



bushfire&natural
HAZARDSCRC

bnhcrc.com.au

RAPID RESPONSE REPORT: STUDY OF HEATWAVE IMPACTS ON RESIDENTS AND BUSINESSES IN WESTERN SYDNEY

Tofa, M. and Gissing, A.
Risk Frontiers
Bushfire and Natural Hazards CRC





Version	Release history	Date
1.0	Initial release of document	19/7/2017



Australian Government
Department of Industry,
Innovation and Science

Business
Cooperative Research
Centres Programme

This work is licensed under a Creative Commons Attribution-Non Commercial 4.0 International Licence.



Disclaimer:

Risk Frontiers and the Bushfire and Natural Hazards CRC advise that the information contained in this publication comprises general statements based on scientific research. The reader is advised and needs to be aware that such information may be incomplete or unable to be used in any specific situation. No reliance or actions must therefore be made on that information without seeking prior expert professional, scientific and technical advice. To the extent permitted by law, Risk Frontiers and the Bushfire and Natural Hazards CRC (including its employees and consultants) exclude all liability to any person for any consequences, including but not limited to all losses, damages, costs, expenses and any other compensation, arising directly or indirectly from using this publication (in part or in whole) and any information or material contained in it.

Publisher:

Bushfire and Natural Hazards CRC

July 2017

Citation: Tofa, M. and Gissing, A. (2017) Rapid response report: study of heatwave impacts on residents and businesses in Western Sydney, Bushfire and Natural Hazards CRC, Melbourne.

Cover: ChameleonEye, Shutterstock

Disclaimer:

Risk Frontiers and the Bushfire & Natural Hazards Cooperative Research Centre advise that the information contained in this publication comprises general statements based on scientific research. The reader is advised and needs to be aware that such information may be incomplete or unable to be used in any specific situation. No reliance or actions must therefore be made on that information without seeking prior expert professional, scientific and technical advice. To the extent permitted by law, Risk Frontiers and the Bushfire & Natural Hazards Cooperative Research Centre (including its employees and consultants) exclude all liability to any person for any consequences, including but not limited to all losses, damages, costs, expenses and any other compensation, arising directly or indirectly from using this publication (in part or in whole) and any information or material contained in it.



TABLE OF CONTENTS

ABSTRACT	2
INTRODUCTION.....	3
BACKGROUND	4
Research Approach	5
FINDINGS	8
Perceptions and concerns about heatwaves	8
Impacts of the heatwave and coping strategies	12
Warnings and Preparedness	18
CONCLUSION	24
Future Research	24
REFERENCES	26



ABSTRACT

During January and February 2017 there were three distinct periods of severe or extreme heat that affected eastern Australia. This study explores the impacts of the heatwaves in February 2017 on residents and businesses in Western Sydney, New South Wales (NSW). In this heatwave, the average temperature across NSW was 42.4°C on 10 February and 44.0°C on 11 February [1]. In Parramatta North, the temperature reached 44.5°C, setting a new February peak temperature record [1], while Penrith reached 46.9°C on 11 February [2]. The Heatwave Service at the Bureau of Meteorology (BoM) provided forecasts and monitored conditions during this heatwave, and these forecasts were further disseminated by other agencies and organisations, as well as through the media. A telephone survey of 100 residents and 60 businesses in Western Sydney was conducted shortly after the heatwave to better understand the impacts of heatwaves, how heatwave warnings were used by residents and businesses in affected locations, what preparedness or protective actions were taken, and what further information and mediums residents and businesses would like to receive in future events. Key findings include that most residents and businesses consider heatwave to be a high or extreme risk, and that their main concerns were the likely impacts on health and wellbeing of themselves, family members, or employees. The main impacts on residents of the February heat event included personal discomfort, feeling unwell, and concern for electricity costs. The impacts on businesses varied, with some noting minimal effects, and others describing impacts on productivity and turnover, and adjustments to their work to ensure worker safety in extreme heat. The main coping strategies used by both residents and businesses are air-conditioning and fans. Around 70% of residents and 78% of businesses received warning of the heatwave, and this was primarily through traditional media (e.g., TV or radio). Of these, 64% of residents and approximately 50% of businesses took actions to reduce the likely impact of the heat, such as rescheduling activities and providing advice to staff. Suggested ways to support better preparedness and reduce the likelihood or severity of impacts tended to focus on reducing vulnerability through improved home and workplace design and reducing vulnerability due social or economic factors. Specific suggestions from residents included subsidies for installing air-conditioning or solar panels, subsidies for electricity, and ensuring that elderly and low-income residents have affordable ways to keep cool during heatwaves.

.



INTRODUCTION

This research was conducted for the Bureau of Meteorology (BoM) by Risk Frontiers with the support of the Bushfire and Natural Hazards Co-operative Research Centre (BNHCRC). The BoM aims to use the findings of this study and future surveys to inform the development of its heatwave service, warnings, and updates. The study delivers valuable knowledge on key issues of risk perception and how residents and businesses respond to heatwave warnings and cope with extreme heat.

Heatwaves are increasingly recognised as a significant natural hazard in Australia and overseas [3, 4]. For instance, Coates et al. [5] demonstrated that heatwaves have been linked to more deaths in Australia than all other natural hazards combined. Thus, understanding vulnerability to heatwaves, the impacts of extreme heat, and how warnings, preparedness, and adaptation can reduce these, is particularly important. Vulnerability to heatwaves can be variously understood as medical vulnerability whereby some people experience greater physiological strain to maintain the body's thermal balance in extreme heat conditions [6, 7], energy or water-related vulnerability where people have limited access to cooling strategies [7], and building-related vulnerability where the housing available restricts the ability to adapt or remain cool during extreme heat events [8]. Each of these kinds of vulnerability need to be considered, alongside the extent to which they influence residents' experiences and coping strategies during extreme heat events.

Efforts to understand the impacts of heatwaves typically focus on extreme impacts, such as excess morbidity rates or heat-related fatalities, or such quantifiable aspects as energy and water consumption or power cuts [5, 9]. Whilst these impacts are significant, it is also important to understand the broader health and social impacts of heatwaves. Several studies have indicated the value of self-reported health concerns in this regard. Further, understanding how warnings and information about extreme heat are obtained and used by communities is key to supporting preparedness and heat resilience. The BoM has developed a methodology to define heatwaves in the Australian context [10, 11], and has introduced a heatwave service that provides regular updates and forecasts [12]. As is evident in both domestic and international research, there is much interest in developing and evaluating warning systems and classifications of heatwaves [4, 13, 14], and in understanding how affected communities perceive the risks of extreme heat, their preparedness and coping strategies, and the impacts they experience during heatwaves [15, 16].

This research draws on the experiences of affected residents and business owners in Western Sydney to support the development of effective warnings and public information about heatwaves, and focuses on 1) the impacts of heatwaves experienced by residents and businesses; 2) how warnings are received and understood; and 3) preparedness and protective actions taken to reduce the impacts of the heatwave.



BACKGROUND

The start to 2017 was characterised by three main heat events. The first was from 10-14 January and affected northern NSW and southern Queensland, the second was from 17-21 January and was experienced mostly in Queensland, and the final and most severe heatwave was from 31 January till 12 February [1]. From 1 December 2016 to 20 February 2017, significant parts of NSW experienced more than 55 days where the temperature was over 35°C, and temperatures were often 8 to 12°C higher than the January and February averages [1]. As shown in Figure 1, in Sydney during the 2017 summer, there were 35 days during which a 3-day heatwave was experienced in Sydney [1]. Of these, more than ten were categorised as ‘extreme’ heat [1]. This study considers the experiences of residents and businesses in Western Sydney during 9-12 February when record-breaking temperatures were reached (see Figure 2. Daily maximum temperatures in Penrith over these days ranged between 36.4°C and 46.9°C, while Parramatta North daily maximum temperatures were between 35°C and 44.5°C [2].

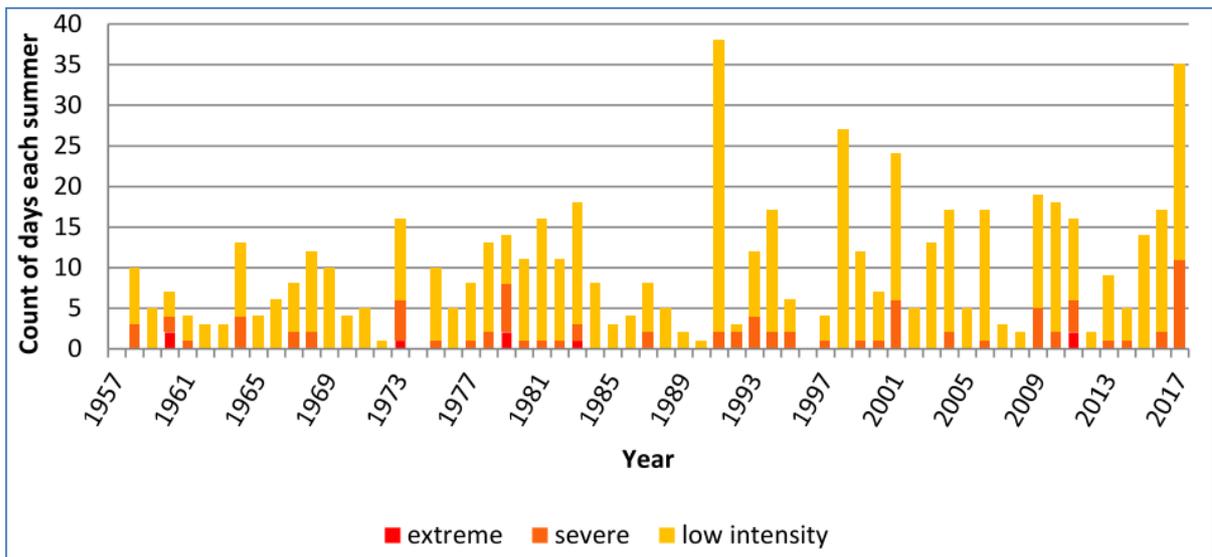


FIGURE 1. NUMBER OF DAYS PER SUMMER DURING WHICH SYDNEY HAS EXPERIENCED A 3-DAY HEATWAVE [SOURCE: 1: 15]

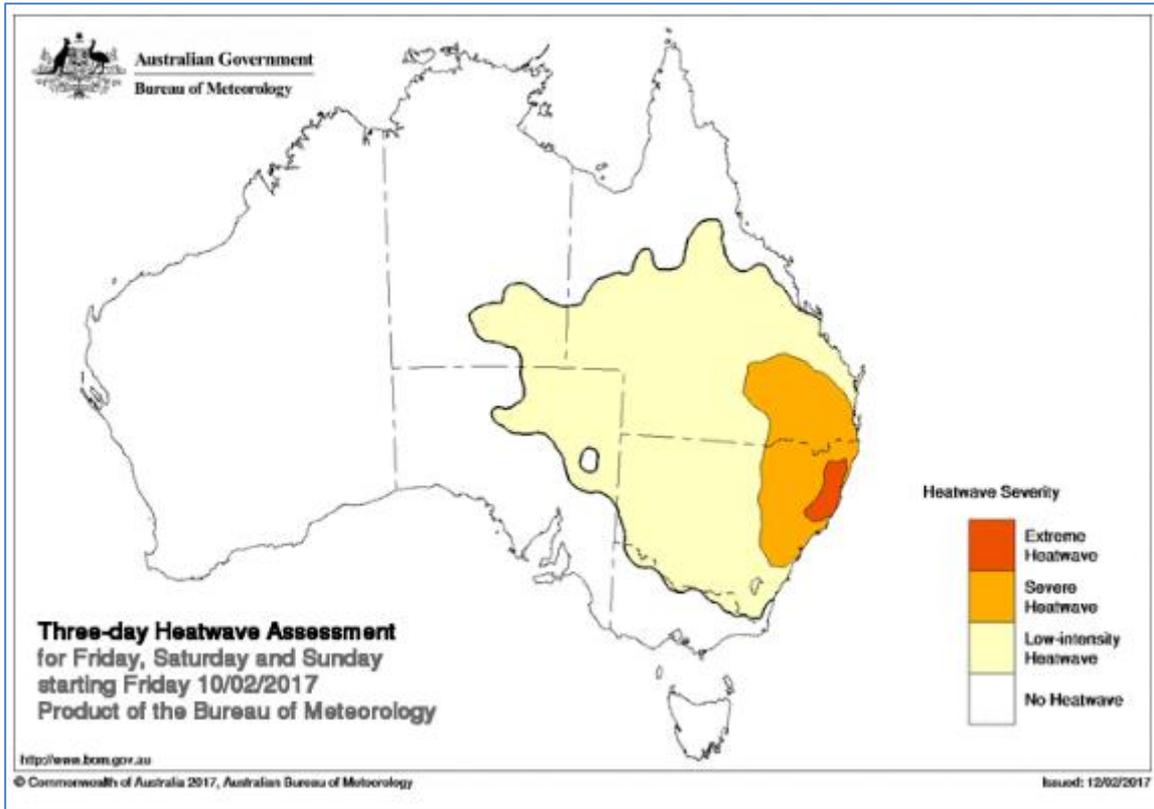


FIGURE 2. SAMPLE BOM HEATWAVE WARNING FOR THE FEBRUARY EVENT

RESEARCH APPROACH

Here we report on the findings of a rapid response project. A telephone survey of 101 residents and 60 businesses affected by the heatwaves in Western Sydney was conducted in February and March. This site was chosen as it experienced severe and extreme heatwave conditions during February, and regularly experiences higher temperatures than other parts of Sydney. It, therefore, is an apposite site at which to consider the impacts of heatwaves in urban area.

For the residential survey, eleven suburbs within Western Sydney were targeted (see Table 1). Six of these suburbs, in the region known as 'The Hills' had a Socio-Economic Indexes for area (SEIFA) score above 1000, and five suburbs, which were located in Western and South-Western Sydney, had an SEIFA score below 1000.

TABLE 1. SUBURBS INCLUDED IN THE RESIDENTIAL SURVEY

The Hills	Western Suburbs
Baulkham Hills NSW 2153	Blacktown NSW 2148
Bella Vista NSW 2153	Liverpool NSW 2170
Castle Hill NSW 2154	Merrylands NSW 2160
Glenwood NSW 2768	Mt Druitt NSW 2770
Kellyville NSW 2155	Penrith NSW 2750 (including Kingswood)
Rouse Hill NSW 2155	

Respondents were randomly selected using a list of the most common surnames in Western Sydney, and then the White Pages to call only those who reside within the target suburbs. Surveying was carried out by two research assistants between 11am and 7pm on weekdays. Survey questions were developed in consultation with the BoM. The survey collected information about residents' perceptions of heatwaves and other hazards, the impacts they and their household experienced during the recent heatwave, if and how residents received heatwave warnings, and the actions they took as a result of the warning (see Appendix 1 for survey questions). Survey respondents had lived in the area for an average of 18.33 years; though notably 25% had lived in the area for 5 years or less. Fifty-two percent of respondents were female. The average number of people per household was 2.42; notably, 27.5% of respondents reported living alone. The majority of respondents were retired (54.5%), and the average age was 61.5 years old. This likely reflects the fact that the survey was conducted primarily during the day



and was limited to landline phones. However, as medical vulnerability to heatwaves has been associated with age, this may also be a strength.

For the business survey, eight suburbs were targeted (see Table 2). These suburbs were selected to include the major business areas in The Hills district and in Western Sydney. As shown in Table 3, a range of business types were targeted to include businesses that might be differently affected by extreme heat events.

TABLE 2. SUBURBS INCLUDED IN THE BUSINESS SURVEY

Suburbs
Baulkham Hills NSW 2153
Castle Hill NSW 2154
Mt Druitt NSW 2770
North Richmond NSW 2754
Parramatta NSW 2150
Penrith NSW 2750
Richmond NSW 2753
Windsor NSW 2756

TABLE 3. BUSINESS TYPES INCLUDED IN THE SURVEY

Type Number	Description	Examples
1	Involves machinery or physical labour	Construction, Mechanic, Manufacturing, Delivery
2	Retail and dining	Retail, Restaurants, cafes, takeaways, travel agent, butcher
3	Office work	Accountants, HR
4	Health-related	Aged care, pharmacies
5	Involves working outdoors	Landscaping, plant nursery
6	Other	Turf supplier

Surveying was carried out by two research assistants between 9am and 5pm on weekdays. Potential respondents were identified by using the Yellow Pages to call businesses within the target suburbs that matched the identified business types. Where there were multiple potential respondents, the research assistants called every second listing in the Yellow Pages, until two responses for each business type in the suburb had been obtained. Surveys were administered to the business owner, operator, or manager, wherever possible. Survey questions were developed in consultation with the BoM. Like the residential survey, information about businesses' perceptions of heatwaves, the impacts they experienced during the heatwave, if and how they received heatwave warnings, and the actions they took as a result of the warning was collected (see Appendix 2 for survey questions).

Table 4 summarises the characteristics of respondents to the survey. Approximately two thirds of respondents were based in The Hills district, and one third were based in Western suburbs. The median number of years the business had operated in Western Sydney was 20-24 years, and the average number of full time employees was 40. Fifty-one percent of businesses that responded to the survey were medium size (20-199 employees), 26% were small (5-19 employees), and 8% were large (200 or more employees) [17]. Two businesses were considered 'micro' size, which refers to businesses with fewer than five employees.

TABLE 4. CHARACTERISTICS OF RESPONDENTS TO THE BUSINESS SURVEY

Location	Number of respondents
Parramatta	12
Castle Hill	17
Baulkham Hills	23
North Richmond	1
Windsor	2
Mt Druitt	1
Richmond	2
Other	2



Type of business	Number of respondents
Aged care	2
Construction	4
Delivery & transport	8
Grocery, butcher	2
Landscaping	5
Manufacturing	4
Mechanic	6
Nursery	2
Office	6
Pharmaceutical supplier	1
Pharmacy	5
Restaurant or café	4
Retail	4
Tourism	2
Travel agency	2
No Response	1
Number of years operated	Number of respondents
<1	0
1-5	6
6-9	7
10-14	5
15-19	4
20-24	9
25-29	7
30-34	3
35-39	4
40-44	8
45-49	1
>50	6

FINDINGS

PERCEPTIONS AND CONCERNS ABOUT HEATWAVES

Residents' views

As shown in Figure 3, heatwaves were perceived as a more severe risk to personal health and safety than severe storms, bushfires and floods, with 56% of respondents describing heatwaves as either a high or extreme risk. In all but one age group (60-69), at least 50% of respondents considered heatwaves to be either high or extreme risk, and among those aged 80-89, almost 90% perceived heatwaves to present a high or extreme risk (Figure 4).

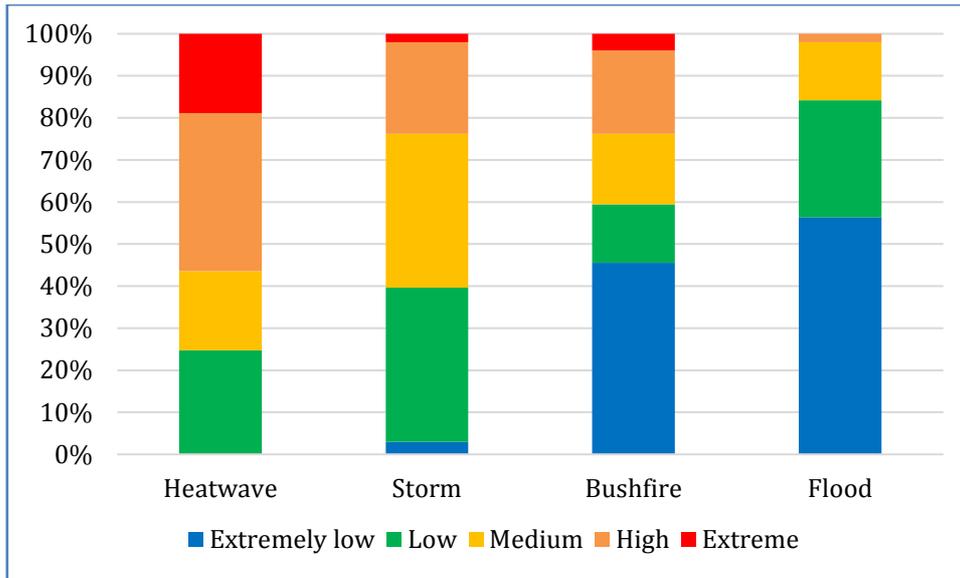


FIGURE 3. RISK PERCEPTION FOR HEATWAVES, SEVERE STORMS, BUSHFIRES AND FLOODS

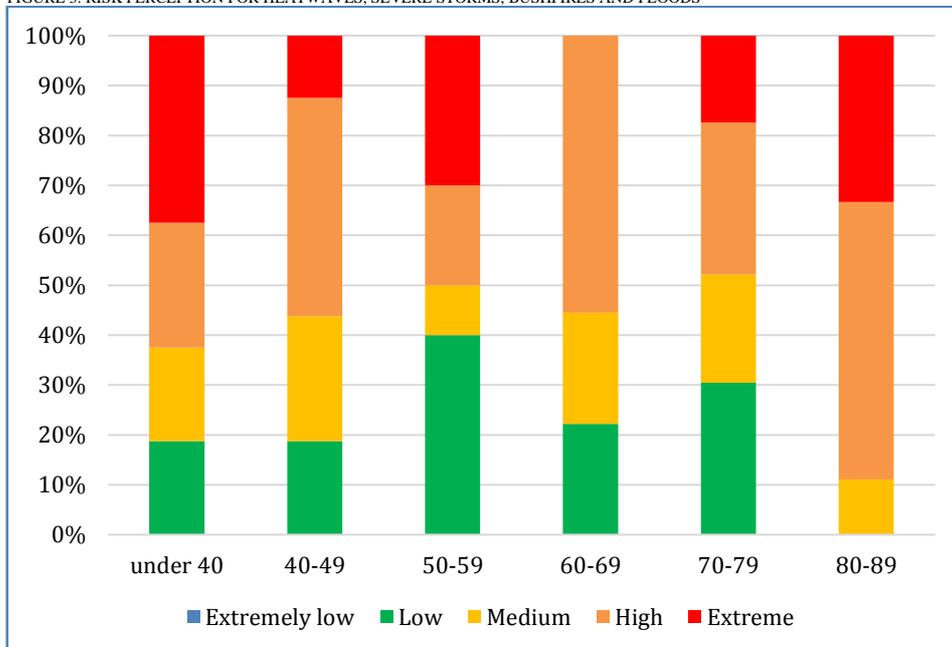


FIGURE 4. RISK PERCEPTION OF HEATWAVES BY AGE GROUP

With regard to heat in the summer of 2016-2017, almost 90% of respondents stated that they believed that this summer was either slightly hotter (32.6%) or much hotter (56.4%) than previous years. Several participants additionally commented that they used their air-conditioning more this summer than ever before. Figure 5 shows the level of concern respondents had for the February



heat event; notably, 50% of respondents reported being either somewhat or very concerned. Among those who reported being somewhat or very concerned about the heatwave, worries about the impacts on personal health (28) and personal discomfort (21) were the most common, followed by concern for vulnerable people and for possible future events (both 13) (Figure 6). Worry about the increasing frequency of heatwaves was also shown in comments, such as “It was OK this time, but if it starts happening more often we could have more trouble” and “I have no idea why we aren’t more worried about what might happen if events like the heatwave start to happen frequently.” Among those who were not particularly concerned about the heatwave, being able to effectively cope with extreme heat was the most common reason (37), followed by the perception that heatwaves are a regular part of summer (15), and a belief that they have a high heat tolerance (12) (Figure 7).

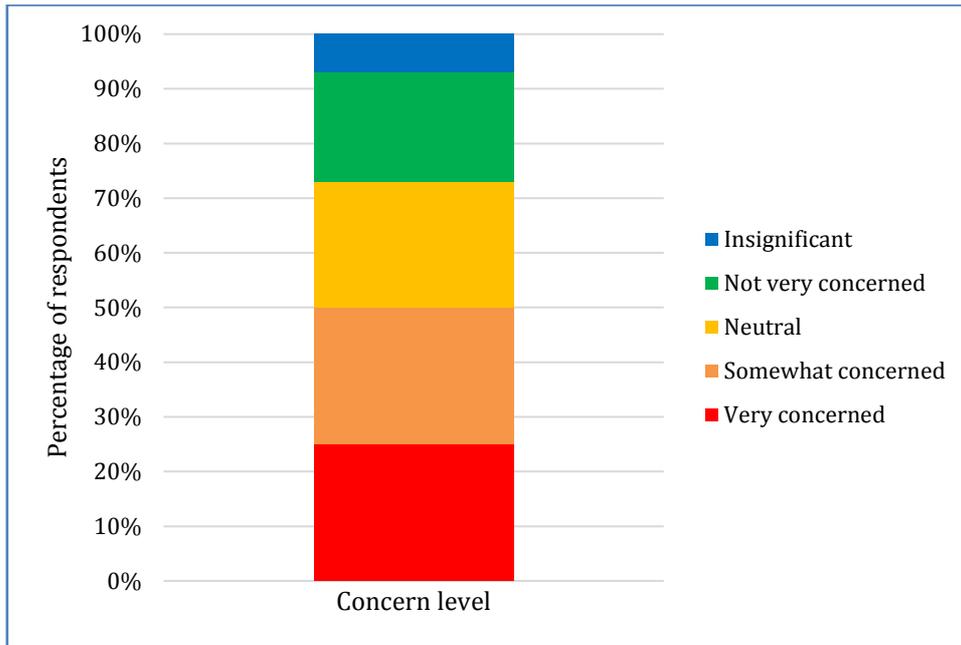


FIGURE 5. SELF-REPORTED CONCERN LEVEL FOR THE HEATWAVE IN FEBRUARY

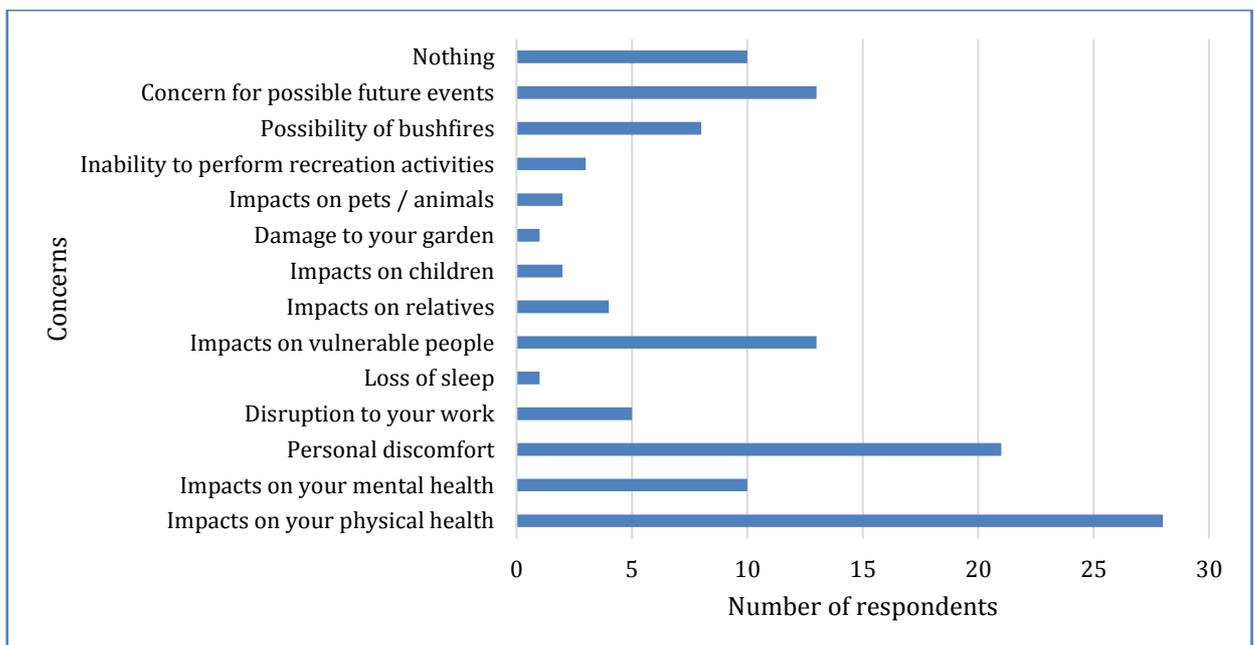


FIGURE 6. RESIDENTS’ CONCERNS RELATED TO THIS HEATWAVE

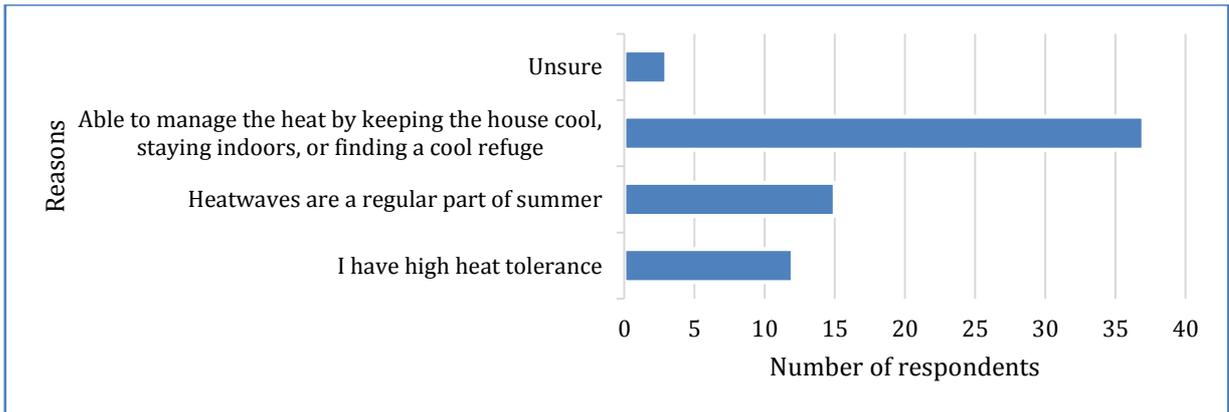


FIGURE 7. REASONS WHY PEOPLE WERE NOT CONCERNED ABOUT THE HEATWAVE

Businesses' views

Almost 60% of respondents described heatwaves as an extreme or high risk to their business. Notably, 80% of respondents from medium-sized businesses, considered heatwaves an extreme or high risk (Figure 8). As shown in Figure 9, the perceived level of risk varied somewhat across the various types of business; office-based businesses generally considered heatwaves a lower risk than other business types.

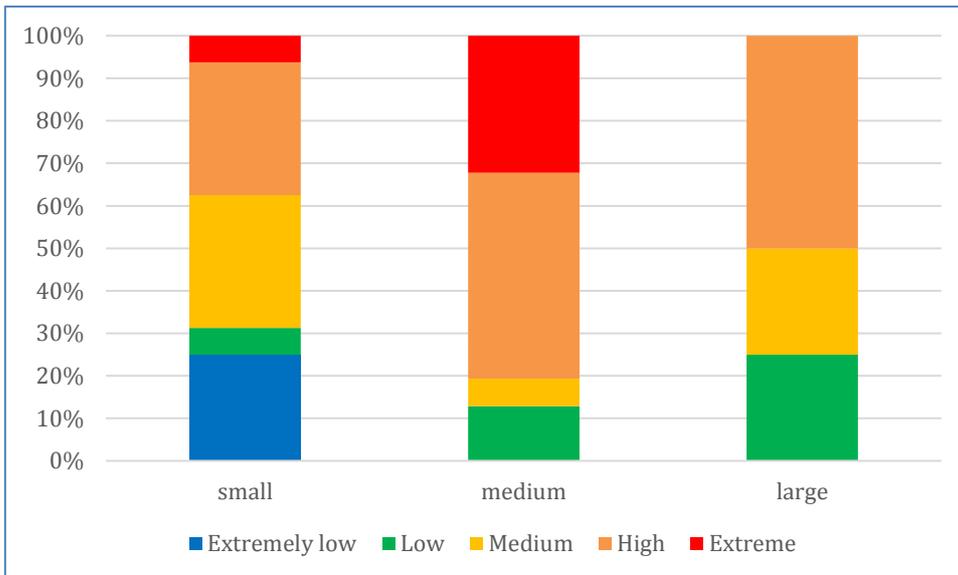


FIGURE 8. PERCEIVED RISK OF HEATWAVES BY BUSINESS SIZE

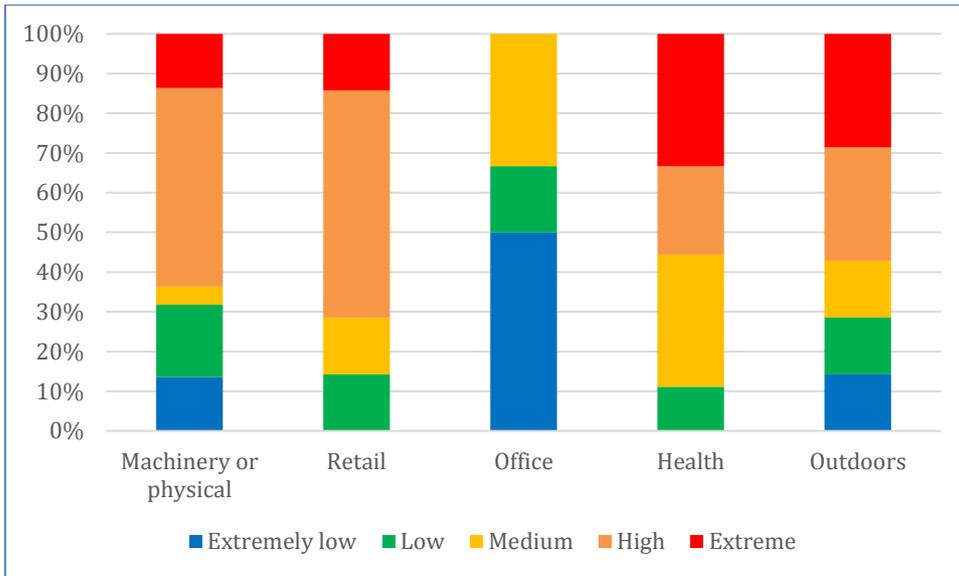


FIGURE 9. PERCEIVED RISK BY BUSINESS TYPE

Like residents, the vast majority of businesses surveyed described this summer as hotter than previous years; almost 50% described it as much hotter, and 33% reported that it was slightly hotter than previous years. With regard to the heatwave in February, 55% of respondents reported being either very concerned (20%) or somewhat concerned (35%) for their business (Figure 10). The most common concerns about the heatwave were the potential impacts on employee health and safety (43%) and personal health and wellbeing (20%), impacts on productivity (26%), and impacts on power usage (21%) (Figure 11). Other concerns identified by businesses included damage to stock, and the safety of customers, tourists, and residents in aged care facilities.

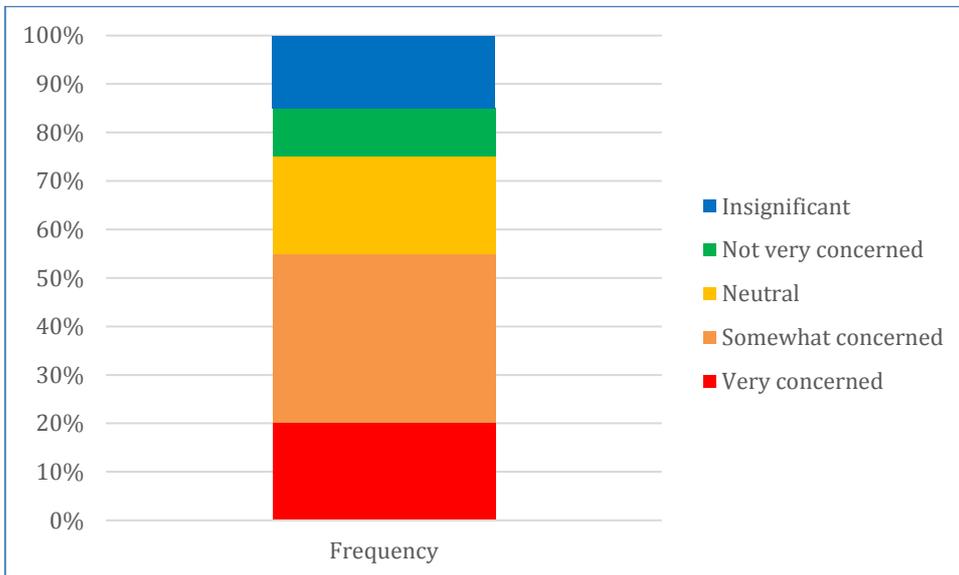


FIGURE 10. LEVEL OF CONCERN FOR THE HEATWAVE IN FEBRUARY AMONG BUSINESS RESPONDENTS

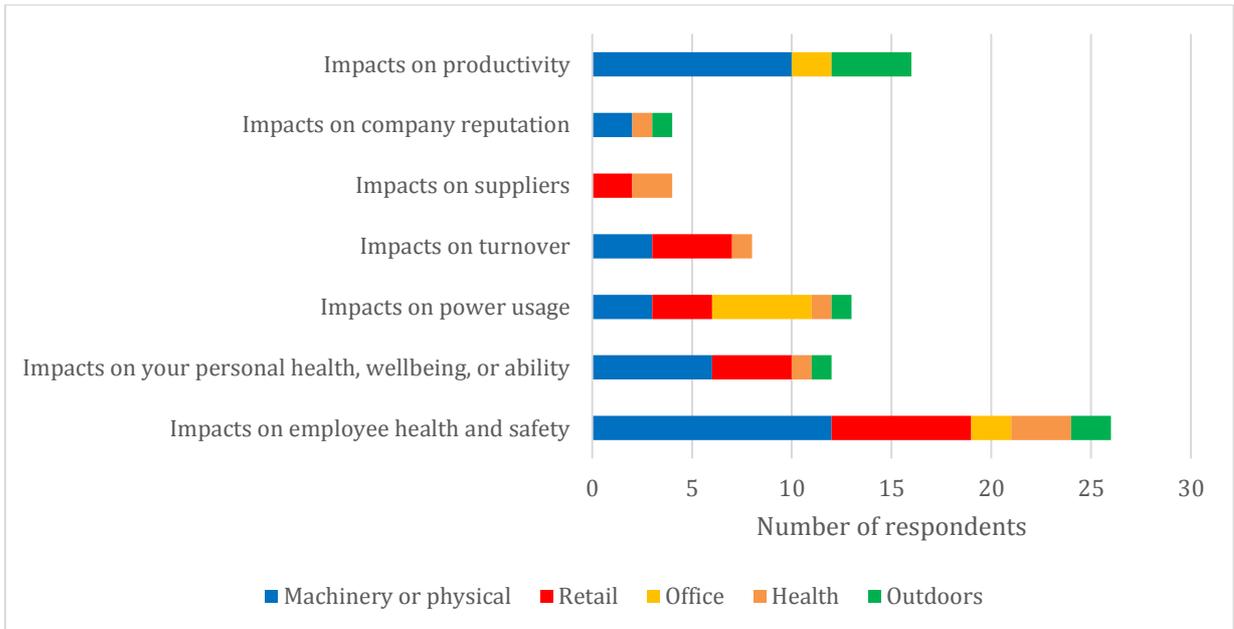


FIGURE 11. REASONS WHY BUSINESSES WERE CONCERNED ABOUT THE HEATWAVE IN FEBRUARY BY BUSINESS TYPE

IMPACTS OF THE HEATWAVE AND COPING STRATEGIES

Residents' views

The everyday impacts of heatwaves on the health and wellbeing of residents in urban areas is a current research concern [7]. In this survey, almost 60% of respondents stated that they felt hot or uncomfortable during the heatwave, and 32% reported having difficulty sleeping (Figure 12). The severity of this heatwave is indicated in such comments as "I don't know if I'd make it through another one like that" and "It's hard to get through a heatwave when you live by yourself, being older doesn't help either." Whilst only one person reported being concerned for their garden (Figure 6), this was the third most common impact reported (21.8%) (Figure 12). Concern about increased electricity costs was reported by almost 21% of respondents, and 11% reported experiencing a power outage, which highlights the potential vulnerability to extreme heat due to limited access to electricity (Figure 12). Health concerns, such as feeling unwell (14.9%), lethargic (6.9%), distressed or mentally fatigued (11.9%), were reported by many respondents, yet only 2.97% of respondents sought medical treatment for heat-related health concerns. This is suggestive of the widespread health and wellbeing impacts of extreme heat.

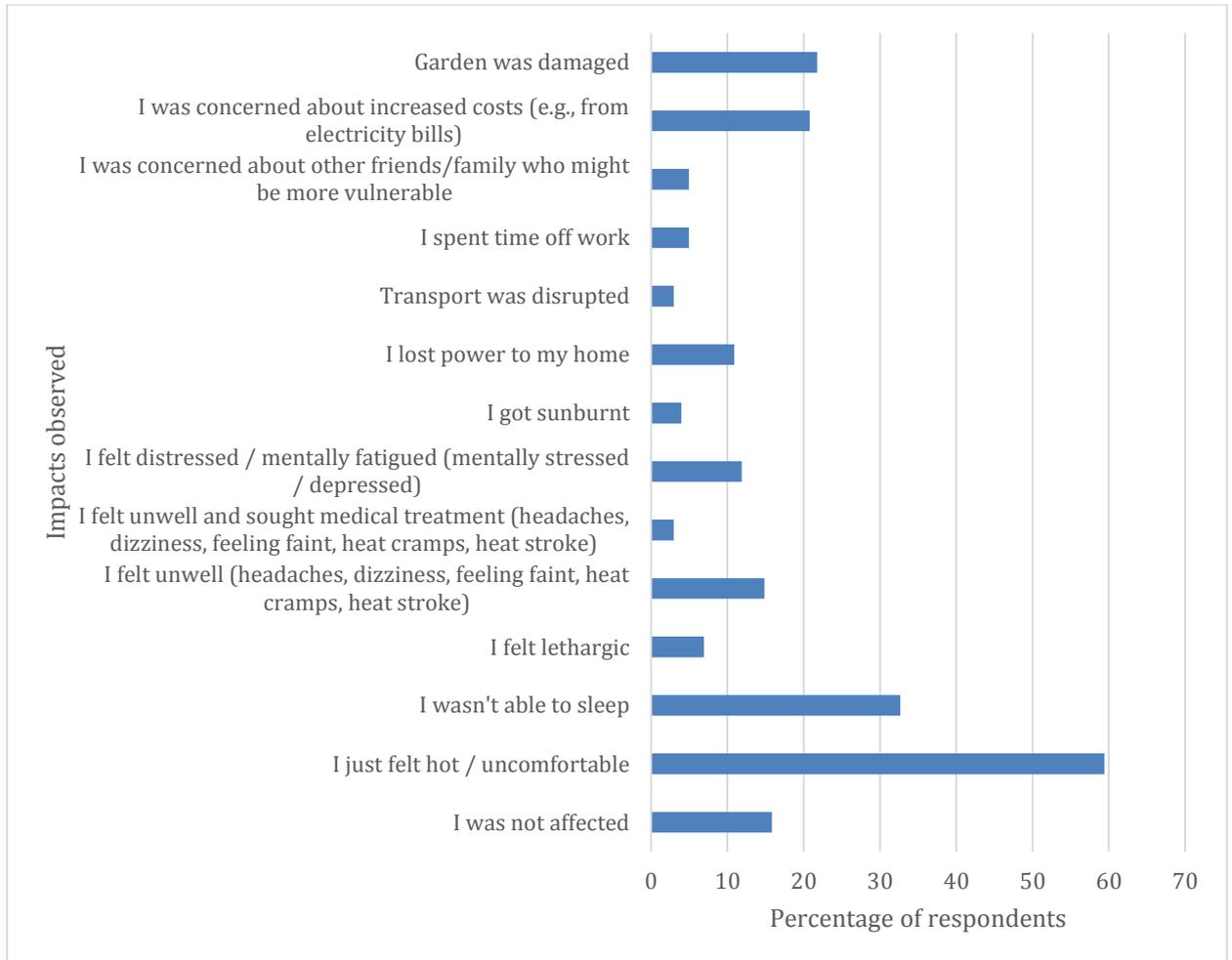


FIGURE 12. PERSONAL IMPACTS DURING THE HEATWAVE IN FEBRUARY

As shown in Figure 13, some groups were considered likely to be especially affected by the heatwave. The most common response was elderly people (57), followed by children (41). Of particular note is that 36 respondents thought no-one was especially vulnerable to heatwaves, and that only 10 perceived chronic or pre-existing medical conditions as increasing vulnerability to heatwaves (Figure 13). Interestingly, some respondents noted that because they stayed inside with the air-conditioning on during the heatwave, they did not notice how others were coping.

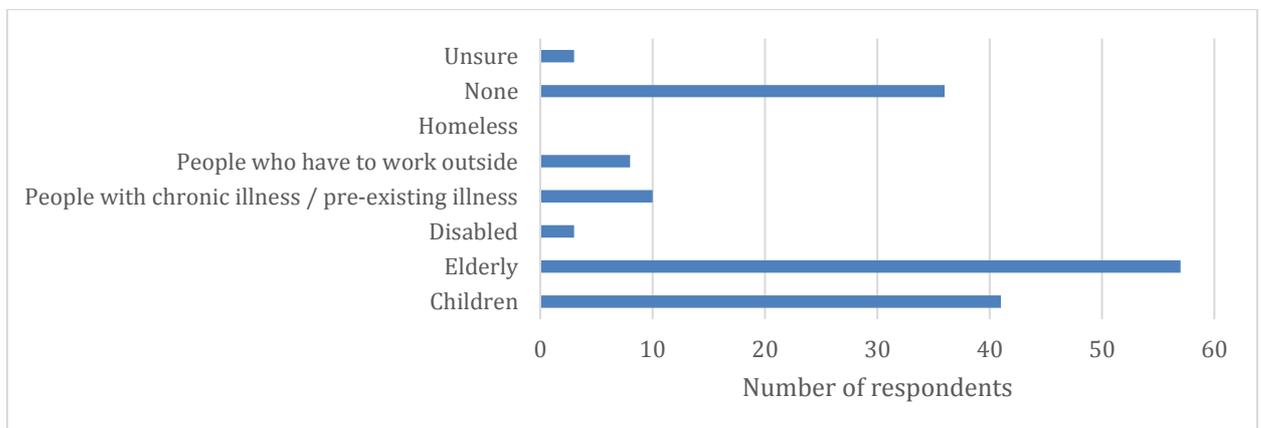


FIGURE 13. GROUPS PARTICULARLY AFFECTED BY THE HEATWAVE

A range of actions to minimise the impacts of the heatwave were identified by respondents (Figure 14). The most common actions were using air-conditioning (89), staying indoors in a cool part of the house (82), closing windows/blinds/shutters (70), and using a fan (52). These findings



highlight the key roles of house design (and quality) and adequate and affordable access to electricity to coping during heat events. Staying well-hydrated, reducing and rescheduling activities and travel were also notable actions taken to reduce the heatwave impacts. Indeed, several respondents noted that they chose to work from home or rescheduled work meetings to reduce their exposure to the heat. Notably, very few people used public spaces or pools/swimming areas to keep cool, and no respondents reported checking in on neighbours or relatives during the heatwave.

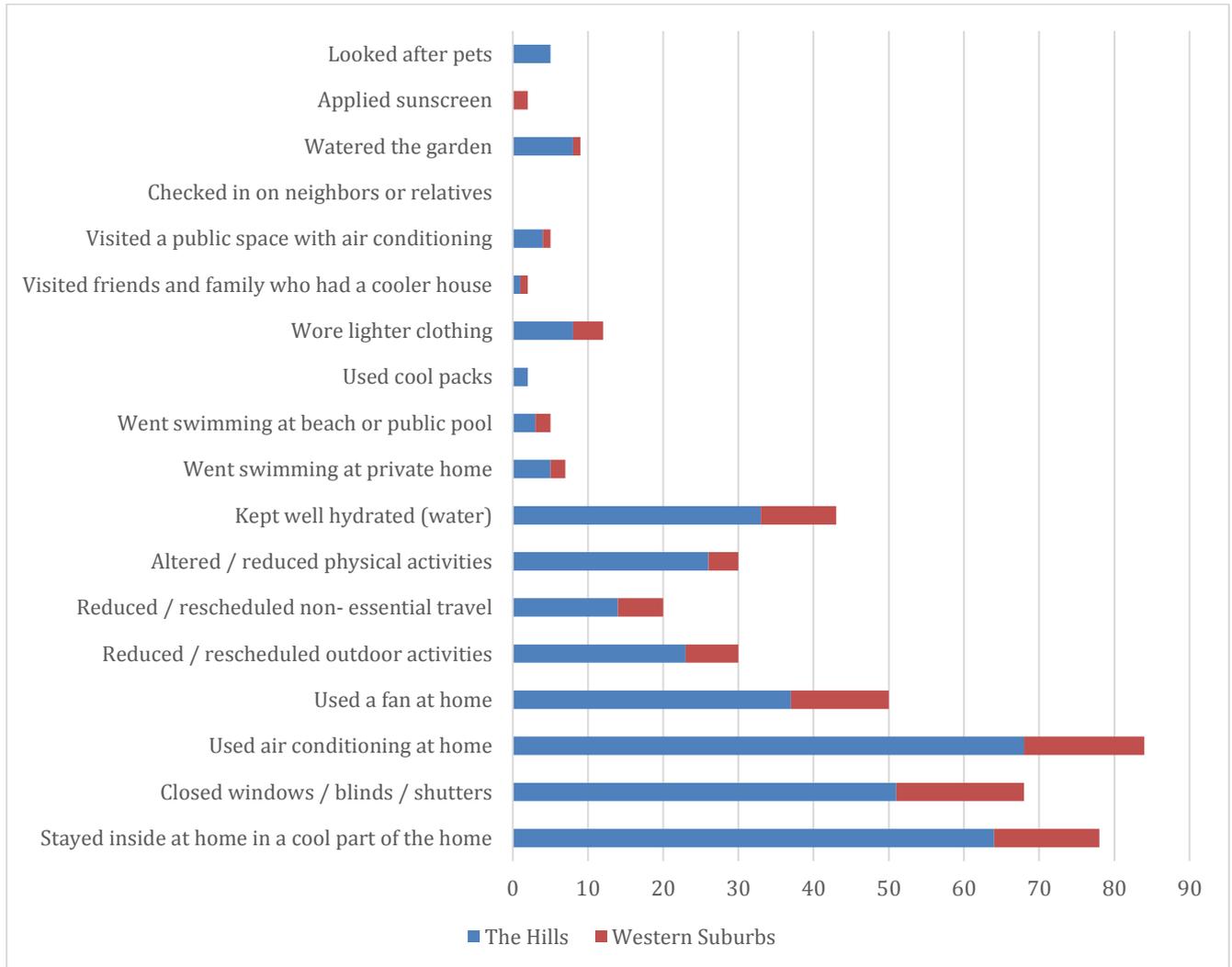


FIGURE 14. ACTIONS TAKEN TO REDUCE HEATWAVE IMPACTS BY LOCATION

Businesses' views

To better understand the impacts experienced by businesses, absenteeism, productivity, turnover, and disruptions to business during the heatwave are considered. These results provide an indication of the impacts as perceived by business owners.

Most businesses (58%) described absenteeism as 'about normal' during the heatwave, and 30% described it as higher than normal. Respondents from each business type reported higher than normal absenteeism; 38% of businesses that use machinery or require physical labour reported higher absenteeism, as did 35% of businesses in the retail and dining sector. As shown in Figure 15, over 50% of medium-sized businesses reported experiencing higher than normal absenteeism during the heatwave, while large businesses indicated that they had either normal or lower than normal absenteeism. Comments from respondents illustrate the different experiences of absenteeism during the heatwave:

"We had almost no-one at the workshop, everyone was at home and I don't blame them really."



“We just had to tell anyone that didn't work in the office with aircon that we didn't think it was safe for them to work, that they should stay home.”

“Everyone came in on the hot days because we had good air-conditioning - better than some of our employees have at home.”

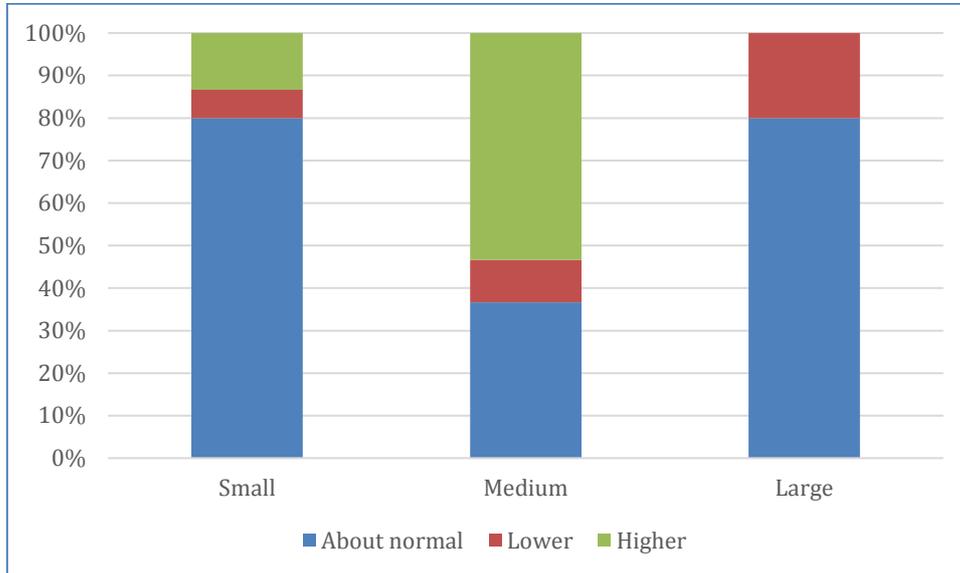


FIGURE 15. PERCEIVED WORKPLACE ABSENTEEISM DURING THE HEATWAVE BY BUSINESS SIZE

While 51% of businesses reported that productivity was ‘about normal’ during the heatwave, 41% indicated that they had lower than normal productivity. As shown in Figure 16, office-based businesses all reported normal activity. However, respondents from all other business types reported lower productivity – particularly those that require working outdoors, with machinery or require physical labour. As with absenteeism, medium-sized businesses appear most affected, with 60% reporting lower than normal productivity during the heatwave. Several comments from businesses provide further insight to the impacts on productivity:

“We just had to postpone our jobs until it got cooler again - no way we could be out in the heat like that”

“We were really slowed down by the conditions.”

“We decided to let everyone go home instead of risking being out in the heat. It delayed our projects, but we decided it was worth keeping our workers safe.”

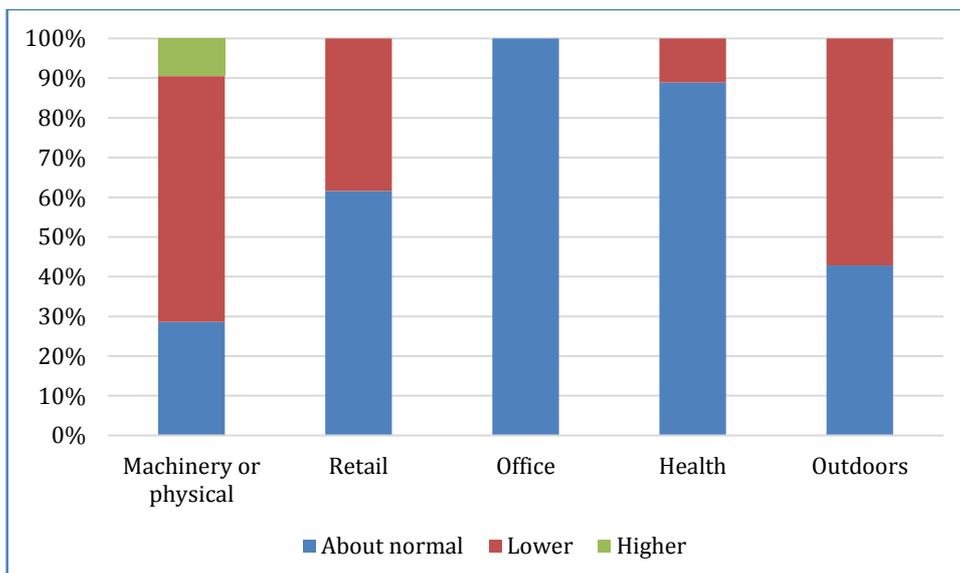


FIGURE 16. PERCEIVED LEVEL OF PRODUCTIVITY DURING THE HEATWAVE BY BUSINESS TYPE



While 48% of respondents considered their turnover during the heatwave to be 'about normal' and 10% were unsure whether it was affected, some businesses reported experiencing higher or lower levels of turnover (Figure 17). Notably, businesses categorised as retail and dining (see Table 3) reported the greatest variation in turnover during the heatwave with 50% reporting lower turnover and 25% reporting higher turnover (Figure 18). Indeed, respondents from retail businesses in shopping centres noted that:

“There did seem to be more people in than usual, probably escaping the heat”

“Might even have had more people in the store than usual because of people trying to escape the heat by going to the shops.”

No businesses categorised as office-based or outdoors reported higher turnover.

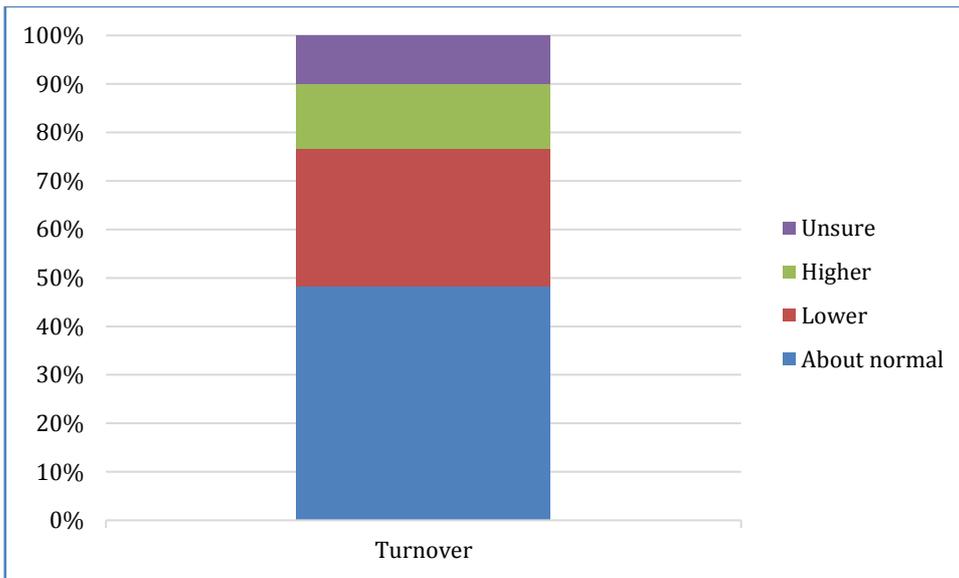


FIGURE 17. PERCEIVED HEATWAVE IMPACT ON TURNOVER

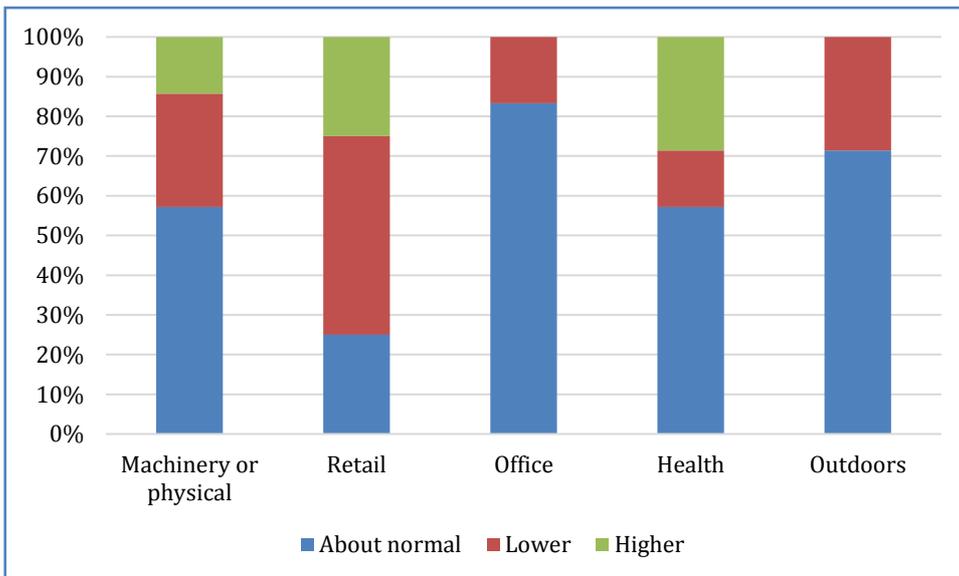


FIGURE 18. PERCEIVED TURNOVER DURING THE HEATWAVE BY BUSINESS TYPE

Although 81% of businesses did not experience any power outages during the heatwave, many were concerned about increased electricity usage. Most reported that their electricity use was unchanged during the heatwave (Figure 19), which may reflect that some of the most severe heat occurred during the weekend. Several businesses, though, reported using more (30%) and



much more (11%) electricity than normal. Some respondents specifically commented on electricity usage; for example:

“I reckon that we had a pretty big spike in the power bill from pumping all the aircon into the workshop to cool that as well.”

“We had the aircon on full bore from sunup to sundown basically. It kept us cool but the power bill sure wasn’t pretty.”

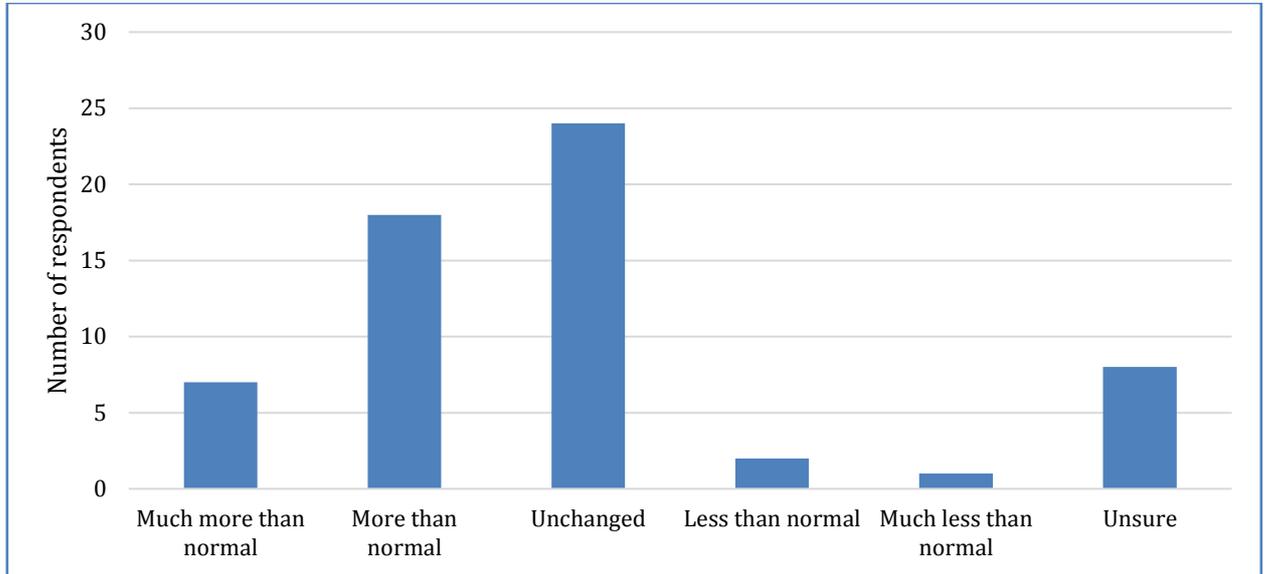


FIGURE 19. PERCEIVED ELECTRICITY USE DURING THE HEATWAVE

Thirty-five percent of businesses reported no disruption experienced by their suppliers; however, some businesses perceived high (10%) and medium (18%) levels of disruption. Most businesses (63%) reported that the number of work health and safety incidents that occurred during the heatwave was normal; 16% reported that there were more than normal, and 11% that there were fewer than normal.

As shown in Figure 23, a range of actions were taken by businesses to minimise the impacts of heat. Like residents, using air-conditioning (88%) and fans (55%) were the most common actions taken, followed by allowing employees to take more breaks (35%) and adjusting work practices (33%). For example, one business described providing additional shade and “employees took a 15-minute break every hour.” Eleven businesses reported sending employees home, and four reported closing early. Indeed, one business reported closing “for multiple days after it became clear it was unsafe to work outside” and another “told multiple workers not to come in because conditions were too dangerous.” Fifteen businesses provided briefings to employees, and some also provided briefings to customers (e.g., tourism-related businesses) and to residents (e.g., in aged-care facilities). Four businesses also reported increased watering of plants during the heatwave. On average, businesses reported taking 3 actions to minimise the impacts of the heat, with some 13 businesses taking 5 or 6 different actions. These findings indicate that businesses of all types took measures to reduce the impacts of the heatwave.

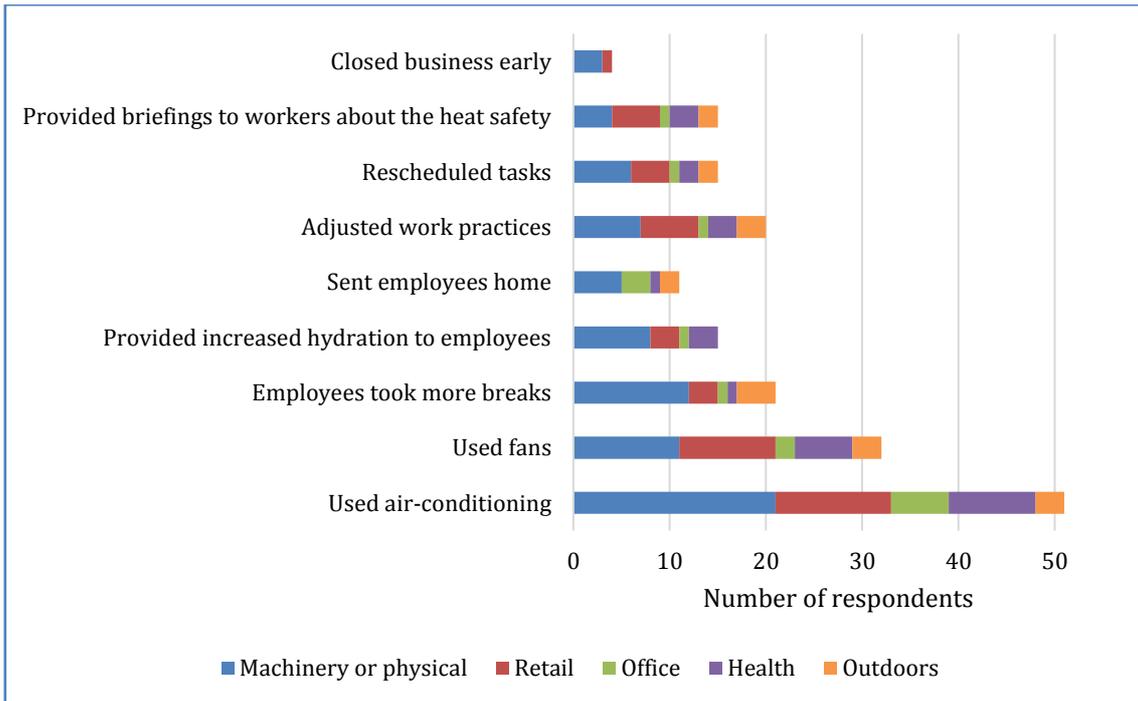


FIGURE 20. ACTIONS TAKEN BY BUSINESSES TO REDUCE THE IMPACTS OF HEAT BY BUSINESS TYPE

WARNINGS AND PREPAREDNESS

Residents' views

The majority of respondents (70) received warning of the heatwave, and around 60% of these reported monitoring the warnings daily. The most common mode of receiving heatwave warnings was overwhelmingly through television (61), with the second most frequent response being radio (20). This was consistent across all age groups (Figure 21), and highlights the continued importance of traditional media for sharing information about heatwaves. Use of websites and social media was mainly reported by those aged under 60 (Figure 21). When asked about the sources of heatwave warnings, the most common response was the media (68), and the second most common response was the BoM (19).

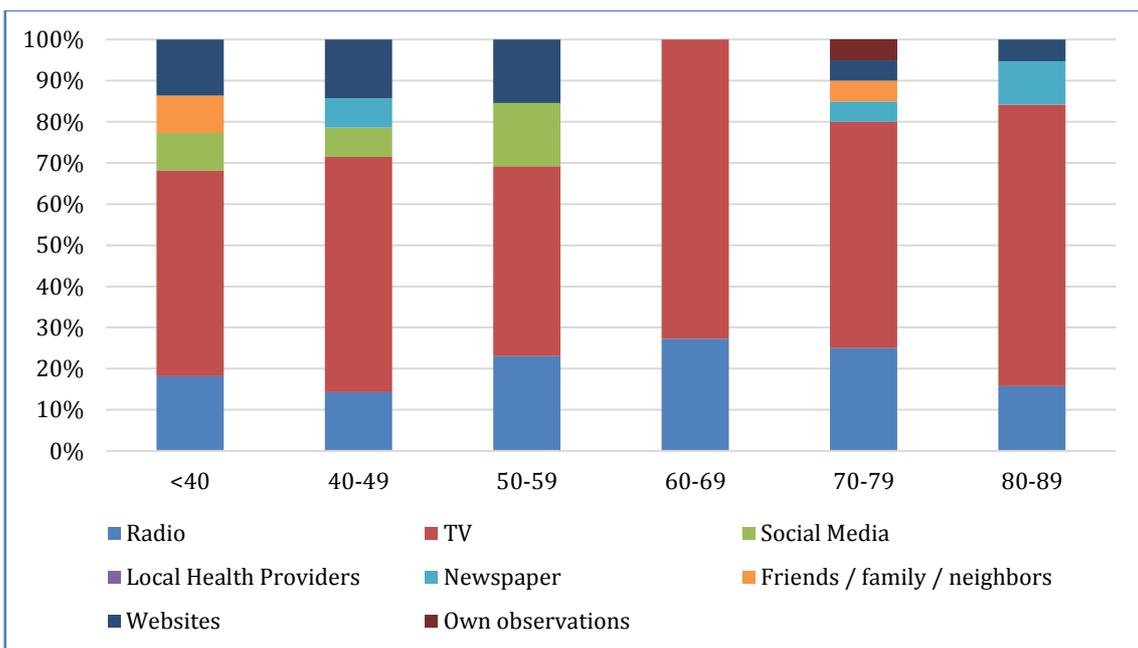


FIGURE 21. MODE OF MONITORING AND RECEIVING WARNINGS BY AGE GROUP



Messaging from the BoM through the heatwave warning service, Facebook and Twitter provided information about the expected temperatures, records being broken, and advised readers to follow the advice provided by NSW Health. NSW Health has four key messages to support public health and wellbeing during heatwaves. These are: (1) Drink plenty of water, (2) Keep cool, (3) Take care of others, and (4) Have a plan [18]. As shown in Figure 22, the main message participants remembered from the warnings is simply that 'it is going to be hot' (64). Other messages that were recalled include: stay hydrated (29), avoid sunlight when possible during the hottest parts of the day (14), and to seek out cool places (13). Several also reported being advised to check on family and friends (9), take care of animals (7), and to seek medical attention if feeling unwell (7).

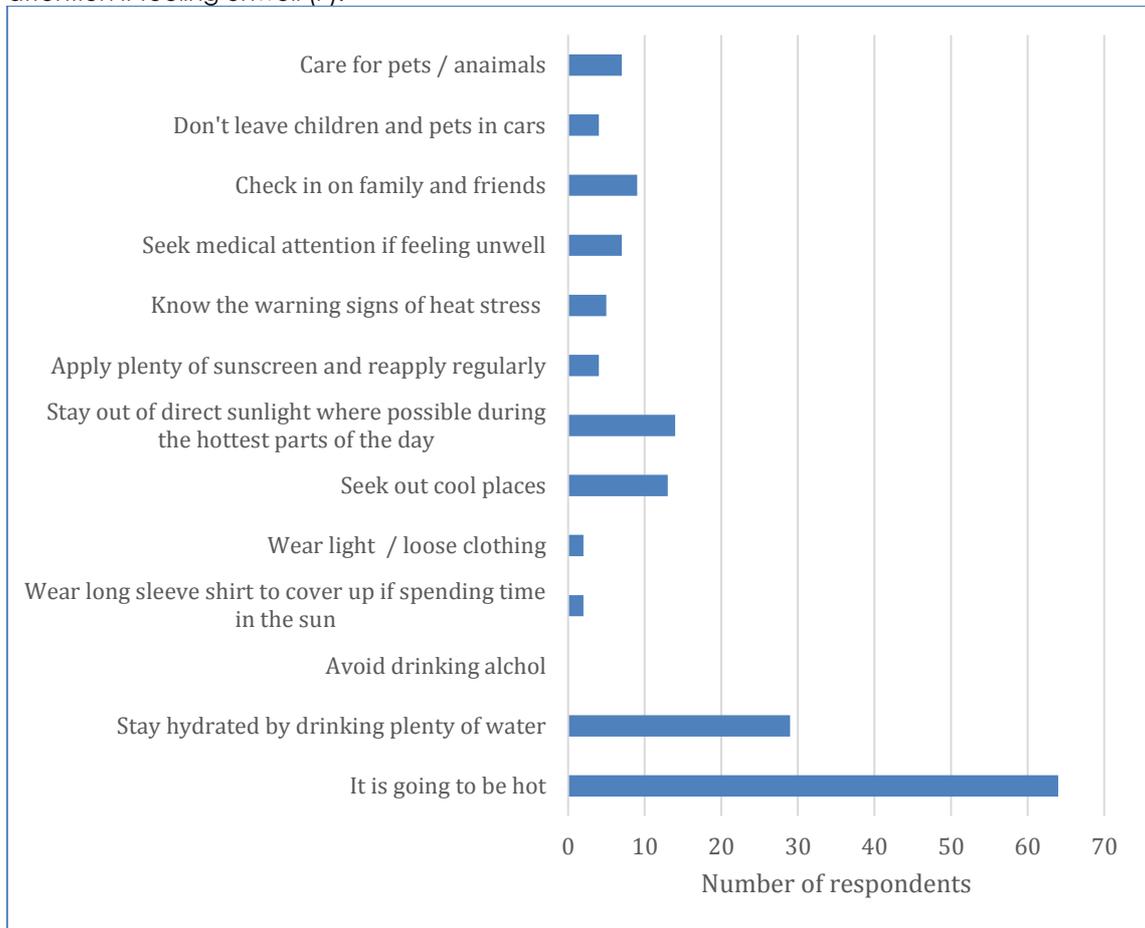


FIGURE 22. MESSAGES RECALLED BY RESIDENTS FROM HEATWAVE WARNINGS

Among those who recalled being advised of the heatwave, 64% reported taking actions to reduce the likely impacts of the heat. The most common action was rescheduling outdoor or physical activities (19), followed by developing a plan for hot days (11), and watering plants and looking after pets (both 9) (Figure 23). Although only one person reported checking in with relatives, neighbours, and friends, these actions are broadly consistent with the advice provided by NSW Health. Two people mentioned preparing for bushfires (e.g., clearing gutters), and several people described plans with their employer (e.g., everyone goes home if there's a power cut) and children's schools (e.g., no outdoor sports or activities). When asked to consider what information in the warnings prompted them to take action, several respondents noted the high temperatures predicted, the duration of these temperatures, and that both the daily maximum and minimum were high. The frequency of warnings was also noted by some respondents who felt that this "made it appear that urgent action needed to be taken." Among those who did not prepare for the heatwave, many simply explained that they "didn't think it was necessary," or that there is little to be done apart from using air-conditioning.

Respondents were broadly satisfied with the warnings provided; one respondent noted that "Adequate information was provided. There are loads of warnings on the radio and TV news. People could only miss it if they don't have radio/TV or choose to ignore it." Several people

discussed a need for more information about what to do during a heatwave and more locally-specific information and advice; for example,

“More advice on what to do in the event of a heatwave. This may change between suburbs depending on age demographic and population density. Broadcast advice based on specific location, rather than general Sydney.”

“News should be more specific to particular suburbs. eg. They mention bushfire dangers, but this often doesn’t apply to residential houses with minimal bush around them. News is also quite sensationalised - always commenting on worst case scenario, needs to be more focus on what to do in extreme heat.”

“Provide more information about what conditions are expected and the possible health impacts.”

Other suggestions included identifying times of the day when it is unsafe to go outside and more explanation of why it is happening.

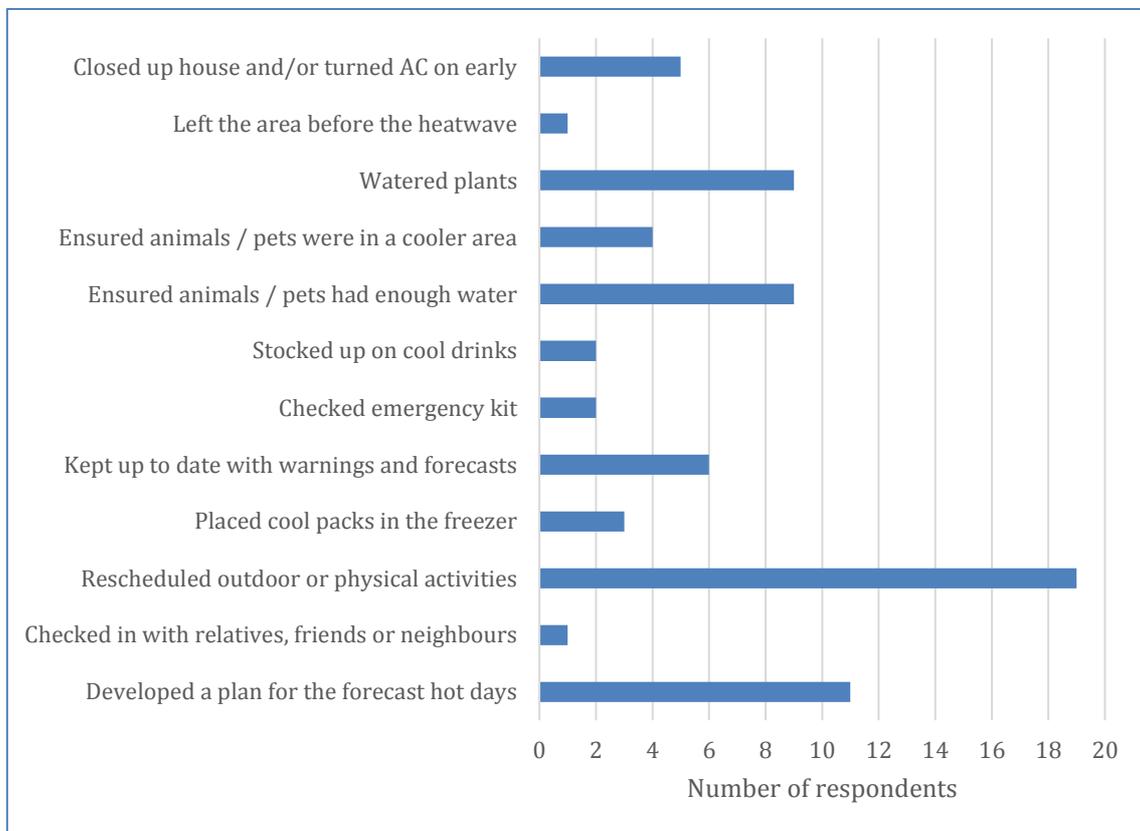


FIGURE 23. ACTIONS TAKEN TO PREPARE FOR THE HEATWAVE

When asked to consider how they could be better prepared for extreme heat events, 51 people responded that no further preparations were needed, and 5 were unsure. Several of the suggested ways to better prepare for heatwaves focused on building quality and features, for instance, installing air-conditioning (10), considering home design (9), and building a pool (6). Additional suggestions included installing blinds or shade, upgrading and maintaining air-conditioning units, and insulation. Listening to warnings was suggested by 8 respondents, while 10 suggested relocating to a cooler town. The majority of respondents (59) stated that there were no barriers to being better prepared for heatwaves. However, some respondents noted that affordability (13) was a significant barrier. Suggestions for ways that government agencies could better assist communities during heatwaves focused on reducing vulnerability from the built environment and reducing vulnerability due to social and economic factors. Subsidies for electricity was the most common suggestion, followed by subsidies and regulations to encourage installation of solar panels and other improvements to buildings. In addition, many people noted a concern for those without affordable access to air-conditioning and fans. Several people also

linked heatwaves to climate change, and suggested that the government should 'take action' to address climate change. For example, one person commented that:

"It's worrying that most people that can actually make changes to combat climate change and reduce the chance of more events like this occurring are doing next to nothing, some even trying to convince us it's not happening."

It is also worth noting that many people felt that nothing further was needed, or that it is "up to the individual." Specific examples of suggestions include:

- Improving homes
 - "Subsidise installation of air-conditioning"
 - "Subsidy or loan for people to buy Tesla energy storage batteries (\$10 000) to store more electricity from solar panels. This will ensure a back-up supply of electricity in case of a power shortage during heatwaves. Governments should be pushing for more enviro-friendly housing/building regulations so houses are more equipped to deal with high temperatures."
 - "building standards, e.g. proper insulation, building design, more bush/trees around housing instead of concrete."
- Improving infrastructure:
 - "Design utility infrastructure to better withstand extreme events"
 - "Make power grid faults less likely"
 - "Ensure electricity grids are able to cope with high use periods."
- Supporting vulnerable people:
 - "Make sure everyone has ways to keep cool, not everyone has AC and fans"
 - "Air conditioning or fans for people in housing commissions. (worried about people that can't afford such luxuries)"
 - "Subsidise electricity for people with low income"
 - "More care for the elderly. Set up a buddy system for elderly people that may not have friends or family to check on them."
 - "More help for the elderly as they are often more affected by high temperatures and are often not mobile enough to just go to the nearest shopping mall and sit in the air con. If they are not well set up at home, then they are at risk of suffering from the heat."

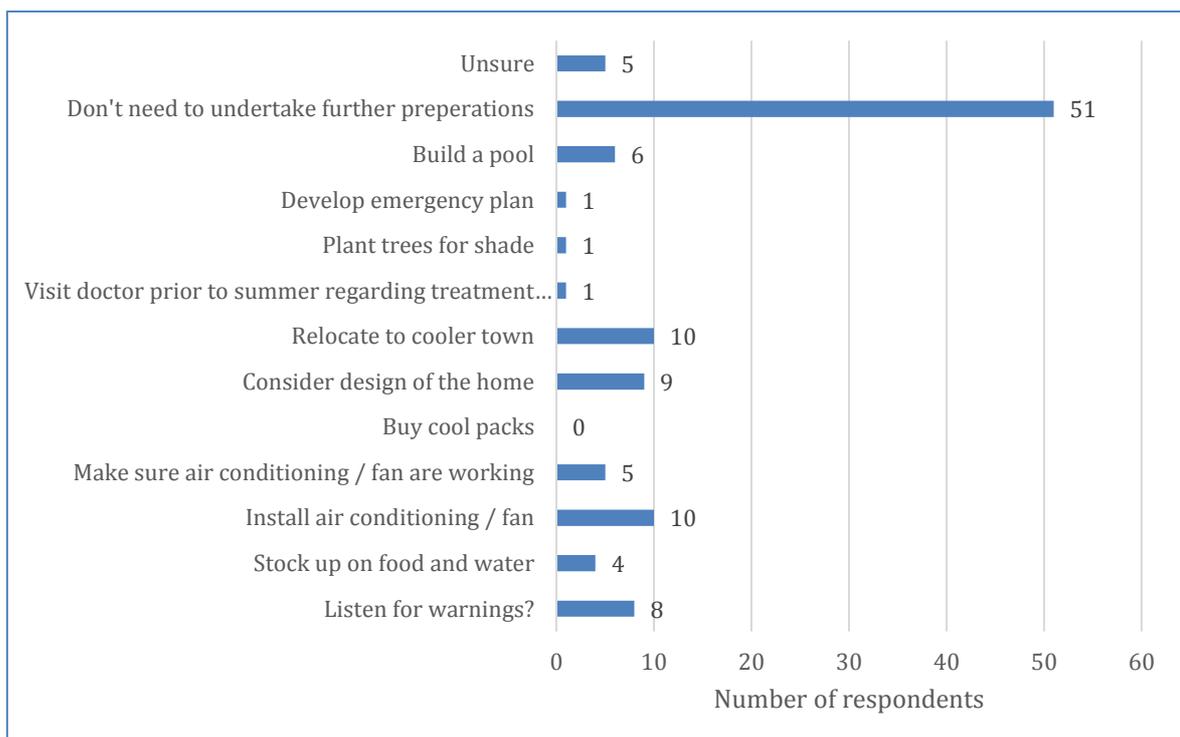


FIGURE 24. ACTIONS THAT COULD INCREASE PREPAREDNESS FOR HEATWAVES



Businesses' views

Most businesses (78%) reported being warned about the heatwave. Like residents, TV (75%) and radio (28%) were the most common modes of receiving and monitoring heatwave warnings. Websites (20%) and social media (8%) were also used by some businesses. The main messages business owners/operators recalled from the warnings were that 'it is going to be hot' and 'to stay hydrated' (Figure 25). One respondent mentioned being advised to "try to minimize electricity usage where possible in case of blackout."

Most respondents reported being satisfied with the warnings they received; however, some discussed a need for better information on what to do during a heatwave and for localized information. Examples include:

- "More accurate temperatures at smaller scales"*
- "Accurate temperature predictions for more localized areas"*
- "Better instructions for what to do when you have to keep working"*
- "More information about how to prevent risks"*
- "What effects are expected on businesses"*
- "Ways to cope with heat"*

Like residents, some business owners were curious to know more about why heatwaves occur, and what should be expected in the future. Longer term forecasts were suggested by one respondent, and more official warnings were recommended by another.

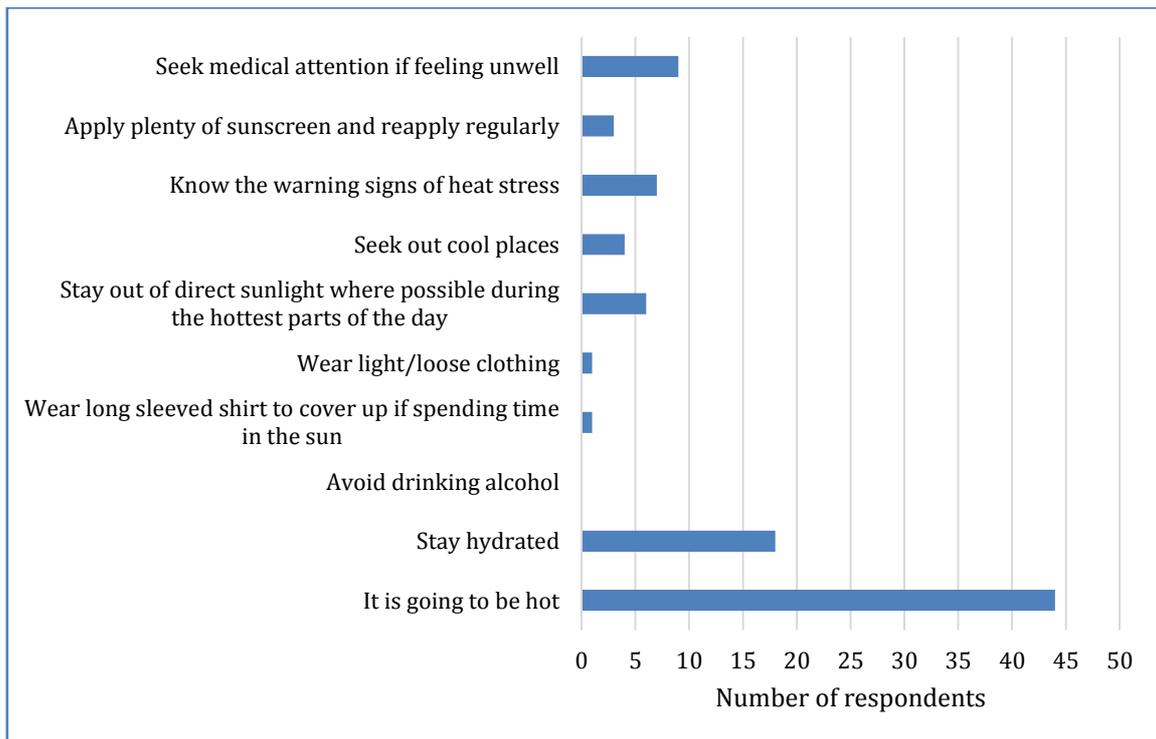


FIGURE 25. MESSAGES RECALLED FROM WARNINGS BY BUSINESSES

Among those business owners/operators who recalled warning of the heatwave, almost half reported taking actions to prepare for the heatwave. The most common actions were to advise staff of heatwave conditions and what to do, reschedule operations, and buy fans. Landscaping and nursery businesses also reported taking steps to prevent impacts on plants (e.g., watering, covering). When asked to consider how their business could be better prepared to cope with heatwaves in future, most respondents felt that nothing further was needed. Some explained that there is "no need to prepare further;" others noted that they "can't do anything about it" or that



they “can’t do much” because of their business type or because they have to work outside. One respondent further explained that:

“There’s very little we can do to protect some of our employees from having to be out on delivery routes. We have to make sure we deliver on time.”

Ideas to be better prepared focused on reducing vulnerability due to the built environment and facilities; for example:

“Install better insulation to keep store cool”

“Can’t do much right now, perhaps upgrade cooling or renovate to improve thermal characteristics of buildings”

“Maybe installing solar panels would offset cooling costs”

“Insulate workshop, create larger shaded areas”

“Upgrade air conditioning, seal workspaces to prevent hot air coming in from outside”

In contrast to residential respondents, only one business owner suggested the government subsidise electricity costs.



CONCLUSION

This report describes the perspectives and experiences of residents and businesses in Western Sydney following the heatwave in February 2017. It found that most residents and businesses consider heatwaves to be a high or extreme risk, and that the overwhelming majority (90% of residents, 88% of business owners) thought this summer was hotter than previous years. During the heatwave, residents reported feeling tired, uncomfortable, lethargic, and unwell. Using air-conditioning, fans, and staying in a cool part of the house were the most frequent coping strategies, alongside keeping hydrated. Notably, few people reported seeking out cooler public places (e.g., libraries, pools), or checking on family and friends that might be particularly vulnerable to or affected by severe heat. While some businesses, particularly office-based ones, reported minimal impacts from the heatwave, 30% experienced higher than normal absenteeism and 41% reported lower than normal productivity. Some commented that they sent employees home or delayed work as the heat conditions made it unsafe. While many business owners thought that their turnover was not affected during the heatwave, some reported experiencing lower than normal turnover, and others noted higher turnover. Concern about electricity use and prices was frequently mentioned by residents and business owners; notably, in some industries, increased water-use was a greater issue than electricity use.

The majority of residents and businesses had seen heatwave warnings and, similar to Akompab et al. [15], most people reported receiving and monitoring warnings through traditional media (e.g., TV, radio, and newspapers). Of the residents who received warning, 64% prepared for the heatwave, primarily through rescheduling activities. Businesses similarly prepared by rescheduling or modifying work activities, and by providing advice to employees. Most people were satisfied with the warnings and information received, though several commented that more advice about what to do to prepare and cope with heat would be useful, as well as more locally-specific information. Among both residents and business owners, many stated that no further preparation was needed for heatwaves, or that they did not believe they could prepare more for heatwaves. Suggestions for ways to support better preparedness and reduce the likelihood or severity of impacts tended to focus on reducing vulnerability through improved home or workplace building design and reducing vulnerability due social or economic factors. Specific suggestions included subsidies for installing air-conditioning or solar panels, subsidies for electricity, and ensuring that elderly and low-income residents have affordable ways to keep cool during heatwaves. It is worth noting that in the UK a similar scheme provides assistance to economically vulnerable citizens during extreme cold weather [19]; this could perhaps serve as a model for Australian governments, though risks relating to the resilience of the power grid would need to be considered alongside the cost effectiveness of adopting such a policy.

These surveys provide an insight to the impacts experienced by residents and businesses in Western Sydney during the heatwave in February 2017, and the ways in which warnings were used. The findings highlight the important role traditional media (especially television) plays in informing residents and business owners about heatwaves, and show an interest in locally-specific information, and advice on how to prepare for and cope with extreme heat. The survey of businesses reveals that the perceived impacts on absenteeism, productivity, and turnover were significant for many; more detailed analysis of the impacts on various business types and sizes would help to generate a stronger understanding of the economic impacts of extreme heat. The findings also reveal that many residents and business owners rely on air-conditioning to cope with heatwaves, and perceive that little more can be done to prepare. Reducing vulnerability to heat through improved building design (e.g., insulation, air-conditioning, shade), and reducing vulnerability to electricity pricing and outages through solar panels, were the main suggestions to improve preparedness.

FUTURE RESEARCH

The findings of these surveys highlight several aspects that future research could usefully consider to better understand the impacts of heatwaves, ways warnings are perceived and used, and preparedness. Firstly, this work shows the possible level of interruption to businesses. Further work could:

- Undertake analyses to quantify business losses as a consequence of heatwaves.
- Examine the impacts of heatwaves on primary producers, their risk perceptions and responses to warnings. How can they best adapt into the future?



- Examine the strategies used by businesses that require working outdoors or being otherwise exposed to the heat to protect the health and wellbeing of their employees to identify 'best practice' ideas that could be used to provide advice about what to do/how to cope during the heat.
- Explore what schools and early childhood centers do to cope with and prepare for heat, how they are impacted, and what warnings they use, and what information/warnings do they share with families.
- Examine coping, preparedness and adaptation by aged care and disability providers.

Secondly, with regard to warnings and preparedness in urban settings, future work could:

- Validate the effectiveness of current encouraged measures such as attendance at cooler places. This could be undertaken by collecting attendance records for service clubs and public swimming pools, and comparing heatwave attendance to normal rates of attendance.
- Analyse TV, radio, and newspaper coverage of heatwaves as these surveys indicate that these are the main information sources for many residents and business owners. Analysis could examine to what extent the BoM's messaging is being used in the media coverage, how it is being used, and what advice is being provided.
- Examine the risk perceptions, preparedness, and coping strategies of culturally and linguistically diverse communities.
- Use online surveys shared through Facebook/Twitter to find out how younger people use warnings, prepare for and cope with heatwaves.
- Investigate hot weather subsidies and cost effectiveness.
- Many of the preparedness actions identified by residents and business owners related to building design or modification; for instance, installing air-conditioning, insulation, or shade. Future research could examine the extent to which heatwave conditions are considered by homeowners or businesses when designing new sites or undertaking renovations.
- Links between research on heatwaves and work by the Water Sensitive Cities CRC could also usefully be explored, particularly with regard to long-term preparedness strategies for both residents and businesses.



REFERENCES

1. Bom, *Special climate statement 61—exceptional heat in southeast australia in early 2017*. 2017, Bureau of Meteorology, Australian Government.
2. Bom. *Climate data online*. n.d. 08.03.2017]; Available from: <http://www.bom.gov.au/climate/data/index.shtml?bookmark=201>.
3. Åström, C., K. Ebi, J. Langner, and B. Forsberg, *Developing a heatwave early warning system for sweden: Evaluating sensitivity of different epidemiological modelling approaches to forecast temperatures*. International Journal of Environmental Research and Public Health, 2014. **12**(1): p. 254-267.
4. Toloo, G., G. Fitzgerald, P. Aitken, K. Verrall, and S. Tong, *Evaluating the effectiveness of heat warning systems: Systematic review of epidemiological evidence*. International Journal of Public Health, 2013. **58**(5): p. 667-681.
5. Coates, L., K. Haynes, J. O'brien, J. Mcaneney, and F.D. De Oliveira, *Exploring 167 years of vulnerability: An examination of extreme heat events in australia 1844-2010*. Environmental Science and Policy, 2014. **42**: p. 33-44.
6. Hansen, A., P. Bi, D. Pisaniello, M. Nitschke, G. Tucker, J. Newbury, . . . L. Kelsall, *Heat-health behaviours of older people in two australian states*. Australas J Ageing, 2015. **34**(1): p. E19-25.
7. Hatvani-Kovacs, G., M. Belusko, N. Skinner, J. Pockett, and J. Boland, *Heat stress risk and resilience in the urban environment*. Sustainable Cities and Society, 2016. **26**: p. 278-288.
8. Hatvani-Kovacs, G., M. Belusko, N. Skinner, J. Pockett, and J. Boland, *Drivers and barriers to heat stress resilience*. Science of the Total Environment, 2016. **571**: p. 603-614.
9. Hatvani-Kovacs, G., M. Belusko, J. Pockett, and J. Boland, *Assessment of heatwave impacts*. Procedia Engineering, 2016. **169**: p. 316-323.
10. Nairn, J.R. and R.J. Fawcett, *The excess heat factor: A metric for heatwave intensity and its use in classifying heatwave severity*. International Journal of Environmental Research and Public Health, 2014. **12**(1): p. 227-53.
11. Nairn, J.R. and R.J. Fawcett, *Defining heatwaves: Heatwave defined as a heat-impact event servicing all community and business sectors in australia*, in *CAWCR technical report*. 2013, CSIRO and the Bureau of Meteorology: South Australia.
12. Bom. *Heatwave service for australia*. n.d. 10.03.2017]; Available from: <http://www.bom.gov.au/australia/heatwave/>.
13. Lowe, D., K.L. Ebi, and B. Forsberg, *Heatwave early warning systems and adaptation advice to reduce human health consequences of heatwaves*. International Journal of Environmental Research and Public Health, 2011. **8**(12): p. 4623-4648.
14. Loridan, T., L. Coates, D. Argueso, S. Perkins-Kirkpatrick, and J. Mcaneney, *The excess heat factor as a metric for heat-related fatalities: Defining heatwave risk categories*. Australian Journal of Emergency Management, 2016. **31**(4): p. 31-38.
15. Akompab, D.A., P. Bi, S. Williams, J. Grant, I.A. Walker, and M. Augoustinos, *Awareness of and attitudes towards heat waves within the context of climate change among a cohort of residents in adelaide, australia*. Int J Environ Res Public Health, 2012. **10**(1): p. 1-17.
16. Saniotis, A., A. Hansen, D. Kralik, P. Arbon, M. Nitschke, and P. Bi, *Building community resilience to heatwaves in south australia*. Transactions of the Royal Society of South Australia, 2015. **139**(1): p. 113-120.
17. Abs. *Small business in australia*. 2002 27 Feb. 2017]; Available from: http://www.abs.gov.au/ausstats/abs@.nsf/mf/1321_0.
18. Nsw Health. *How to prepare for a heat wave*. 2016 2 December 2016 11 April 2017]; Available from: <http://www.health.nsw.gov.au/environment/beattheheat/Pages/prepare-for-heat.aspx>.
19. Gov.Uk. *Cold weather payments*. n.d. 15.05.2017]; Available from: <https://www.gov.uk/cold-weather-payment>.