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# Resilience: conceptualisations and challenges for effective heatwave public health planning



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## ABSTRACT

**Objectives:** This article examines diverse perspectives on heatwave resilience in public health planning, interviewing stakeholders from various sectors. It identifies challenges, including operational, political, economic, and cultural aspects, hindering effective strategies. The study advocates for a holistic approach to heatwave resilience, emphasising interdisciplinary research and collaboration for targeted interventions. Enhancing resilience is crucial to mitigating adverse health impacts and safeguarding vulnerable populations during heatwaves.

Conceptualisations of resilience related to heatwave public health planning and heatwave resilience vary significantly. There is a need to unveil the multifaceted nature of resilience in the context of heatwaves and identify key challenges that hinder effective public health planning efforts.

**Study design:** Qualitative study to explore key stakeholders' conceptualisations of resilience and highlight challenges and opportunities needed for greater heatwave resilience and public health planning.

**Methods:** Interviews were conducted with a diverse group of key stakeholders involved in local, regional, and national heatwave planning, academics, civil sector and private sector representatives.

**Results:** The findings of this study highlight diverse conceptualisations of resilience. Conceptualisations of resilience mainly differ on the following: 'whom'; 'what'; 'how'; 'when'; and 'why'. This analysis shows that the concept of resilience is well understood but has different functions. The analysis of challenges revealed several key problems, such as operational and technical; political and governance; organisational and institutional; economic; linguistic; cultural, social, and behavioural; and communication, information, and awareness. These significantly hinder effective heatwave public health planning strategies.

**Conclusions:** The study emphasises the need for a holistic and integrated approach to heatwave resilience. Addressing these challenges is crucial for enhancing heatwave public health planning. This study provides valuable insights into the complexities of heatwave resilience, offering guidance for different sectors of society to develop targeted interventions and strategies. The development of new resilience interdisciplinary and intersectoral research, practice, and governance will prove crucial to ongoing efforts to strengthen national heatwave resilience public health planning. By fostering resilience, societies can mitigate the adverse impacts of heatwaves and safeguard the health and well-being of vulnerable populations.

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## Introduction

## Climate change, heatwaves, and health

Climate change is one of the most significant challenges facing humanity today.<sup>1,2</sup> Heatwaves, characterised by prolonged periods of excessive heat are becoming more frequent and intense due to

climate change and are one of the most significant climate-change-related threats to public health, with increased risk of heat-related illnesses and deaths which are differently distributed within the population.<sup>3–5</sup> Heatwaves can cause heat stress, which can lead to heat stroke, other health problems, and death. They can also exacerbate chronic health conditions, such as heart disease and respiratory disease, particularly among vulnerable individuals.<sup>6–10</sup>

In the United Kingdom (UK), climate change, emerges as an imminent and escalating threat to public health.<sup>11,12</sup> The increase in the frequency, intensity, and duration of heatwaves in the UK

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demands urgent attention.<sup>13–15</sup> Acknowledging the well-established link between human health and temperature, heatwaves pose a pronounced public health concern<sup>16–20</sup> and are deemed a threat to national security.<sup>21</sup> Despite evidence from the UK's Third Climate Change Risk Assessment (CCRA3) underscoring the under-managed risk of heatwaves, the impact on population health and healthcare system delivery remains inadequately addressed.<sup>15</sup>

The burden of climate change disproportionately falls on the most vulnerable, poor, and marginalised individuals and communities, and future changes are likely to exacerbate existing health inequalities.<sup>22–24</sup> In this alarming context, a whole-of-society approach is needed; one that takes decisive actions to protect local communities and uphold public health against climate risks. By fulfilling this, different sectors of society can enhance resilience and contribute to the establishment of a healthier and more cohesive society.<sup>24</sup>

In the aftermath of the 2003 heatwave in Europe which led to an estimated 70,000 excess deaths, numerous cities and countries worldwide have developed and implemented heat-health action plans to better prepare and respond to such events.<sup>25</sup> Heat-health action plans aim to both coordinate response efforts in the event of a heatwave, help identify vulnerable groups, and provide them with necessary assistance.<sup>25</sup> As an example, in England, UK, a Heatwave Plan (now 'Adverse Weather and Health Plan') is published annually by the National Health Service, UK Health and Safety Agency, and the Met Office with recommendations and warnings.<sup>26</sup> The responsibility for heatwave implementation and delivery involves a combination of national, regional, local entities, government departments, academia, non-governmental organisations, and businesses, including the Department of Health and Social Care, NHS England, Age UK, and Local Government Association among others.<sup>26</sup>

The EM-DAT database<sup>27</sup> a global database of worldwide hazards and disasters contains mortality information on the occurrence of six heatwaves in the UK: 2003 (301 deaths); 2013 (760 deaths); 2018 (n/a); 2019 (166 deaths); 2020 (2556 deaths); 2022 (3469 deaths), and a more recent heatwave in 2023 (estimates only). Despite the implementation of Heatwave Plans since 2003, evidence shows a persistence of high mortality rates during heatwaves<sup>27</sup> which raises important questions about the effectiveness of these plans and how they can be improved.

### Resilience

Resilience is a multidimensional concept that has been applied in various contexts.<sup>28–30</sup> The term resilience comes from the Latin word 'resilio', which means to bounce back or recover and has emerged as a critical concept with a focus on building capacity to cope with threats and recover.<sup>31</sup>

In the context of climate change, resilience has been defined as the ability of systems or individuals to withstand, adapt to, and recover from shocks and stressors.<sup>3,4</sup> In the context of heatwaves, resilience has been defined as the ability of individuals and communities to cope with and recover from the physical and psychological impacts of extreme heat.<sup>3</sup> As the health risks of heatwaves increase, the promotion of resilience is essential for public health planning.<sup>32–34</sup> In the public health literature, resilience has been used to describe the ability of individuals, communities, and systems to maintain or regain health and wellbeing in the face of adversity.<sup>35</sup>

These different conceptualisations of resilience may have various consequences that can span from miscommunication, inconsistent application, disagreements and conflicts, impaired problem-solving, incomplete understanding, difficulty in research and knowledge mobilisation, as well as policy implications.<sup>36,37</sup>

Given that, it is important to understand and examine the current conceptualisations of resilience: how different definitions and measures may impact the effectiveness of heatwave public health planning efforts and identify challenges for improving heatwave resilience and public health planning. This study aims to contribute to this public health opportunity, which constitutes an urgent area of research. It aims to unveil the multifaceted nature of resilience in the context of heatwaves and identify key challenges that hinder effective planning efforts. By exploring the topic comprehensively, this research seeks to contribute to the development of strategies to enhance heatwave resilience.

## Methods

### Design

This study adopted a qualitative research design method to explore conceptualisations of resilience and highlight challenges and improvements needed for greater heatwave resilience and public health planning. In-depth semi-structured interviews were conducted with a diverse group of key stakeholders in England, UK.

### Participants and recruitment

Participants constitute a diverse group of key stakeholders from government, private sector, civil society, and academia based in England, UK and spread throughout the country (e.g. North, South, East and West, urban and rural areas). Potential stakeholders were identified through a review of existing literature, policy documents, and previous studies related to heatwave planning. Experts and practitioners were also consulted to provide recommendations for individuals who demonstrate understanding and active involvement in heatwave resilience. Inclusion criteria included participants' experience, knowledge, and active role in heatwave resilience policy and practice. Stakeholders were selected via purposive sampling to achieve maximum variability.<sup>38</sup> Snowball sampling<sup>39</sup> was then used to reach other individuals with experience and knowledge of heatwave resilience. Stakeholders were contacted via email and invited to take part in the study and were provided with a study information sheet. Interested stakeholders were subsequently sent a consent form.

### Data collection

In-depth semi-structured interviews<sup>39–41</sup> were used, and an interview topic guide was developed, containing open-ended questions that sought to elicit stakeholders' perspectives on the conceptualisation of resilience and challenges for greater heatwave resilience ([Supplementary Material 1](#)). Twenty-six one-to-one interviews were conducted at a convenient time to stakeholders. Interviews were audio-recorded and transcribed verbatim. Interviews lasted between 20 and 60 min, with a median of 33.5 min.

### Data analysis

Responses were exported to NVivo12® software (QSR) to organise and integrate data. A preliminary analysis to identify major categories (i.e. themes or patterns) was made using content analysis to present interactions between analysis, interpretations, and construction of meaning.<sup>42–46</sup> Sections of text were coded according to themes or patterns and stakeholder type aiming at identifying areas of communality and discordance in their answers. During an iterative process, themes or patterns were detected and developed through the combination of inductive and deductive coding,<sup>42,47,48</sup> where certain preliminary categories were

established considering relevant resilience literature. Additionally, qualitative content analysis was undertaken while looking at the frequency of specific words used.<sup>45</sup> Although word frequency may not automatically indicate significance, this has been calculated as it can allow the investigation of under-represented or hidden themes and improve understanding of the popularity of the themes.<sup>47</sup>

## Results

A total of 26 participants were recruited. Stakeholders' diversity of perspectives in relation to their working sector meant that government, private sector, academia, and civil society were included, as well as different working disciplines such as health and social care, social science, technology or science (Tables 1a and 1b).

As shown in Table 1a, nine stakeholders were from national (NG) and local government (LG), eight from academia (A), six from civil society (CS), and three from the private sector (PS). Additionally, stakeholders' four main disciplinary areas were represented as seen in Table 1b. Health and social care ( $n = 9$ ), social science ( $n = 8$ ) and science ( $n = 7$ ) were highly represented and technology ( $n = 2$ ) was the least represented.

### Unpacking conceptualisations of resilience

Analyses reveal several insights and important categories and themes associated to the conceptualisation of resilience. To distil these, we undertook categorisation and frequency of commonly occurring words (%) in stakeholders' conceptualisations of 'resilience', with the findings presented in descending order in Table 2 (as seen in<sup>49</sup>).

For stakeholders, resilience is dependent on a variety of factors. Entities, skills, actions, subject matter, time unit, and phenomena all play a role, as shown in Table 2. Certain words emerged as recurrent and highly prevalent in stakeholders' conceptualisations of resilience, and this can be a sign of their importance. A closer examination revealed that these conceptualisations primarily diverged in terms of the 'whom' (e.g. people/individuals, systems, services); 'what' (e.g. ability, capacity); 'how' (e.g. adapt, respond); 'when' (e.g. quickly, long term); and 'why' (e.g. adverse, negative; impacts, shocks) of resilience, each offering a distinct lens through which to view this intricate concept.

Stakeholders consistently acknowledged the significance of both individual and collective units of analysis. 'People/individuals' took centre stage at 30%, with 'system(s)' (14%), 'organisation(s)' (11%), and 'services' (11%) also prominently featured across all conceptualisations. Furthermore, 'ability' (85%) and 'capacity' (15%) emerged as vital attributes indispensable for resilience.

Stakeholders detailed the focal points of their analyses, emphasising actions such as 'adapt/respond/deal with/address/cope' (27%), 'bounce back/recover/get back to normal(ity)' (22%), and 'withstand/resist' (12%). Resilience, as depicted by these

stakeholders, spans diverse dimensions, including the 'economic' (22%), 'physical' (11%), 'mental' (11%), 'health' (11%), 'climate change' (11%), 'general' (11%), 'social' (11%), and 'community' (11%).

Temporal dimensions were also mentioned, with stakeholders conveying the varied pace at which resilience unfolds—be it 'quickly' (26%) or over the 'long term' (26%). The temporal dimensions expanded to include the 'present' (11%), 'future' (11%), and 'short term' (11%), echoing the dynamic nature of resilience responses to different contexts.

In terms of contextual layers, stakeholders revealed nuanced distinctions, pinpointing areas such as 'impact(s)/shocks' (17%), 'event(s)/effect/issues' (17%), 'conditions/circumstances' (14%), 'change(s)' (11%), and 'risks' (11%). Notably, stakeholders also emphasised those that are 'adverse/negative' (43%).

It was also found that conceptualisations of resilience are not noticeably different between stakeholders' characteristics such as sector of society. This finding is of extreme importance as it shows that despite acute differences between stakeholders. Their understanding of resilience is relatively similar, which constitutes a real advantage point when they are brought together to plan, develop, and implement actions for greater heatwave resilience and public health planning. Overall, such conceptualisations of resilience can be encapsulated as one: *the ability of individual and collective entities to adapt and respond quickly or long term to adverse or negative impact(s) or shocks.*

These examples illustrate how resilience definitions can be tailored to different stakeholders, emphasising their roles, actions, and contributions within their respective contexts.

1. **Who:** Resilience is the ability of **individuals, communities, and organisations** to adapt and recover from adversity, displaying strength, determination, and perseverance in the face of challenges.
2. **What:** Resilience refers to the **capacity** of a system, whether it's a natural ecosystem or a complex infrastructure network, **to absorb shocks, maintain functionality, and adapt or transform** in response to disturbances.
3. **When:** Resilience is most evident during **times of crisis**, natural hazards or disasters caused by natural hazards, economic downturns, or personal hardships, where individuals or communities demonstrate their ability to bounce back, rebuild, and thrive.
4. **Where:** Resilience can be observed in various contexts, including **social, economic, environmental, and personal** domains. It is seen in individuals, families, neighbourhoods, cities, and even nations, as they navigate and recover from adversity.
5. **Why:** Resilience is important because it enables individuals and communities **to withstand and recover** from setbacks, **promoting overall well-being and sustainable development.** It empowers people to face challenges, adapt to change, and build a more secure and prosperous future.

**Table 1a**  
Characteristics of participants.

| Sector        | Description  | Number     |
|---------------|--|------------|
| Government    | National non-ministerial departments and executive agencies (NG)   | 4          |
|               | Local councils (LG)  | 5          |
| Private       | Business and industry (PS)   | 3          |
| Civil society | Civil society organisation and non-governmental organisations (CS) | 6          |
| Academia      | Researchers and academics (A)                                      | 8          |
|               |  | Total = 26 |

**Table 1b**  
Characteristics of participants.

| Disciplinary background | Description   | Number     |
|-------------------------|---|------------|
| Health and Social Care  | Public health, social work (H–S)  | 9          |
| Social Science          | Economics, geography, sociology, social policy, politics and international studies (SS) | 8          |
| Technology              | Environment and engineering (T)   | 2          |
| Science                 | Earth and environmental sciences, life sciences, sustainability (S)                     | 7          |
|                         |   | Total = 26 |

*Customised resilience definitions*

Despite the above, findings show that resilience definitions should be tailored to different stakeholders, emphasising their roles, actions, and contributions within their respective contexts. Customising resilience definitions for different stakeholders is essential as resilience is a complex and multifaceted concept that can vary depending on the perspective and context of the individuals or groups involved (Supplementary Material 2). Reasons why this was found important include:

- *Relevance and ownership*, as stakeholders are more likely to identify with and take ownership of a resilience concept that directly relates to their roles, actions, and contributions. This encourages active engagement.
- *Contextual understanding*, as a clearer understanding of how resilience applies to their specific context and the actions they can take to enhance resilience within their sphere of influence.
- *Collaboration and coordination* can help bridge the gap between different stakeholders by fostering a common language and shared understanding; it can also encourage collaboration, facilitate effective communication, and promote a coordinated approach to resilience.
- *Motivation and buy-in* highlight the potential benefits and positive outcomes of resilience; stakeholders are more likely to be motivated and committed to taking action.

- *Flexibility and adaptability* allow for flexibility and adaptability in addressing the specific needs and challenges. Resilience is not a one-size-fits-all concept.

*Challenges faced by heatwave resilience*

The study also aimed to identify challenges hindering the achievement of greater heatwave resilience and effective public health planning. Several challenges were identified from the analysis of responses to the question ‘What do you consider the challenges for greater heatwave resilience to be?’. The following challenges we identified from the analysis (also see Fig. 1).

A general description of the challenges identified by stakeholders is provided in the following with illustrative quotes included in Table 3. It is important to mention that some topics and findings may be cross-cutting; hence, these should not be interpreted as rigid groupings.

*Operational and technical*

This group includes strategic aspects influencing the development and implementation of heatwave resilience. It includes mechanisms for prioritisation, focus on preparedness, addressing interdependencies with other priorities, and ensuring the protection of vulnerable populations.

**Table 2**  
Categorisation and frequency of commonly occurring words (%) in stakeholders’ definitions of ‘resilience’ in descending order.

| Antecedent conditions | Unit of analysis              | Attributes                        | Resilience                               |            |                      |                           | Context (ii)             |
|-----------------------|-------------------------------|-----------------------------------|--|------------|----------------------|---------------------------|--------------------------|
|                       |                               |                                   | Focus on                                 | Dimensions | Temporal variability | (i)                       |                          |
| Planning              | People/Individuals            | Ability                           | Adapt/Respond/Deal with/Address/Cope     | Economic   | Quickly              | Adverse/Negative          | Impact(s)/Shocks         |
| Protocols             | System(s)                     | Capacity                          | Recover/Bounce back/Get back normal(ity) | Physical   | Long term            | Difficult                 | Event(s)/Effect/Issues   |
| Preparations          | Organisation(s)               | Services                          | Withstand/Resist                         | Mental     | Present              | Disruptive                | Conditions/Circumstances |
|                       | Services                      |                                   | Prepare/Provide/Ensure/Create            | Health     | Future               | Abnormal                  | Change(s)                |
|                       | Population(s)                 | Improve/Strengthened/Thrive/Build | Climate change                           | Short term | External             | Risks                     |                          |
|                       | Community                     | Continue/Remain                   | General                                  | Before     | Increased            | Influence(s)              |                          |
|                       | Vulnerable individuals/people | Bend/Alter/Vary                   | Social                                   | During     | Changing             | Vulnerabilities           |                          |
|                       | Future generations            | Minimise                          | Community                                | After      | Worst                | Challenges                |                          |
|                       | Environments                  | Protect                           |  |            | Radical              | Crisis                    |                          |
|                       | Social                        | Forward looking/Future proofing   |  |            |                      | Turbulence                |                          |
|                       | Institutional                 | Achieve/Deliver                   |  |            |                      | Demand(s)                 |                          |
|                       | Cities                        | Identify                          |  |            |                      | Situations beyond control |                          |
| Resources             | Avoid                         |                                   |  |            |                      |                           |                          |

Legend: Frequency of occurrence (gradient of colour)







Fig. 1. Challenges driving heatwave resilience.

#### Political and governance

This group relates to political and legislative elements, such as strategic decision making, mandatory mechanisms, and accountability for long-term planning. The goal is to have heatwave resilience made as a priority on the political agenda at all levels of society now and in the future, adopting clear and structured frameworks for collaboration, communication, and co-production. Agenda alignment would mean that planning systems and processes are in place and operate to respond to heatwaves in a reality where exposure and vulnerability are increasing and resilience decreasing because of other existing problems in the system.

#### Organisational and institutional

This group is strongly linked to holistic approaches emphasising the need for organisations and institutions to shift their focus and work collaboratively towards achieving heatwave resilience. A transformation in thinking, learning, education, and overall organisational structure is essential. Too much emphasis is thought to have been given to trying to persuade individuals to change their behaviours in response to heatwaves, but the challenge is to change the role of institutions to create an environment in which people and systems are resilient.

#### Economic

This group addresses the need for significant investment due to cutbacks and limited funding availability. It emphasises the importance of having the capacity, resources, and time to focus on heatwave resilience amid dwindling resources both in terms of staffing and available capital.

#### Linguistic

This group highlights the challenge posed by governmental agencies using different languages to address the same issue and by developing disjointed contents and resources. This makes it difficult to coordinate efforts across different sectors of society.

#### Cultural social, and behavioural

This group explores people's knowledge, understanding, perception, and opinion of the risks posed by heatwaves and the

need for heatwave resilience. It emphasises the importance of recognising heatwaves as a threat, even if they occur infrequently, and calls for a shift towards long-term thinking. If individuals, communities, businesses, and governments are faced with more frequent heatwaves, and these heatwaves are recognised as clear, identifiable problems, there is a higher likelihood that proactive measures will be taken. However, if heatwaves are infrequent in England, they may not be prominent in the public view, making it challenging for people to recognise the associated risks. In general, stakeholders highlighted that heatwaves are not always taken seriously, which poses a challenge in improving resilience. Unlike cold homes in England, stakeholders recognised that heatwaves are perceived as being as relatively rare and short-lived events. This makes it difficult to emphasise the importance of developing resilience to heatwaves. The focus tends to be on the present rather than considering long-term implications. According to stakeholders the potential significance and increased frequency of heatwaves in 2030 or 2040 compared to today in England is not fully recognised.

#### Communications, information, and awareness

This group focusses on the type of advice that is given to the public, which according to stakeholders is seen as being somewhat paternalistic, nanny-state type, and communicating the obvious (i.e. keep out of the sun in hot periods, drink plenty of water). It calls for evidence-based interventions, increased awareness and understanding of the risks associated with heatwaves, and a shift towards building better social and community support networks, particularly for the most vulnerable populations. Stakeholders highlight that one of the foremost challenges is acknowledging that heatwaves are not just an acute problem but a recurrent one.

#### Discussion

In exploring stakeholders' conceptualisation of resilience and identifying challenges for enhanced heatwave resilience and public health planning, the results show that resilience is perceived as the ability of individual and collective entities to adapt and respond quickly or long term to adverse or negative impact(s) or shocks. The conceptualisations varied based on the 'whom,' 'what,' 'how,' 'when,' and 'why' aspects, with stakeholders distinguishing between people/individuals, systems, organisations, and services. These findings are consistent with previous research,<sup>31,33,34</sup> emphasising the need to understand how individuals define resilience.

The actions deemed necessary for resilience included adapting/responding/dealing with/addressing/cope and bouncing back/recover/getting back to normality. The identified skills for resilience were noted as the ability and capacity. Stakeholders also drew distinctions between different time units and various types of phenomena, which aligns with previous findings.<sup>33,34</sup>

Heatwave planning was found to be critical to save lives, aligning with research by Ebi et al.<sup>50</sup> Challenges highlighted by stakeholders included operational and technical, political and governance, organisational and institutional, economic, linguistic, cultural, social, and behavioural aspects, as well as communication, information, and awareness. Additionally, the study found that the conceptualisation of resilience displayed a relative similarity across stakeholders from different sectors and disciplines. This commonality could prove advantageous when stakeholders collaborate on actions for enhanced heatwave resilience and public health planning.

The research draws attention to several opportunities for effective heatwave public health planning:

**Table 3**  
Summary of challenges driving heatwave resilience and illustrative quotes.

| Challenges                                | Illustrative quotes  |
|---|--|
| Operational & Technical                   | <p>'It's about the long-term planning, looking at outcomes and scenarios, trying to minimise the impacts heatwaves might have in systems. Identify vulnerabilities and address those vulnerabilities. Forward looking at the worst-case scenario but seeing how you can improve the systems right now, not just making them more resilient but how we can improve the health of the population at this moment in time' [P3: LG, H–S].</p> <p>'Related to interdependencies, [...] For example, if it's very very hot, and everyone is using a lot of power to cool buildings, then if there is a constraint on power supply ... another interdependency is communication infrastructure. Interdependencies are a very big concern.' [P6: PS, T]</p> <p>'I feel is the lack of collaboration, communication, and co-production across different stakeholders who are both impacted by heatwaves but also play an important part in decision-making to increase resilience to heatwaves. So, if they are not communicating, if they are not aligned, then we can come up with a large exacerbation of the impacts of the original heatwave due to a breakdown in systems and processes that try to respond to the event' [P16: A, S].</p> <p>'There are technological challenges. [...] It's not that we don't have the technological solutions, actually sometimes I think we rely very much on the harder infrastructure solution rather than on the softer infrastructure solutions' [P24: CS, S].</p>  |
| Political & Governance                    | <p>'Long-term planning and resilience is something that is not on the agenda right now' [P3: LG, H–S].</p> <p>'It is difficult to prepare for emergencies and take sensible steps because it's not in their priorities to do it' [P4: LG, SS].</p> <p>'Not having the mandatory mechanisms ... to do anything about it (e.g., local authorities)' [P5: PS, S].</p> <p>'Politically, the discussion is around short-term issues. [...] So, exposure is increasing, vulnerability might be increasing, and resilience decreasing because of other existing problems in the system' [P17: A, H–S].</p> <p>'I think most of all acknowledgement that it's just not a temporary blip, it's surely the biggest challenge. It is going to be something that we are going to have to plan, and it is going to be a recurring theme. We have to expect that it is here to stay, and therefore we have to manage. Prolonged exposure to heat, there needs to be acknowledgement that this is not an acute problem; this is going to be a recurrent problem' [P22: CS, H–S].</p>  |
| Organisational & Institutional            | <p>'Thinking about now rather than thinking long term. I don't think people necessarily have a picture of what heatwaves, for example, in 2030 or 2040 might feel and look like. They could be very, very significant and much more embedded than they are today' [P24: CS, S].</p> <p>'In government, working across departments and divisions, sometimes people are working on the same things and same ideas but no joint-up holistic approach, which sometimes makes it quite difficult to work together' [P3: LG, H–S].</p> <p>'With heatwaves, which given climate change, may well become more common phenomenon, there will need to be more thinking, more learning, more education, and more working out what needs to be done, so I think there needs to be institutional shift that is probably required' [P20: CS, SS].</p> <p>'I think that the challenges to building resilience are primarily institutional. I think there has been too much emphasis on trying to persuade individuals to change their behaviours in response to extreme events. I think it's the role of institutions to create an environment in which people are resilient' [P26: A, S].</p>  |
| Economic                                  | <p>'Need for significant investment to do this properly. [...] It's like turning up to the scene of an earthquake with a dustpan brush. We need to do something much more significant than this' [P2: LG, H–S].</p> <p>'Cutbacks and limited funding available make it challenging; it tends to be something that is not addressed now but later on' [P3: LG, H–S].</p> <p>'In most organisations is having the capacity, the resources, the time to do anything about it' [P5: PS, S].</p> <p>'The biggest one for us is resources. In the current public sector, the biggest challenge is being able to be resilient in the context of ever dwindling resources both in terms of staffing and available capital to spend, in both within organisations and across the public sector' [P9: NG, H–S].</p> <p>'At the moment is resources. Lots of organisations who would naturally be in a best place to put in place some of these initiatives are being cut to the bones so ... (e.g. local authorities). [...] So you don't have the individuals and also the capital to spend on some of these projects.' [P17: A, H–S]</p>   |
| Linguistic                                | <p>'In government, working across departments and divisions, sometimes people are working on the same things and same ideas, but the problem is that people have different language for the same issue' [P3: LG, SS]</p>   |
| Cultural, Social and Behavioural          | <p>'It's a problem with the whole sustainability agenda, and air pollution, things that you can't see or necessarily feel immediately threatened by. It's interesting now, that we have a heatwave, and everyone is now, oh gosh are we ready for heatwaves?' [P1: LG, H–S]</p> <p>'If people are faced with a situation on a more frequent basis and it is clear, identifiable, and definable problem, people are more inclined to do something about it. Then if you have a heatwave once every blue moon ... if heatwaves don't happen very often, they are not in the public psyche very much, and it's difficult from them to recognise the risks' [P4: LG, SS].</p> <p>'Unlike cold homes in the UK, heatwaves are relatively infrequent, and they last for quite short periods. It means that, it's difficult for people to realise the importance of developing resilience' [P10: CS, SS].</p> <p>'... a cultural norm around dealing with heat in this country. There is an issue that generally in this country we have not always a lot of very hot weather, and so when it is very hot sometimes, there is sort of a 'oh, bring on the heat' kind of mentality without necessarily seeing the risks associated with it. I think in general heatwaves aren't necessarily taken very seriously, so that's a sort of starting point of how do you build resilience if you don't think it is necessarily a risk or challenge or a threat to anyone? Heat is a much more invisible sort of threat Firstly, there is the cultural thing about 'do we think heat is a problem?', then a second thing is 'do we know where the threat is?', 'who is at risk?' We are still at an earlier stage of understanding the risks, and then there is the question if the people themselves feel vulnerable or at risk' [P18: CS, SS].</p> <p>'I am thinking more about cultural and mindset challenges here in the UK' [P24: CS, S].</p> |
| Communications, Information and Awareness | <p>'The type of advice that is given regarding to heatwaves is seen by the public to be somewhat paternalistic, nanny-state-type thing, telling them the obvious (i.e. keep out of the sun in hot periods, drink plenty of water). We got quite a lot of feedback this year, a little bit of cynicism from media outlets (radios), telling us 'It's obvious', 'do you think we're daft', that kind of stuff. Hotels and other business, were also saying 'you are telling people to stay out of the sun, but we want their business; we are seaside resorts; we want people out' [P4: LG, SS].</p> <p>'So, the general message about the risks. Awareness-raising amongst older people, extra support for those at risk. For example, the most basic support would be for every old person to have a glass of water to hand, better design of the environment' [P10: CS, SS].</p> <p>'Ensuring that those more vulnerable are looked after. Ensuring that all the messages are going out to care homes, if we have private providers providing a service on behalf of the Council communicating will all the facilities and facility managers to ensure they are putting all the actions needed in place to safeguard their residents. We have this communication in place already, but it's just the case of making sure that everybody is adhering to the advice they are receiving' [P12: LG, SS].</p> <p>'One major challenge is awareness or has been awareness in the past. I think people still have a perception, at least in this country that when it's hot then that is a good thing, so they will expose themselves to temperatures without consideration to what the health impacts will be. Traditionally, I think, people would associate cold weather with adverse health effects but not so much with heat. [...]</p>   |

Table 3 (continued)

| Challenges | Illustrative quotes  |
|------------|--|
|            | <p>it's trying to improve awareness, and hopefully the problem with had this year will change and will improve people's awareness in the future. That is one thing, but also, we need more evidence on what kinds of interventions are effective. There is a lot of advice that can be given, but it might not be evidence-based, so we need to know what kind of measures protect people during hot weather, so there is a strong need for the research community to address some of these issues' [P13: A, H–S].</p> <p>'In the UK, there is some survey work that shows that the majority of the public thinks that the incidence of heatwaves is declining, which is inaccurate, and so there needs to be greater communication to people that the incidence of heatwaves is increasing and therefore the risks, that there needs to be more and stronger regulations around the building and design of homes so that they are taking into account the risks of overheating and trying to prevent them.[...] And we need better social and community support networks, that means that in hot weather, those people who are vulnerable are given particular attention and people check in on them. I think people are used to doing that in cold weather, I think people are less aware of the risks during hot weather and maybe don't check elderly people with underlying conditions; they don't check on them as much during the hot weather season' [P21: A, SS].</p> <p>'A lack of awareness or a lack of understanding of the likelihood of the risks associated with heatwaves. So, how prevalent is it going to be in the future and how is that going to affect what I am planning and building now? An overall lack of awareness and data, I think, is probably the main challenge. It's not on many people's radars at the moment' [P23: PS, T].</p> |

**Challenge 1: Operational and technical**—develop and implement clear and structured frameworks for collaboration, communication, and co-production across different levels and stakeholders.

**Challenge 2: Political and governance**—make heatwave resilience a priority on the political agenda at all levels of society.

**Challenge 3: Organisational and institutional**—shift the focus from trying to persuade individuals to change their behaviours to changing the role of institutions to create an environment in which people and systems are resilient.

**Challenge 4: Economic**—invest in heatwave resilience measures, such as green and blue spaces, better housing stock, and improving public transportation.

**Challenge 5: Linguistic**—develop clear and consistent messaging about heatwaves across all government agencies and organisations.

**Challenge 6: Cultural, social, and behavioural**—raise awareness on the risks of heatwaves and on how to stay safe.

**Challenge 7: Communications, information, and awareness**—tailor communications about heatwaves to different audiences.

The findings highlight the need for a clear and structured framework for collaboration, communication, and co-production across diverse levels and stakeholders impacted by heatwaves. This insight can offer valuable guidance to policymakers, practitioners, and researchers in the formulation of effective strategies to enhance resilience and address the identified challenges. These echo concerns raised in previous studies with suggestions for cross-agency work avoiding siloed governance.<sup>18,35,51–53</sup>

The study findings can translate into individual-level heat-risk reduction by informing targeted strategies and interventions that empower individuals and communities to protect themselves during heatwaves such as education and awareness programmes, early warning systems and alerts, and access to cooling centres and resources. Despite this, as found in other research, there were concerns that planning is not prioritised.<sup>54</sup> Addressing the identified challenges can also have a cascading effect that 'trickles down' to improve and protect individuals, especially those most vulnerable to heat-related illnesses. These can include ensuring information and protective measures reach individuals, funding for community cooling centres, public health campaigns, infrastructure improvements, and tailor communications to different audiences to make them relevant and accessible. By integrating evidence and implementing heatwave planning measures such as those mentioned earlier, public health agencies and communities can enhance their ability to mitigate the health impacts of heatwaves and protect the well-being of individuals, particularly those most vulnerable to heat-related illnesses, as suggested by others.<sup>50,55–58</sup>

This study stands as a pioneering endeavour, investigating stakeholders' conceptualisations of resilience and the challenges integral to greater heatwave resilience and public health planning.

An additional strength of this study is the comprehensive inclusion of diverse stakeholders representing various sectors and disciplines. The engagement of such a varied group enriches the study by capturing a spectrum of viewpoints aligned with different professional backgrounds.

However, it is essential to acknowledge the limitations in the study's design, which may influence the generalisability of the findings. The focus on England restricts the geographical scope. The use of purposive sampling<sup>38</sup> may introduce bias and may limit the generalisability of the findings. The use of snowball sampling<sup>39</sup> may introduce network-related biases. The deliberate selection of participants based on certain criteria may not fully capture the diversity of perspectives within different sectors or communities. Differences in response and participation rates across sectors may have occurred. Individuals from certain sectors may have been more or less inclined to participate in the interviews, potentially impacting the representation of perspectives in the final analysis. Despite these, efforts were made to mitigate bias by seeking diverse participants from various sectors and backgrounds. In Table 2, although word frequency may not automatically indicate significance, this has been calculated as it can allow the investigation of under-represented or hidden themes and improve understanding of the popularity of the themes.<sup>45</sup> To address these limitations, future research endeavours could explore more extensive and varied sampling methods, ensuring a more comprehensive representation of stakeholders. Using a mixed-methods approach, combining qualitative interviews with quantitative surveys, may also provide a more nuanced understanding of heatwave resilience across different sectors and communities.

Notwithstanding these constraints, the study successfully assembled a diverse array of stakeholders in the heatwave-resilience arena, contributing to an analysis of conceptualisations and challenges. This research significantly contributes to the development of strategies aimed at enhancing heatwave resilience. By actively involving stakeholders, it offers valuable, real-world insights that decision-makers can use to make informed choices when developing or refining heatwave resilience strategies. It identifies challenges in the current heatwave resilience policies, emphasising critical areas for improvement. The interdisciplinary and sectorial perspectives, incorporating a diverse group of stakeholders, ensure a comprehensive understanding of heatwave challenges. Stakeholder input has contributed to applied policy recommendations and the improvement of early warning systems, ultimately aiming to improve heatwave resilience strategies, coordination, preparedness, and reduce adverse health impacts. The overarching message is the need to foster increased heatwave resilience and a comprehensive approach to addressing the harmful effects of heatwaves.

In conclusion, the findings of this study serve as a foundational step, offering valuable insights that can inform future research endeavours and guide policymakers, practitioners, and stakeholders in the development and implementation of strategies aimed at enhancing heatwave resilience and public health planning.

## Author statements

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### Ethics approval

Ethical approval from the University of Warwick Research Ethics Committee was obtained prior to conducting this study, and all stakeholders gave written informed consent. Confidentiality was guaranteed in that no names or contact details were recorded on the recordings or transcriptions, and no unauthorised persons had access to the material. The risk of identification was minimised by the study sample not being described in detail.

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### Competing interests

None declared.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhe.2024.02.023>.

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