



Are We Adequately Promoting Climate Change Adaptation to Address the Increasing Heatwaves Affecting the Elderly?

Alison Hutton^{1,2,5} · Kim Maud³ · Helen Giggins³ · Michela Skipp⁴ · Danielle Verdon-Kidd⁴

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Abstract

Australia is a significant hotspot for heatwaves due to its geographical location and pronounced climatic variability, and heatwave exposure is expected to further increase in the future with anthropogenic climate change. With the intent to support United Nations Sustainable Development Goals 3 (Good health and well-being) and 13 (Climate action), in this study we identified key challenges and opportunities for adapting to heatwaves, focusing on the most vulnerable members of our community—older adults. A naturalistic, qualitative approach was selected for this study. Data were collected via semistructured interviews. Key insights were captured through a series of semistructured interviews with key informants from local government agencies and community groups that provide care for older adults in New South Wales, Australia. Questions centered around current preventative measures adopted by the organization regarding heatwaves, level of heatwave knowledge of local residents, and common effects of heatwaves in the local community. The findings highlight four primary challenges: (1) increasing duration and intensity of heatwaves; (2) lack of knowledge among older adults regarding symptoms and the effect on the body; (3) the financial and social impacts of heatwaves; and (4) inadequate urban planning practices and building codes including the need for the creation of cool and green spaces. This study provides important insights for protecting our most vulnerable populations from the growing threat of heatwaves.

Keywords Climate change · Disaster resilience · Heatwaves · Local councils · Older adults · Qualitative research

1 Introduction

Heatwaves have claimed more lives than any other natural hazard; yet they are often overshadowed by the devastation of other climate related disasters such as floods and bushfires (Coates et al. 2022). Defined as prolonged periods (typically three days or more) of excessively hot weather, meteorological heatwaves are typically characterized by temperatures

significantly above average for a particular region and time of year. These events are often accompanied by high humidity levels, which can exacerbate the effects of heat on human health and the environment (Wehner et al. 2017). Heatwaves occur globally, but they are particularly common in regions with arid or semiarid climates, where the combination of intense sunlight, limited cloud cover, and dry air can lead to rapid heating of the surface (Thompson et al. 2023).

Australia is acknowledged as a significant hotspot for heatwaves due to its pronounced climatic variability and geographic location within the subtropical high-pressure belt (Adnan et al. 2022). These extreme heat events are not confined to specific seasons; rather, they can occur throughout the year (Cowan et al. 2014; Davis and Hanna 2020). However, they are more frequent during the summer and autumn months (Sharifi and Yamagata 2016). Australia faces a challenging future with respect to heatwaves, as the frequency, duration, and intensity is expected to increase because of anthropogenic climate change (Cowan et al. 2014; Perkins-Kirkpatrick and Lewis 2020). These trends are already emerging, with severe heatwaves

✉ Alison Hutton
a.hutton@westernsydney.edu.au

¹ School of Nursing and Midwifery, Western Sydney University, Liverpool, NSW 2170, Australia

² School of Nursing and Midwifery, University of Newcastle, Newcastle, NSW 2038, Australia

³ School of Architecture and Built Environment, University of Newcastle, Callaghan, NSW 2038, Australia

⁴ School of Environmental and Life Science, University of Newcastle, Callaghan, NSW 2038, Australia

⁵ Ingham Institute, South Western Sydney Local Health District, Liverpool, Australia

having recently impacted on the State of New South Wales (NSW) during the summer of 2020 and again in 2023.

Heat impacts disproportionately affect the most vulnerable, particularly individuals with existing cardiovascular and respiratory issues and the older adults (Jun et al. 2013; Herbst et al. 2014). While humans exhibit varied thresholds to heat depending on geographical location and physiological factors, sudden increases in temperature do not provide adequate time for adaptation, exposing more people to the crossing of critical body temperature limits (Buckley and Huey 2016). This is seen particularly in people who do not understand the risks and hence take precautions to keep cool and hydrated (Maughan et al. 2012). Other vulnerability factors were identified by Brucker (2005) and Naughton et al. (2002), who identified individuals living alone, those with mental health conditions, and people of lower socioeconomic status as being at higher risk. Mental illnesses can impair individuals' ability to recognize and respond to heat-related symptoms, while social isolation can prevent timely assistance or intervention (Amolegbe et al. 2022). The older adults who live alone often fall into additional risk categories (including existing illness), compounded by the fact older adults may have limited mobility or physical frailty, making it harder for them to seek relief from extreme heat, such as by moving to cooler locations or accessing air conditioning. Further, older adults are more likely to be on fixed incomes, which can limit their ability to afford cooling systems or increased utility costs during a heatwave (Naughton et al. 2002; Jun et al. 2013; Campbell et al. 2018; Williams et al. 2018).

Heatwaves have been linked to increased levels of health service demand in Australia (Mason et al. 2022). Extreme heatwaves are a risk for anyone who does not take precautions to keep cool and hydrated. However, research has shown that the most vulnerable populations of the community are older adults who live at home (van Iersel and Bi 2009). With age, the body's ability to regulate temperature becomes less efficient, increasing the risk of heat-related illnesses. Chronic health conditions prevalent among older populations, such as heart disease and diabetes, can be exacerbated by extreme heat (Xu et al. 2023). Mobility issues may hinder older adults' ability to seek relief from the heat or access cool environments, while social isolation may leave them without assistance during heatwaves. Cognitive decline can impair their ability to recognize and respond to heat-related risks, while a diminished sense of thirst may lead to dehydration. Additionally, aging skin is often thinner and more fragile, rendering older adults more susceptible to sunburn and heat-related skin conditions (Choi et al. 2023). These factors, compounded by the escalating frequency and intensity of heatwaves driven by climate change, highlight the urgent need for targeted interventions to safeguard the

health and well-being of older adults during extreme heat events.

The population of Australia over 65 years is expected to double, over 85 years is projected to triple, and the number of centenarians is expected to increase six-fold over the next 40 years (Commonwealth Government 2023). Further, vulnerability has complex dimensions beyond just aging, and is also influenced by socioeconomic and health conditions as well as social connections and location (Daddoust et al. 2018). All these factors combined (increased exposure to heatwaves due to climate change, an aging population, and shifting socioeconomic factors) demonstrate the need for dedicated research on heatwaves preparedness for older adults and those responsible for caring for them. Specifically, areas of action need to be identified and then implemented to ensure a resilient community against future heatwave events.

The aims of this research were to identify geographical differences in the challenges posed by heatwaves in older adults in NSW local government areas (LGAs), as well as establish their level of preparedness and understanding of climate-based risk. This article reports on the findings from interviews conducted with the LGA representatives responsible for providing care for older adult groups and individuals.

2 Methods

A naturalistic, qualitative approach was selected as the most appropriate methodology for this study (Sandelowski 2000). Data were collected via semistructured interviews. Semistructured interviews encourage participants to elaborate on their experiences, perspectives, and feelings, leading to richer qualitative data (Saldaña 2015).

2.1 Participant Selection and Interview Approach

Ethics approval for this study was obtained prior to contacting potential participants (The University of Newcastle, Human Research Ethics committee, H-2022-0192). Twelve participants from the LGAs in New South Wales were invited to participate through purposive sampling in May–June 2023 (Table 1). These LGAs included coastal and inland council areas.

New South Wales is one of the six states and two territories within Australia, with a population of 8.34 million (Australian Bureau of Statistics 2024). It is made up of 128 LGAs. The LGAs that were contacted to participate in this study have increased temperature scores, and therefore were identified as having increased risk of heatwaves. Fifteen LGAs were contacted, and 12 participated in interviews. The participants were recruited via cold calling to local councils, healthcare providers, and community groups, explaining the

Table 1 Roles of the interview participants

Participants role	Organization type
Employee of local government area	Local council
Employee of local government area	Local council
Employee of local government area	Local council
Employee of local government area	Local council
Employee of local government area	Local council
Employee of local government area	Local council
Employee of local government area	Local council
Employee of local government area	Local council
Employee of local government area	Local council
Community member	Community center
Community member	Country Women's Association
Registered nurse	Medical center

study aims, and asking if people were interested in talking on the topic of heatwaves.

Data were collected via semistructured interviews that lasted approximately 60 minutes. The nature of the interviews provided structure, while enabling elaboration and free-flowing conversation (Whitehead and Whitehead 2016). Questions centered around current preventative measures adopted by the organization regarding heatwaves, level of heatwave knowledge of local residents, and common effects of heatwaves in the local community. Informed consent was obtained from each participant prior to the commencement of the session. A semistructured interview schedule was used to ensure that all areas pertinent to the research question were introduced for discussion. The interviewers did not have any pre-existing relationship with the participants.

Each interview was audio recorded with participant consent. Three authors (Alison Hutton, Helen Giggins, and Michela Skipp) conducted the interviews. Audio recordings were transcribed verbatim, by a transcription company. Member checking as part of the session wrap-up was conducted to ensure that all issues important to the participants were captured (Polit and Beck 2020). Notes were made throughout each interview and at the conclusion of each session the principal researcher recorded thoughts and observations arising from the discussion. These notes aided the reflexivity of the researcher and proved another valuable source of data for the study (Polit and Beck 2020).

2.2 Data Analysis

Thematic analysis was used to analyze the data. An inductive, semantic approach to thematic analysis was selected as this method supports the exploratory nature of the study and ensures that the themes identified were strongly linked to the collected data (Braun and Clarke 2021). This approach involved initially analyzing the data at a semantic level and

identifying the surface meanings of what the participants said. This subsequently moved to the “deeper” thematic style of “circling and parking” (Harding and Whitehead 2016) as an “iterative” process of moving back and forth over the data until “meaning making” occurs. The analysis process involved five phases: (1) familiarizing oneself with the data (through “surface” reading the whole text down to line-by-line analysis); (2) generating initial codes as a means of indexing and categorizing the transcript text to establish the framework of thematic ideas, allowing pattern, emotion, value, and evaluation coding techniques to establish frequency, relationship, and underlying meaning leading to the theming of data (Saldaña 2015); (3) searching for themes as they arose from term codes and categories; (4) reviewing themes for accuracy and consistency; and (5) defining and naming final themes. A key step in the analysis was generating a thematic “map,” which provided a visual understanding of how the themes related to each other (Harding and Whitehead 2016). This then allowed patterns to appear, sub-themes to be grouped, and finally, key themes to emerge.

3 Findings

The findings were collated into four organizing themes. These were: (1) increasing duration and intensity of heatwaves; (2) lack of knowledge of older adults regarding how heatwaves affect their body; (3) the financial and social impacts of heatwaves; and (4) inadequate urban planning practices and building codes.

3.1 Demographics

Twelve participants from different LGAs were interviewed. Due to the individual nature of the local districts, there were a variety of role titles of participants who were interviewed (Table 1). To increase trustworthiness, the data and resulting analysis were individually undertaken by each member of the research team and then member-checked (cross-referenced) where agreement on the final themes was achieved.

3.2 Noticing the Increasing Duration and Intensity of Heatwaves

Many participants discussed noticing the increasing duration and intensity of heatwaves, reporting consecutive days of temperatures over 40°C in their local areas. The extreme temperatures were not limited to central NSW. Areas close to the coast also reported consistently hot temperatures.

Two years ago, we had four nights straight over 40. Maybe two or three years ago it was. [...] We had 14 days over 40. [...] that's unusual. But December of

this year and of last year was unusual because we had hardly any days over 30 [before] (LGA employee 4). We're not used to having extended days of hot weather, even though we are close to the coast (LGA employee 2).

A consistent message arose that it was becoming more difficult to cool houses down, sleep, and undertake normal activities of daily living during extended periods of heat.

As in extreme heat during our summer periods which we do get. And we've got large pockets of low social economic groups, which suffer hugely during summer, so as the temperatures are increasing, they don't have any means to cool their properties down (Community member 1).

I think it's the prolonged [heat] over, you know, three to four days [...], with minimal cooling overnight. So, I think if you've got sort of shorter two-day bursts, you know people can seek areas of cooling for those couple of days, but once you get sort of that third day, and particularly when you've had a very little rest overnight that's when the risk starts to really jump up quite high. I think so anything over that three days is [...] a really dangerous situation (LGA employee 2).

3.3 Older Adults' Lack of Knowledge Regarding Symptoms and Effect on Body

Due to the sustained effects of heatwaves over many days, participants reported older adults in their community being impacted physically and mentally. Physical symptoms observed included lethargy and dehydration and mental health effects included delirium due to dehydration.

I mean just the obvious physical, physiological sort of impacts of dehydration. Obviously probably the biggest impacts associated with that you know. I think there's probably a whole matrix that we need to look at, both the mental aspects, the physical and there's the financial aspects as well. Particularly as we move... social isolation has been highlighted as a massive issue (LGA employee 1).

I know it's already a silent killer, but it's become quite an obvious killer of people (LGA employee 2).

Participants reported that many of the older adults they came into contact with did not understand the medical implications of not consuming enough fluids during hot weather, leading to inadequate preventive measures. These conditions often result in hospital visits, particularly when older adult individuals collapse while performing daily activities like shopping or gardening.

I just don't think people understand just how the heatwave is not just affecting going. Oh, it's hot! It's hot. There's just not enough consumption of fluids. They're not understanding the medical side as well as the outcome [...] But they're not compensating for the medical side of things for their body. That's the lack of knowledge (Registered nurse).

But when it comes to the medical side of things, because I don't think a lot of the people, and this is across the board I believe people don't realize how the heatwaves affect. For example being dehydrated, failing kidneys (LGA employee 3).

I've noticed that we are having a lot more of the elderly people being affected from this in intensive heat [and] that falls in particular and we've had at least, I think, 10 to 15% of the people that actually had [...] fractured a hip. All have had a traumatic injury. We had one person that fell [...] She had to get stitches in her head. She was well, she has dementia symptoms. She was what delirious on top of the dementia and in Hospital for about a week. [...] You can see that they [have] mouth dry. Yeah, the sign that they've got dry eyes, so they start using the eyedrops (LGA employee 5).

And I personally [think], a lot of it that happens, get into the delirium and that sort of stuff, and because they don't like to go to the toilet all the time they drink less and [in that situation] heatwaves to be really dangerous (LGA employee 4).

3.4 Financial and Social Impacts on Older Adults—Including Increase in Electricity/Water Prices

The high cost of utilities, such as water and electricity, has a large effect on the older adult population. Many older adult individuals may have air conditioning but are unable to afford the high operational costs, exacerbating their vulnerability during heatwaves. In addition, water restrictions and loss of green space cause ambient heat, and many councils reported that due to the heat, the older adults lose their passion for maintaining their own green spaces. Participants reported that giving up activities such as gardening has led to a rise in mental health problem and isolation for community members.

They're losing their green space. They're losing their cool haven and their passion. [...] Large mental health effects of that as well (LGA employee 6).

It's like not just the physical impacts, but the mental ones (LGA employee 6).

I guess they can get to stress and maybe not be able to share that with anybody. It might stop them from going out and attending their regular activities, you know, if it's too hot, I'm sure. So I guess there're emotional and

psychological distress comes along with that physical distress as well (LGA employee 1).

So yeah, I just think mainly mental health and social [well-being] for the [older adults] (LGA employee 6).

As well as mental health issues, the costs of utilities also impacted on the behavior of the older adults to keep cool and maintain their green spaces. Participants stated that they could not afford to run on air conditioning, and due to increased utility prices they stopped watering their garden, which leads to the loss of vegetation contributing to ambient heat.

They may not be able to afford a conditioning, or they may actually have air conditioning, but cannot afford to run it. Given the issues with the cost of energy, as we can see at the moment, and heading forward, this is going to be more and more of a problem. Western Sydney, as you know, can be, and often is, 8 to 10 degrees hotter on a hot day than Newcastle, Wollongong, Sydney, and it makes a huge difference (LGA employee 8). When our water charges went up, people stopped watering their gardens. Then we greatly reduce the amount of vegetation [area] that had grass on it, and that then caused a lot of ambient heat, and that causes things so. A lot of those older adults people you look at no longer have gardens where gardens used to be their pride and joy They couldn't actually afford to. (LGA employee 4).

3.5 Inadequate Urban Planning Practices and Building Codes

Many buildings, particularly older ones, are not designed to keep heat out, making it difficult to cool them without air conditioning. The existing building stock in the local councils involved in this research provided poor thermal regulation, which can lead to heat stress.

Those who are most vulnerable, the older ones, such as the over 65, but also people with disabilities, chronic illnesses, very young children, and of course, those who, for whatever reason, just cannot get out of the house cannot afford to go to the local pool. We're not near beaches. Our natural waterways are not really swimmable. They have been polluted over long periods of time. And we're a long way from a lot of places (LGA employee 8).

Because the houses aren't really built to keep the heat out. You cannot cool it down without air conditioning (LGA employee 9).

But there are pockets within our LGA, such as Brookvale, and Mona Vale and Dee Why which have higher populations, higher hard surfaces, disrupted air-

flows, due to tall buildings and things like that (LGA employee 1).

One the biggest issues we've seen recently is the introduction of synthetic fields, you know. And you know, taking away that sort of greening space and cooling space and providing heat sinks essentially (LGA employee 1).

So rather than [...] having to fork out like \$30,000 to put solar on their own roof, they invest in the community based. [...] I guess that would increase adaptive capacity (LGA employee 7).

4 Discussion

The NSW LGA key informants highlighted a concerning trend of increasing duration and intensity of heatwaves. This trend is indicative of broader climate change patterns, where extreme weather events become more frequent and severe (Clarke et al. 2022). This trend is part of a consistent and ongoing pattern, which has accelerated in the last two decades (Trancoso et al. 2020). One of the impacts of this acceleration is that socioeconomically disadvantaged groups, such as older adults, are disproportionately affected by heatwaves (Ferguson and Anna 2024). The individuals' ability to reduce their perceived heat exposure is often influenced by socioeconomic and cultural factors, and older adults are no exception. This study found that this was due to several factors such as limited access to cooling resources and healthcare, financial constraints, as well as lack of awareness of heat-related health risks. Additionally, many older adults suffer from co-morbidities such as respiratory, cardiovascular, and renal diseases that may exacerbate their risk of hospitalization during heatwaves (Gronlund 2014). Even though there is continued evidence of health effects in the wider community, little has changed globally to provide infrastructure or resources to assist this population in dealing with the effects of heatwaves.

The lack of knowledge about heatwaves and their effects on the body, especially among older adults, underscores the importance of health literacy and education initiatives. Participants described heatwaves as a "silent killer" that affected both physical and mental health of older adults, citing dehydration as a key determinant of these effects. Confusion is a by-product of dehydration, which led to falls and other injuries in the local community. The World Health Organization's Quantitative Risk Assessment of the Effects of Climate Change on Selected Causes of Death, 2030s and 2050s report (Hales et al. 2014) states that there has been a 50% increase in deaths over the age of 65 in the past 20 years and this is set to continue. Increased health literacy of communities is required to reduce the mortality and morbidity of heatwaves (Razzak et al., 2022).

Healthcare accessibility is critical in protecting older adults from climate-related risks (Amakama et al. 2024). Increasing telemedicine services and deploying mobile health units to reach homebound individuals can make health services more accessible during extreme weather. Personalized health monitoring devices, such as wearable devices that track vital signs, can send alerts to caregivers or healthcare providers if certain health thresholds are exceeded during heatwaves. Training caregivers and family members in recognizing and responding to heat-related illnesses, like heat exhaustion and dehydration, can further enhance protection during extreme conditions (Okwuofu-Thomas 2017).

As well as the significant health risk posed, heatwaves also have far-reaching social and economic consequences. These include increased energy costs, loss of green spaces, and adverse effects on mental health and social well-being, particularly among older adults who may feel isolated and unable to engage in outdoor activities. These findings are not new, and the Australian government has implemented a variety of strategies in this space, but they are not yet yielding concrete results (Xu et al. 2023). The communities who spoke to us in this work had also implemented strategies but were restrained by budgets and resources. All participants recognized that more needs to be done to reduce the effect of heatwaves in their communities. Social support networks play a key role in helping older adults adapt to climate change (Hasan et al. 2021). Community-based check-in programs, where volunteers or government staff contact older adults during heat events, can provide both emotional and logistical support. Educational workshops on climate adaptation, targeting both older adults and their caregivers, are also useful in preparing them to respond to extreme weather, particularly heatwaves.

Inadequate urban planning practices and building codes exacerbate the heat island effect in urban areas, leading to higher temperatures and greater heat-related risks. Investing in climate-resilient infrastructure, such as cool roofs, green spaces, and heat-resistant building materials, can mitigate the adverse effects of heatwaves and promote sustainable development (Klein-Rosenthal and Raven 2017). This not only applies to new buildings but also the retrofitting of existing homes with better insulation, shading, and ventilation systems to maintain stable indoor temperatures during heatwaves. Engaging local communities in the development and implementation of heatwave adaptation strategies fosters resilience and collective action (Guardaro et al. 2020). Encouraging community-based initiatives, such as neighborhood cooling centers and tree planting campaigns, can enhance adaptive capacity and promote social cohesion. Providing air conditioning or cooling devices in homes, along with subsidies for affordable electricity, is essential for low-income older adults.

Lastly what this study has shown is that local governments need further support to protect their constituents from the harms of heatwave and climate change. Moving forward, Australia needs to adopt cohesive strategies that include all levels of government (Xu et al. 2023). By investing in housing improvements, healthcare accessibility, social support, urban cooling, policy advocacy, and data-informed strategies, communities can create a more climate-resilient environment for older adults. These initiatives not only enhance the safety and health of older populations but also foster greater overall resilience against the accelerating impacts of climate change. A limitation of this study is that theoretical saturation may not have been fully reached, as key informants were purposely selected due to increased temperatures in their LGA. This may impact the depth and breadth of insights obtained. Furthermore, the study relied solely on key informants, which may not fully capture the perspectives of older adults themselves. Including interviews with older adults could have enriched the findings, providing a more comprehensive view of their experiences and perspectives.

5 Conclusion

Exploring strategies to support vulnerable populations during heatwaves, such as community outreach programs and heatwave emergency response plans, is crucial for ensuring public health and safety. Public health campaigns aimed at raising awareness about heat-related illnesses, proper hydration practices, and signs of heat exhaustion can empower individuals to take proactive measures to protect their health during extreme heat events. Addressing these impacts requires comprehensive policy interventions that prioritize community resilience and equitable access to resources. By harnessing local knowledge and resources, communities can effectively respond to these challenges posed by heatwaves and build a more resilient future.

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