The majority of people say they are *somewhat* or *extremely unlikely* to acquire insurance to protect themselves and their families from the health risks of extreme heat (53 %) or to change jobs to reduce their risk of exposure to heatwaves and very hot weather (57 %). However, we identify a gap relating to work-related behaviours, with fewer stating they would work at different times of the day (38 %) or work less (35 %) to stay cool. In addition, a substantial proportion (41 %), irrespective of vulnerable status, perceives costs and barriers which may impede their ability to implement measures to protect themselves. Almost half (49 %) of respondents state they will think twice about travelling overseas to places which experience hotter weather than the UK, and 47 % are more likely to holiday in the UK due to perceived risks of heatwaves and overheating abroad.

3.4. Climate-heat concern gap

We also see a gap between climate change and heat-specific concern. Almost half (45 %) of respondents report being *very* or *extremely worried* about climate change, but fewer (32 %) share this degree of concern when asked about heatwaves and very hot weather in particular (Fig. 5). Over a third (35 %) consider heatwaves to be a normal part of summer, and 43 % view them only as a future problem. Though in the minority, almost a quarter (24 %) do not believe the UK is at risk from extreme heat, and a similar number (22 %) see heatwaves and very hot weather as having a *positive* impact.

3.5. Heat adaptation-mitigation gap

We identify a gap in awareness on the environmental impact of cooling strategies. The UK public is looking to the government to provide climate-friendly alternatives for staying cool (Fig. 6). Almost two-thirds (62 %) of respondents feel any government action aimed at keeping people cool during heatwaves must not make climate change worse, and 55 % state green/renewable energy should be used. At the same time, we find relatively strong support for the use of air conditioning (59 %) to cope with heatwaves and extreme heat. With a

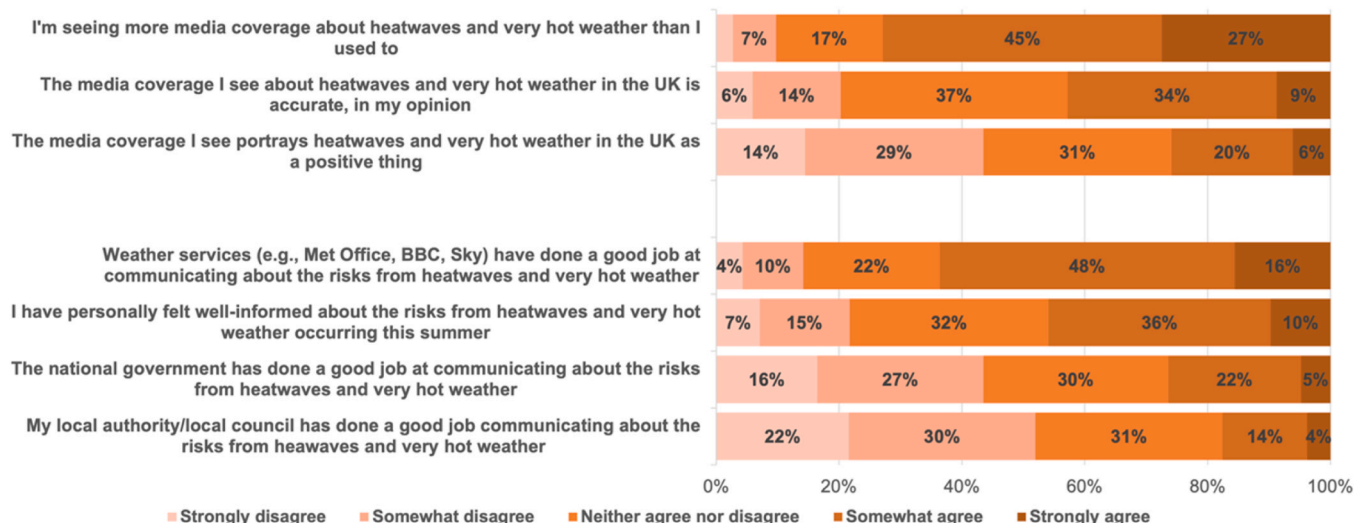


Fig. 3. Views on sources of advice on heatwaves and very hot weather.

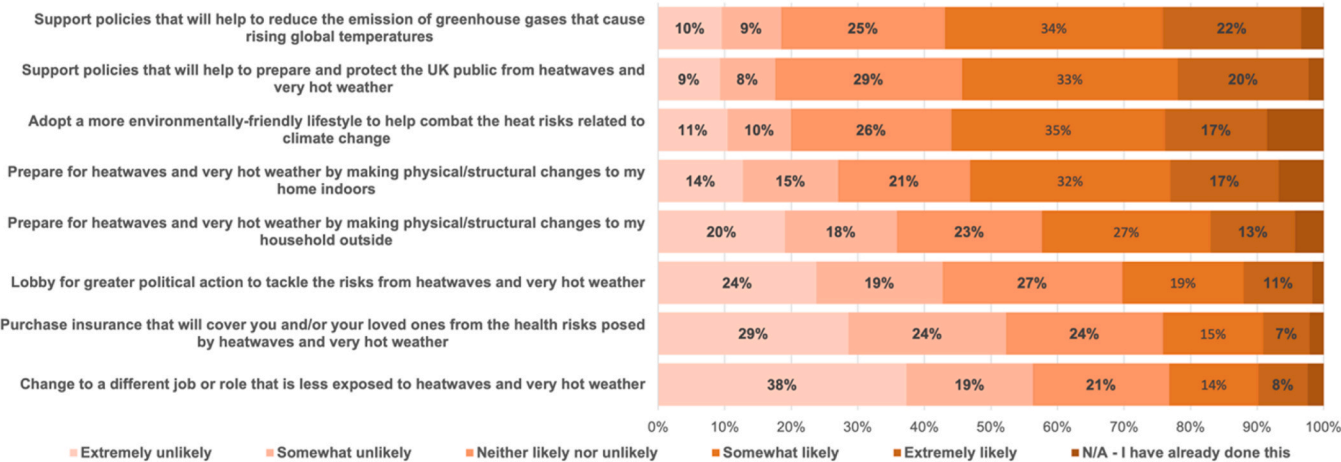


Fig. 4. Support for range of initiatives for individual-level response to heatwaves and high temperatures.

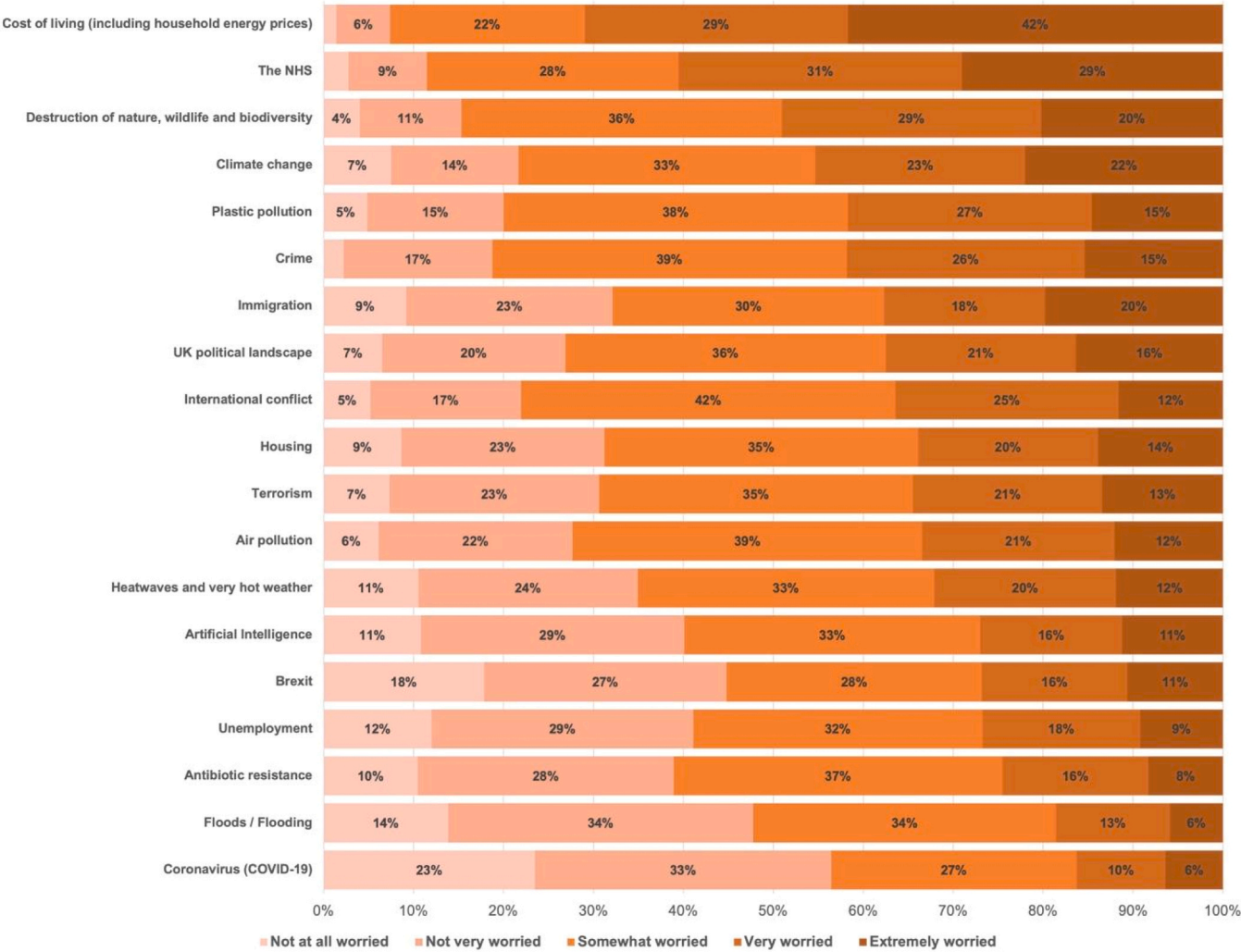


Fig. 5. Worry about nationally significant issues (%). The chart ranks 19 national issues by ‘extreme/very worried’ responses, illustrating a gap between the concerns about climate change (ranked 4) and heatwaves and very hot weather (ranked 13).

balanced spread of attitudes regarding the environmental impacts of air conditioning, 38 % believe it is okay if it leads to an increase in energy use, 37 % were not sure about the negative impacts of air conditioning on the environment, and 36 % see it as harmful.

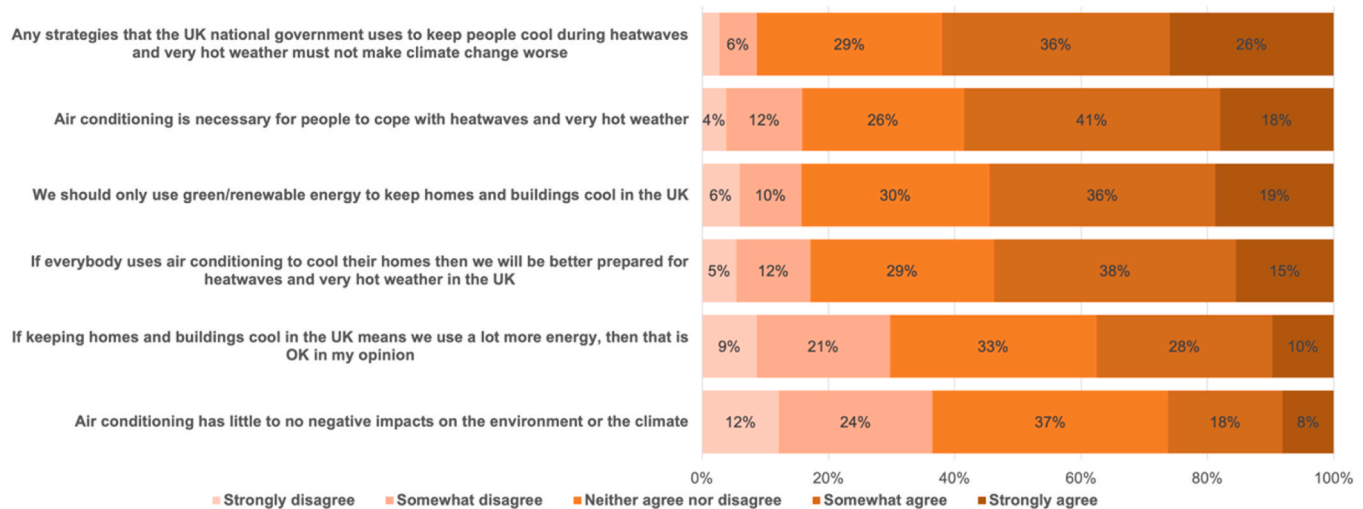


Fig. 6. Perceptions relating to impacts of cooling solutions.

4. Discussion

4.1. Public awareness and perceptions of heat risk

Despite the 2022 heatwaves leading to just under 3000 heat-related deaths, and a growing awareness of the life-threatening risks of heat, the UK public does not consider the UK to be prepared to respond to the impacts of extreme heat. National and local governments are ranked lowest in terms of preparedness, compared to the NHS, buildings, infrastructure and the workplace. This suggests a substantial gap between the public's perceptions of threat and their confidence in government, highlighting the need for policy changes to design and deliver a comprehensive heat preparation and response plan. This diminished trust could be due to respondents more likely to turn to behavioural measures, or changes to their indoor environment to prepare themselves for extreme heat, or their ability to change protection factors.

Whilst most people in the UK acknowledge that heatwaves negatively impact health and wellbeing, they broadly perceive themselves as being able to cope and believe others are more likely to be directly affected than themselves. Our findings confirm data from a 2021 survey which found that only a small proportion (9 %) of the UK public perceive themselves as being vulnerable to heatwaves, contrary to evidence suggesting 17 % of the UK population are considered vulnerable (British Red Cross, 2021). These results are consistent with research showing people tend to underestimate the likelihood and severity of climate-related risks to themselves compared to others (Gifford et al., 2009; Hansen-Easey et al., 2019; van der Linden, 2014), reflecting an optimism bias (Weinstein, 1980) which could result from psychological distance to climate change (van der Linden et al., 2015). The data may also indicate a need for proximity to heatwaves to increase risk perceptions, since the risk salience of climate-related events is thought to diminish over time (McCoy and Walsh, 2018; Ray et al., 2017). The 2022 summer heatwaves occurred a year before our survey, and no significant heat event in the UK occurred in 2023.

Vulnerability, coping strategies and infrastructure gaps

Respondents categorized as vulnerable, those in Greater London, and urban areas more generally demonstrate a higher degree of awareness that heat can affect them, their workplace and where they live in future. The way individuals respond to extreme heat could stem from the perceived likelihood and severity of climate-related threats (i.e. risk appraisal) and the evaluation of ways to reduce the impacts of this risk (coping appraisal) (Kuhlicke et al., 2020). People in the UK are generally aware of simple behaviours they can adopt to stay cool during periods of heat (British Red Cross, 2021), however, we find a gap with respect to

more significant behaviours, e.g. changing work patterns to adapt to increasing temperatures. This may build on the perception that workplaces are safe in hot conditions and reflect workplace cultures which provide less flexibility than other countries which experience high temperatures (European Environment Agency, 2022).

Relative to spaces where people live, workplaces are perceived as being lower risk from the heat, with 28 % of respondents believing the impacts of heat where they work will not be serious or harmful, perhaps due to those work environments having cooling mechanisms. Considering the UK does not have legislation in place prohibiting working when temperatures meet a maximum temperature threshold, and the fact that the UK building stock is not well prepared for extreme heat, the suggestion that people perceive the UK building stock to be well prepared for extreme heat is problematic (Bouhi et al., 2022). This also brings to the fore issues of social justice and highlighting issues around lack of widespread access to cooling facilities and measures in workplace environments, which can further exacerbate the health implications of heat.

4.2. The role of the media and public engagement in heatwave preparedness

Effective communication and public engagement are essential for raising awareness, promoting adaptive behaviours, and fostering community resilience to extreme heat (McLoughlin et al., 2023). Almost half of our sample considers itself to be well informed about heat, and the data indicate most people in the UK have noticed an increase in media coverage of heat events, however questions are raised regarding how the heat is reported. Considering the majority of our respondents perceive the UK not to be prepared for extreme heat, the media plays an important role in shaping and influencing perceptions of extreme heat and the impacts they have, and by portraying experiences of heat as positive ones of 'having fun in the sun' they are playing a dangerous role in conveying misperceptions about heat coping mechanisms (O'Neill et al., 2022). Clear and accessible messaging tailored to diverse audiences can enhance public understanding and encourage appropriate responses to extreme heat events (McLoughlin et al., 2023). Yet, if the way the media portrays heat is not perceived as accurate or may be encouraging risk enhancing behaviours it may not be trusted as much. As a result of this, respondents are turning to weather services over national and local government sources for information on heat, highlighting a troubling lack of accurate, accessible information on heat risk guidance.

We find widespread agreement that action to prepare and respond to extreme heat should not contribute to making climate change worse.

However, the lack of understanding of the environmental impacts of air conditioning is problematic and could lead to unsustainable use of energy-intensive cooling technologies. We see here an opportunity to raise awareness on what these impacts are, how this measure can be part of a suite of wider options (e.g. behavioural, passive and blue-green) and how climate-friendly approaches are part of the solution.

Understanding public perceptions of extreme heat in the UK is crucial for informing evidence-based policies and interventions which aim to enhance the UK's preparedness and response to heatwaves and very hot weather (McLoughlin et al., 2023; Howarth et al., 2024). Building on recent work concerning perception gaps (Park et al., 2021), our survey analysis has shown several gaps and contradictions in public perceptions regarding vulnerability to heat, trust in local and national government, and media portrayals. For example, unless categorised as vulnerable, respondents do not consider the heat to directly affect them, and in some instances (i.e. participants aged 65 years and over), there is a diminished sense of self-vulnerability. This is concerning, as it could lead to higher degrees of exposure to extreme heat and an increased number of avoidable heat-related deaths.

5. Conclusion

Our findings show that the UK public is increasingly aware of the threat of heatwaves, with 75 % acknowledging their life-threatening impacts and 66 % believing they are getting worse as a result of climate change. We found that many report feeling a degree of discomfort during hot weather, and over a third have suffered health issues as a result. Despite this, there is a widespread perception that both local and national governments, as well as infrastructure and healthcare systems, are unprepared for extreme heat events. We identify a notable vulnerability gap, with people generally viewing themselves as less vulnerable than others. While vulnerable groups, such as older adults and those with medical conditions, express higher concern about heat risks, they also perceive heatwaves as a future problem rather than an immediate one. A geographical divide also exists, with urban residents more likely to report that they suffer from heat discomfort and health impacts compared to rural residents. Urban areas also report higher concerns about future heat risks, yet paradoxically, urban residents express more confidence in the UK's preparedness for heatwaves. Additionally, we identified regional differences, with Greater London showing the most concern, while Northern Ireland showed the least.

Our analysis highlights important communication gaps, as while media coverage of heatwaves is increasing, nearly half the public feels inadequately informed about heat risks, and most respondents from our sample trust weather services more than government sources for heat-wave information. In terms of behavioural responses, many people express a willingness to adopt lifestyle changes to cope with heat, such as improving their home environment or staying hydrated; however, fewer are willing to adjust work hours or take other significant measures to mitigate heat-related risks. There is also a climate-heat concern gap, with public concern for climate change being significantly higher than concern specifically about heatwaves. Additionally, while there is broad support for climate-friendly cooling solutions, many people also favour energy-intensive methods like air conditioning, often without fully considering their environmental impact. Building on this, an adaptation-mitigation gap shows that the UK public expects government action on cooling solutions to be both effective and environmentally responsible, yet many are unaware of the potential environmental consequences of air conditioning.

Temperatures similar to those experienced in 2022 are not necessary for the UK to be at risk of overheating, as milder temperatures in the mid/high twenties can lead to severe heat-related health impacts on individuals in vulnerable conditions and/or living environments which significantly overheat (ONS, 2023). If the issues and perception gaps we highlight in this paper are not addressed, the UK will face significant challenges in facilitating adoption of heat preparedness and response

measures (Environmental Audit Committee, 2023) without necessarily reaching the temperature records seen in 2022. In order to advance this debate, there are a number of directions that future research could take building on the findings presented in this paper, such as exploring the difference in concern over extreme heat given the positive perceptions of heat we have identified, the work-related behaviour gap and the implications of the reduction in leisure travel due to perceptions of heat risk, and the reduced self-identification as vulnerable to heat by those over the age of 65, a known heat-vulnerable group.

Extreme and prolonged periods of heat are likely to become more frequent, and whilst heat-related deaths are avoidable, they could further be exacerbated by other crises the UK is likely to face, such as drought, which compound heat-mortality impacts (Yin et al., 2023). Public perceptions must thus be more carefully incorporated into designing national heat risk preparedness to ensure that rapid, life-saving actions are taken in a country where perceptions of the dangerous impacts of heat are not aligned with the severity of heat risk, and where buildings and infrastructure are not designed to keep occupants safe during periods of heat risk.

CRediT authorship contribution statement

Candice Howarth: Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Ganga Shreedhar:** Conceptualization. **Niall McLoughlin:** Writing – review & editing, Methodology, Conceptualization. **Heidi Zamzow:** Writing – original draft, Visualization, Formal analysis.

Ethics statement

This research has received approval from the London School of Economics Ethics Committee (approval number 236107).

Declaration of Competing Interest

The authors declare no competing interests.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.envsci.2025.104101.

Data Availability

Data will be made available upon reasonable request, for research purposes. Data and SPSS Syntax are available upon request

References

- Alizadeh, M.R., Abatzoglou, J.T., Adamowski, J.F., Prestemon, J.P., Chittoori, B., Akbari Asanjan, A., Sadegh, M., 2022. Increasing heat-stress inequality in a warming climate. *Earth's Future* 10, e2021EF002488.

- Andre, P., Boneva, T., Chopra, F., et al., 2024. Globally representative evidence on the actual and perceived support for climate action. *Nat. Clim. Chang* 14, 253–259. <https://doi.org/10.1038/s41558-024-01925-3>.
- Bouhi, N., Canta, A., Chikte, S., Edwards, M., Fielding, V., Reynolds, J., 2022. Addressing overheating risk in existing UK homes. Arup, London. (<https://www.theccc.org.uk/wp-content/uploads/2022/10/Addressingoverheating-risk-in-existing-UK-homes-Arup.pdf>).
- British Red Cross, 2021. Feeling the heat: A British Red Cross briefing on heatwaves in the UK. British Red Cross. (<https://www.redcross.org.uk/-/media/documents/about-us/heatwaves-feeling-the-heat.pdf>).
- Clayton, S., 2024. A social psychology of climate change: progress and promise. *Br. J. Soc. Psychol.* <https://doi.org/10.1111/bjso.12749>.
- van Daalen, K.R., et al., 2024. The 2024 Europe report of the Lancet Countdown on health and climate change: unprecedented warming demands unprecedented action. *Lancet Public Health* 9 (7), e495–e522.
- van der Linden, S., Maibach, E., Leiserowitz, A., 2015. Improving public engagement with climate change: five “best practice” insights from psychological science. *Perspect. Psychol. Sci.* 10 (6), 758–763. <https://doi.org/10.1177/1745691615598516>.
- van der Linden, S.L., 2014. The social-psychological determinants of climate change risk perceptions: Towards a comprehensive model. *J. Environ. Psychol.* 41, 112–124.
- Environmental Audit Committee (2023) Inquiry on Heat Resilience and Sustainable Cooling. Fifth Report of Session 2023–24.
- Erens, B., Williams, L., Exley, J., Ettelt, S., Manacorda, T., Hajat, S., Mays, N., 2021. Public attitudes to, and behaviours taken during, hot weather by vulnerable groups: results from a national survey in England, 6 *BMC Public Health* 21 (1), 1631. <https://doi.org/10.1186/s12889-021-11668-x>. PMID: 34488695; PMCID: PMC8422617.
- European Environment Agency (2022) Climate change as a threat to health and well-being in Europe: focus on heat and infectious diseases. EEA Report 07/2022. <https://www.eea.europa.eu/publications/climate-change-impacts-on-health>.
- Gifford, R., Scannell, L., Kormos, C., Smolova, L., Biel, A., Boncu, S., Corral, V., Günther, H., Hanyu, K., Hine, D.W., Kaiser, F.G., Korpela, K.M., Lima, L., Mertig, A. G., Mira, R.G., Moser, G., Passafaro, P., Pinheiro, J.Q., Saini, S.K., Sako, T., Sautkina, E., Savina, Y., Schmuck, P., Schultz, W.P., Soback, K., Sundblad, E., Uzzell, D., 2009. Temporal pessimism and spatial optimism in environmental assessments: an 18-nation study. *J. Environ. Psychol.* 29, 1–12.
- Haase, D., Hellwig, R., 2022. Effects of heat and drought stress on the health status of six urban street tree species in Leipzig, Germany. *Trees People* 8, 100252. <https://doi.org/10.1016/j.tfp.2022.100252>.
- Hanson-Easey, S., Hansen, A., Williams, S. and Bi, P. (2019). Communicating about heatwaves: Risk Perception, Message Fatigue, and Threat Normalisation. (https://www.researchgate.net/publication/330844253_Communicating_about_heatwaves_RISK_PERCEPTION_MESSAGE_FATIGUE_AND_THREAT_NORMALISATION).
- Hass, A.L., Runkle, J.D., Sugg, M.M., 2021. The driving influences of human perception to extreme heat: a scoping review. *Environ. Res.* 197. <https://doi.org/10.1016/j.envres.2021.111173>.
- He, C., Kim, H., Hashizume, M., et al., 2022. The effects of night-time warming on mortality burden under future climate change scenarios: a modelling study. *Lancet Planet. Health* 6, e648–57.
- Howarth, C., McLoughlin, N., Armstrong, A., Murtagh, E., Mehryar, S., Beswick, A., Ward, R.E., Ravishankar, S., Stuart-Watt, A. (2024) Turning up the heat: Learning from the summer 2022 heatwaves in England to inform UK policy on extreme heat. London: Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science.
- Howe, P.D., Marlon, J.R., Wang, X., Leiserowitz, A., 2019. Public perceptions of the health risks of extreme heat across US states, counties, and neighborhoods. *Proc. Natl. Acad. Sci. U. S. A.* 116, 6743–6748.
- Kuhlicke, C., Seebauer, S., Hudson, P., Begg, C., Bubeck, P., Dittmer, C., Grothmann, T., Heidenreich, A., Kreibich, H., Lorenz, D.F., Masson, T., Reiter, J., Thaler, T., Thieken, A.H., Bamberg, S., 2020. The behavioral turn in flood risk management, its assumptions and potential implications. *WIREs Water* 7 (3).
- McCoy, S.J., Walsh, R.P., 2018. Wildfire risk, salience & housing demand. *J. Environ. Econ. Manag.* 91, 203–228. <https://doi.org/10.1016/j.jeem.2018.07.005>.
- McLoughlin, N., Howarth, C., Shreedhar, G., 2023. Changing behavioral responses to heat risk in a warming world: How can communication approaches be improved? *WIREs Clim. Change*, e819. <https://doi.org/10.1002/wcc.819>.
- Met Office (2022a) A milestone in UK climate history. (<https://www.metoffice.gov.uk/about-us/news-and-media/media-centre/weather-and-climate-news/2022/july-heat-review>).
- Met Office (2022b) UK Climate Projections: Headline Findings. https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18_headline_findings_v4_aug22.pdf.
- O'Neill, S., Hayes, S., Strauß, N., Dautreix, M.-N., Steentjes, K., Ettinger, J., Westwood, N., Painter, J., 2022. Visual portrayals of fun in the sun in European news outlets misrepresent heatwave risks. *Geogr. J.* 189 (1), 90–103. <https://doi.org/10.1111/geoj.12487>.
- ONS (2023) Climate-related mortality, England and Wales: 1988 to 2022. <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/article/s/climate-related-mortality-and-hospital-admissions-england-and-wales/1988-to-2022>.
- Park, R., Behrer, A., Goodman, J., 2021. Learning is inhibited by heat exposure, both internationally and within the United States. *Nat. Hum. Behav.* 5, 19–27. <https://doi.org/10.1038/s41562-020-00959-9>.
- Ray, A., Hughes, L., Konisky, D.M., Kaylor, C., 2017. Extreme weather exposure and support for climate change adaptation. *Glob. Environ. Change* 46, 104–113. <https://doi.org/10.1016/j.gloenvcha.2017.07.002>.
- Romanello, M., di Napoli, C., Green, C., et al., 2023. The 2023 report of the Lancet Countdown on health and climate change: the imperative for a health-centred response in a world facing irreversible harms. *Lancet Countdown*. [https://doi.org/10.1016/S0140-6736\(23\)01859-7](https://doi.org/10.1016/S0140-6736(23)01859-7).
- Semenza, J.C., et al., 2008. Public perception and behavior change in relationship to hot weather and air pollution (Available at:). *Environ. Res.* 107 (3), 401–411. <https://doi.org/10.1016/j.envres.2008.03.005>.
- Smit, B., Wandel, J., 2006. Adaptation, adaptive capacity and vulnerability. *Glob. Environ. Change* 16 (3), 282–292.
- Suldoosky, B., Baer Kramer, M., Fink, J., 2024. ‘Extreme heat & public perception in Portland, Oregon: Evidence of a compounding vulnerability effect for climate hazards (Available at:). *PLOS Clim.* Ed. E. Coughlan De. Perez 3 (5), e0000386. <https://doi.org/10.1371/journal.pclm.0000386>.
- UKHSA, 2023. Health Eff. Clim. Change (HECC) Uk. State Evid. 2023. (<https://assets.publishing.service.gov.uk/media/659ff6a93308d200131fbc78/HECC-report-2023-overview.pdf>).
- Valois, P., et al., 2020. Using the theory of planned behavior to identify key beliefs underlying heat adaptation behaviors in elderly populations (Available at:). *Popul. Environ.* 41 (4), 480–506. <https://doi.org/10.1007/s11111-020-00347-5>.
- Watkins, P., Cimato, F., Hunt, A., 2021. prepared for the climate change committee. Monet. Valuat. Risks Oppor. CCRA3. Suppl. Rep. UK Clim. Change Risk Assess. 3.
- Weinstein, N.D., 1980. Unrealistic optimism about future life events. *J. Personal. Soc. Psychol.* 39, 806–820.
- Williams, S., et al., 2019. Heat-health warnings in regional Australia: examining public perceptions and responses (Available at:). *Environ. Hazards* 18 (4), 287–310. <https://doi.org/10.1080/17477891.2018.1538867>.
- Yin, J., Gentile, P., Slater, L., et al., 2023. Future socio-ecosystem productivity threatened by compound drought–heatwave events. *Nat. Sustain* 6, 259–272. <https://doi.org/10.1038/s41893-022-01024-1>.