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Extreme heat driven by the climate emergency: impacts on the health and wellbeing of public housing tenants in Mildura, Victoria

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ACKNOWLEDGEMENTS

We acknowledge that our work is being conducted on the lands of the Gadigal people of the Eora Nation, Sydney, New South Wales and on the lands of the First People of the Millewa Mallee, including the Latji Latji, Paakantji (Barkindji), Ngiyampaa, Mutthi Mutthi, Wemba Wemba, Tati Tati and Barapa Barapa people. We also acknowledge the generous support from The Jack Brockoff Foundation.

CITATION

Please cite this document as:
Lander, J., Breth-Petersen, M., Moait, R., Forbes, C. and Stephens, L., Dickson, M. (2019). Extreme heat driven by the climate emergency: impacts on the health and wellbeing of public housing tenants in Mildura, Victoria. Report prepared for Mallee Family Care. Sydney: Authors.

INTRODUCTION

The current climate emergency is driving more severe periods of extreme heat, increasing the vulnerabilities of those living in public housing without adequate cooling. However, no new policy changes have been made since 1997 addressing the need for cooling in Victoria's public housing. This study identifies the impacts of living with extreme heat in public housing without air-conditioning on the health and wellbeing of public housing residents.

METHOD

Focus groups and interviews were used to explore the lived experience of residents living in public housing in Mildura as well as the opinions of service providers who support them.

RESULTS

Significant evidence emerged of the detrimental impact of prolonged extreme heat exposure on the physical, mental and social health and wellbeing of public housing residents. Residents' struggle to gain relief from extreme heat within their homes was also demonstrated.

DISCUSSION

The results of the study make very clear the impact of inadequate housing and cooling methods on residents' physical and mental health, as well as their social and economic wellbeing. The consequences identified were found to be inter-related with the potential to have recurrent effects for both residents and the greater community into the future.

RECOMMENDATIONS

The findings highlight that the current condition of housing is unfit for habitation during periods of prolonged extreme heat exposure. The Victorian State Government should adopt the precedent set by the NSW Aboriginal Housing Office and urgently review their policies regarding provision of air conditioning for public housing residents.

CONCLUSION

This research established the impact of prolonged heat exposure and the lack of adequate cooling on the health and wellbeing of public housing residents and urgently recommends implementation of solutions to prevent further harm to both residents and the greater society.

‘Health and wellbeing heavily influenced by climate change’

1. Introduction

A significant volume of published scientific research attests that worldwide temperature increases are occurring on an unprecedented scale that cannot be attributed to natural climate variations alone (Rosenzweig et al., 2008). In Australia, where weather can be variable and often extreme (Zhang et al., 2018), climate change is driving hotter and more intense heatwaves (Hughes, Hanna & Fenwick, 2016). Prolonged periods of extreme heat[1] have been identified as the most dangerous of all extreme weather conditions in Australia, with major heatwaves having caused more deaths since 1890 than bushfires, cyclones, earthquakes, floods and severe storms combined (Hughes, Hanna & Fenwick, 2016).

This study was commissioned by Mallee Family Care (MFC); an organization that advocates for vulnerable residents in the Mallee region of Victoria in partnership with a team of researchers from the Sydney School of Public Health at the University of Sydney.

The Mallee region lies in north-west Victoria and south-west New South Wales, Australia. The Mallee includes a number of Local Government Areas (LGAs) including Mildura, Swan Hill, Robinvale, Gannawarra and Buloke. Within these areas there are large numbers of people living in public housing. Due to the vast area the Mallee covers, for the purposes of this paper, statistics from Mildura LGA will be used to show climate data and demonstrate the experiences of those living in public housing. Mildura also served as the site of our data collection.

1.1 Health implications of extreme heat exposure

The health and wellbeing of individuals and their communities are heavily influenced by climate change and exposure to extreme weather events (Zhang et al., 2018). Physical and psychological health and social and economic wellbeing are interrelated and should all be taken into account when assessing the overall impact of prolonged exposure to extreme heat.

1.2 Physical health

The physiological effects on individuals of prolonged exposure to extreme heat are known and well documented. Heatwaves consistently increase overall mortality and morbidity rates (Campbell, Remenyi, White & Johnston, 2018; Basu & Samet, 2002; Ye et al., 2011). Hospitalisations for renal conditions, ischemic heart disease and acute myocardial infarction have been shown to increase, as well as admissions to emergency departments and ambulance call-outs (Bi et al., 2011; Fisher et al., 2017). Certain population groups experience increased vulnerability during periods of extreme heat. These include the elderly, especially those who live alone (Campbell, Remenyi, White & Johnston, 2018; de Vaus & Qu, 2015), culturally and linguistically diverse (CALD) communities (Hansen et al., 2014) and those suffering from pre-existing chronic conditions (Campbell, Remenyi, White & Johnston, 2018; Bouchama et al., 2007).

1.3 Psychological health

Prolonged exposure to extreme heat has detrimental psychological impacts equivalent to that of experiencing unemployment (Ding, Berry & Bennett, 2016). During heatwaves, hospital admissions for psychological and behavioural conditions increase (Berry et al., 2018; Hansen et al., 2008; Zhang et al., 2018) and suicide rates spike (Page, Hajat & Kovats, 2007; The Lancet, 2018). Extreme heat amplifies the stresses of everyday life; heat-related sleep disruption, lethargy and a reduced level of functioning negatively reinforce each other (Ding, Berry and Bennett, 2016). People living with existing mental health issues are particularly vulnerable to heat-related morbidity during prolonged periods of extreme heat (The Lancet, 2018; Bouchama et al., 2007). Medications such as antipsychotics and antidepressants often alter the body’s ability to thermoregulate, thereby increasing susceptibility to the health impacts of extreme heat (Queensland Government, 2015; Hansen et al., 2008). Research also indicates that extreme heat may have long-term effects on psychological health in communities (e.g. Hansen et al., 2008; O’Brien, Berry, Coleman & Hanigan, 2014).

1.4 Economic impacts

Prolonged extreme heat has a range of economic impacts across both public and private sectors. This also applies at the individual level, including the negative economic impacts of higher electricity bills due to use of household cooling devices for those who have access to these, the loss of income from lost workdays due to extreme heat and in some cases increased medical expenditure (Saman et al., 2013; Toloo, Guo, Turner, Qi, Aitken & Tong, 2014).

1.5 Impact on social well-being

There is evidence of adverse social consequences arising from prolonged extreme heat exposure; for example, extreme heat places constraints on daily activities and social interactions (Williams et al., 2013; Bambrick, Capon, Barnett, Beaty, and Burton, 2011). Further, trauma and safety concerns arise, associated with increased aggression and violence during heatwaves (Bambrick et al., 2011). Lack of heat relief may trigger irritability and psychological distress, which can increase risky behaviours such as alcohol consumption and violent crime (Hansen et al. 2008; Queensland Government, 2017, Bambrick et al., 2011; Nitschke, Tucker and Bi, 2007). Personal safety is also compromised when windows are kept open at night to cool premises (Williams et al., 2013).

1.6 Housing, extreme heat and health

Housing is a key determinant of health and well-being which, in the face of increasing climate emergencies, including extreme temperatures and weather events, has the potential to either protect residents against climate-related harms (Howden-Chapman, 2004) or expose them to increased risk of the adverse physical, psychological and social harms noted above.

Housing has both direct and indirect effects on health. Direct effects result from the condition of the property, for example mould and poor ventilation giving rise to respiratory infections. Indirect effects include stress and anxiety related to housing instability, adversely impacting the psychological and social wellbeing of individuals and their families (Suglia, Duarte, & Sandel, 2011).

Socio-economic factors significantly influence the health-related effects of housing. Housing unaffordability can result in people relying on rental or public housing, which is often substandard and unsafe and poorly adapted to high temperatures (Hansen-Easey et al, 2016; Instone, Mee, Palmer, Williams & Vaughan 2014; Vaidyanathan et al, 2019). This creates a significant equity issue given that a high proportion of Aboriginal people and migrants live in public housing (Australian Bureau of Statistics, 2010). The potential for homelessness also exists. Renters have little influence over their landlords’ decisions whether to improve the thermal efficiency of their homes or not (Parliament of Australia, 2019),

[1] According to Australia’s Bureau of Meteorology, extreme heat is “*a period of at least three days where the combined effect of excess heat and heat stress is unusual with respect to the local climate.*” Also commonly referred to as heatwaves, these are identified when the average temperature reaches a heat health temperature threshold for a district. The threshold is the average temperature above which rise in mortality can be expected. According to Victoria’s Heat Health Plan (2015), the Mallee District, in which the study’s location Mildura lies, has a heat health threshold of 34 degrees.

‘The majority of public housing dwellings do not have air conditioning’

and those on low incomes are often unable to pay for cooling devices or the electricity needed to run them.

For those already belonging to vulnerable groups (e.g. the elderly, those living alone and those living with chronic physical and mental health issues), being forced by socioeconomic disadvantage to live in substandard, uncooled or unsafe housing will amplify their vulnerability to heat (Queensland Government 2017).

1.7 Policy environment

Current legislation and policies at the national, state and regional level in Australia commonly do not provide for air conditioning in public residences. Housing is not included in the legislative powers of the Australian national government, which means there is no national policy regarding housing, public housing and the provision of cooling systems (Kelly, Hunter, Harrison & Donegan, 2013).

Housing is a matter of state responsibility. Throughout Australia, state laws relating to residential tenancies set out general provisions for the cleanliness of the property upon lease and the obligation of the landlord to conduct repairs (Martin et al., 2016). State governments are under the same legal obligations as landlords: to provide tenants with housing that is ‘fit for habitation’ (e.g. New South Wales Government, 2010). However, this term is not explicitly defined and generally does not stipulate the provision of cooling facilities such as air conditioning. While there is general uniformity in public housing policies across states, some variations and exceptions do exist; for example, variations exist regarding maintenance of private air conditioners, subsidies for electricity costs and whether air conditioning units can be left at the property after a tenant leaves. In some states, policies for government employee housing provide for cooling or air conditioning and/or subsidies for electricity costs, depending on the location. Interestingly, in NSW only, the NSW Aboriginal Housing Office’s policy is to provide air conditioning in properties located within the Isotherm 33 boundary (Aboriginal Housing Office Air Conditioning Policy, 2016).

In all states and territories, tenants who can provide compelling reasons for the installation of any special equipment or appliances (usually severe medical conditions that require climate control) may be eligible for government funded assistance or reimbursement (e.g. King, 2014). However, lack of transparency and difficulty of access to this assistance have been cited as major barriers to applying (Ferguson, 2016; King, 2014).

1.8 Regional physical and policy context

Temperature data from the Bureau of Meteorology suggest that worldwide global heating trends are replicated in Mildura. For example, between 1998-99 and 2018-19 the number of days during the period from November to March with temperatures over 34°C has increased from 41 to 64 days. Likewise, the number of consecutive days over 34°C has increased from 30 to 52 days and the number of heatwaves (three or more days over 34°C) from 6 to 9 episodes.

Average monthly temperatures during the hotter months have risen appreciably and, most importantly, midnight temperatures during heatwaves generally remain over 20°C, the common maximum temperature regarded as conducive to restorative sleep and relief from the heat (see Appendix 1 for more detail). The average number of days per year reaching temperatures over 35°C is predicted to reach 76 days in 2070, compared with 32 days currently (Ferguson, 2016). With climate change predicted to bring higher temperatures and more extreme heat waves, heat related deaths in Victoria are projected to rise to up to 604 per year by 2020 and up to 1,318 per year by 2050 (Hansen Partnership, 2013).

In Mildura, 14% of all households who are renting are living in public housing; the percentage of the total population living in public housing in Mildura is almost twice the Victorian average. Of the 780 public housing dwellings in Mildura, the ABS 2016 Census indicates 30.6% are one parent households; 24.1% are households with two parents; and 45.3% are lone person households. Further, 25% of households have residents of Aboriginal or Torres Strait Islander descent.

Within Mildura, public housing is provided by the Victorian State Government’s Department of Health and Human Services. Relevant legislation for the provision of social housing in Victoria currently contains no minimum standards or requirements for cooling homes (Toohey, 2010; Vaidyanathan, et al., 2019), although these do exist for heating.

In the absence of legislative requirements, the task of cooling a home falls to the tenant. However, the numerous requirements for making home alterations (Victoria State Government, 1997) create administrative and bureaucratic hurdles, limiting the ease with which people can install air conditioning units. Furthermore, people living in public housing have low incomes, with extremely limited access to the capital required to make investments in cooling systems (Perkins, 2019). With no security of tenure, there is little incentive to take on the financial burden of investing in the property (Saman et al., 2013).

Public housing tenants are often those who experience marginalisation, vulnerability and disadvantage and many live with chronic physical and mental health conditions. As noted previously, it is exactly these groups who are most vulnerable to the effects of extreme heat (Toohey, 2010).

Despite Mildura experiencing extreme heat conditions each summer, the majority of public housing dwellings do not have air conditioning of any description. It is therefore imperative that minimum standards be introduced for public residencies in Mildura and other regions experiencing extreme heat to meet the fundamental needs of tenants and protect them from the effects of global heating (Toohey, 2010). This paper is intended to provide a voice to this group of people who experience exhausting living conditions but are denied (except for those with certain medical conditions) access to air conditioning by their public housing landlord.

1.9 This study

Since 2013, Mallee Family Care (MFC) has been advocating for tenants of the Victorian Office of Housing (a division of the Victorian Department of Health and Human Services) in relation to living with extreme heat in public housing without access to air-conditioning. MFC recognises the significant impact of extreme heat on Mildura residents, especially those experiencing vulnerability in public housing. This study was undertaken on behalf of MFC by researchers from the University of Sydney School of Public Health with the aim of answering the question: What is the impact of extreme heat on the health and well-being of public housing residents living in premises without air conditioning in Mildura, Victoria? Evidence collected in this research will contribute to a review of policy regarding the provision of air conditioning in public housing premises in Mildura. This study has been approved by the University of Sydney Human Research Ethics committee (Approval number 2019/329).

2. Methods

This study is primarily qualitative, using focus groups and interviews to explore the lived experience of residents of public housing in Mildura as well as the opinions of the service providers who support them. Six focus groups were conducted, five of them with community members (23 participants) and one with service providers (7 participants). Two one-on-one interviews were conducted. Participants ranged in age from 18 to 71 years and came from a variety of diverse backgrounds. The amount of time participants had spent living in public housing ranged from 2.5 years to their entire lives. Participants were recruited by means of flyers placed in community centres and workplaces as well as Facebook posts. The project received publicity in local radio and print media. Participants self-registered by email or text message. At least two researchers were present for each focus group, with one leading the discussion and the other(s) taking notes. The focus groups were audio-recorded; informed consent was obtained.

For this report, we analysed the recorded data, identified themes and allocated comments and quotes to each theme. Participants and focus group locations have been de-identified to preserve anonymity. To respect the valuable contributions of those in our study, we will refer to participants as residents or service providers. Service provider comments have been appended to resident comments where relevant. We plan to summarise our findings for those involved at the close of the project.

3. Results

The data obtained from focus groups and interviews falls into two main categories. The first is data which follows closely the impacts of extreme heat identified in the literature, namely on physical and mental health, on social wellbeing and on individual financial security. The second group comprises local factors: the times and places where heat is most problematic for public housing tenants, the solutions they have attempted to implement and their experiences of applying to have air conditioning installed. These major themes are described in more detail below.

3.1 Times and places most affected by extreme heat

At the beginning of each focus group, residents were asked when and where they noticed extreme heat affecting them the most.

3.1.1 Time of day

During periods of extreme heat, all residents agreed that there is no real respite from the heat at any time during the day. There was general agreement that it starts to get hot each day by 11am and is at its worst from 3pm until 5pm or 6pm.

3.1.2 Places most affected by heat

Residents agreed that it is hotter inside non-air-conditioned houses than outside, but many say that they are forced to stay indoors to reduce the risk of sunburn, especially if they have children with fair-skin. Depending on the orientation of the house, different rooms heat up at different times, but residents have recorded temperatures in the 40°C s and 50°C s, and even higher.

3.1.3 Night time heat - inability to sleep

Residents described night-time heat as being as bad as (or even worse) than daytime heat since there is *"nowhere to escape during the night"*, whereas during the day, it is possible to escape to the river, pool, library or shopping centre. Many resolve this by walking around outside at night or drinking alcohol until the temperature drops a little, around 4 am. Safety concerns preclude many residents sleeping outside or leaving windows open, although some do sleep on their lawns.

3.2 Physical health

During the focus groups and interview, residents were asked how extreme heat impacts on their health and wellbeing. Generally, it seemed that most residents were comfortable discussing physical impacts of heat, however it is possible that some may not have felt comfortable discussing pre-existing conditions or medications in the presence of researchers or other residents. This means that the true extent of physical impacts of heat may be more wide-ranging than the results described below. This section focuses on aspects of physical health adversely impacted by living in non-air-conditioned housing, rather than heat-related health issues more generally.

Many direct and indirect physical impacts of heat on physical health were discussed. Residents also discussed examples of pre-existing chronic conditions which either worsened during periods of extreme heat, or increased vulnerability to the physical adversities of living in extreme heat. Residents also spoke about the fact that extreme heat affects medications taken for physical conditions.

3.2.1 Direct physical impacts of heat

3.2.1.1 Heat stroke and heat exhaustion

Heat strokes and heat exhaustion had been experienced by several of the residents. One resident said that during summer she is in and out of hospital due to heat-related issues, while another stated that she gets heat stroke every summer. A third talked about her partner collapsing twice due to extreme heat last year.

3.2.1.2 Sweating, dehydration and headaches

Heat-related sweating, dehydration and headaches were common themes discussed by residents, with a couple of them stating that severe sweating was a daily and constant occurrence. Many said that they found it difficult to drink enough to stay hydrated, especially during night time heat. One resident said that she has been hospitalized during summer due to dehydration, and another said that she becomes so dehydrated that she starts to shake. A couple of residents mentioned that they get headaches during periods of extreme heat, and one resident whose grandson suffers from migraines said that the migraines occur more often during these periods.

3.2.1.3 Breathing

A common theme amongst residents was that being unable to keep cool during periods of extreme heat negatively impacted breathing. A number said that they experience shortness of breath or heaviness of the chest, and some of the residents also spoke about their children struggling to breathe, especially during the night. One resident said:

"It's terrible, you can't even breathe. My son last year got sick, he couldn't breathe so we had to rush him to hospital."

These breathing issues were described as being even more problematic for those suffering from asthma. One resident said that in summer, her son's asthma would necessitate multiple hospital trips, and lead to numerous instances of being sick or lying awake during the night.

'...extreme heat impacted upon their prescribed medication'

3.2.1.4 Physical impacts of heat specific to infants and children

Physical adversities specific to children living in homes without air conditioning were also described by residents. One resident said:

"Babies are constantly sick. You are constantly needing Nurofen, Panadol because they've got higher temperatures..."

A couple of residents talked about their children developing eczema during periods of extreme heat, while several mentioned children getting nosebleeds during hot nights, which they noted does not happen in cooler weather.

3.2.1.5 Heat and pregnancy

Some of the residents who had been pregnant during summer spoke about the extreme heat being worse during pregnancy. One resident who had been highly pregnant in summer without access to air conditioning said:

"I thought I was going to die... Like I honestly wanted to die because it was just so hot. I didn't want to leave the house, I isolated myself, just lying in the hallway... So I just lay there like a fat whale, trying to breathe and telling my husband, 'I can't breathe, I'm gonna die, I'm gonna die'... The heat is like ten million times worse for you."

Another resident who had also been pregnant during summer months stated:

"No shoes at all, all summer cause my feet just swelled that much. And oh my god. I spent 90% of my third trimester down the river or at the lake."

3.2.1.6 Pre-existing conditions

Many residents who spoke about pre-existing medical conditions said that chronic conditions or illnesses worsen during extreme heat, and some discussed that their condition makes them more vulnerable to the physical adversities of living in extreme heat. Epilepsy was mentioned by multiple residents who said that both children and adults with epilepsy are worse off during extreme heat, as they are at higher risk of experiencing seizures and convulsions when they become too hot. A resident spoke about her father's kidney disease worsening when he was unable to escape the extreme heat. Another said that she experiences recurring abscesses during hot periods as she is constantly overheated, and this results in numerous hospital visits in summer for surgery and wound care.

Service providers suggested that not providing air conditioning could be a matter of life and death and noted cases where elderly women have died during extreme heatwaves in residences without air conditioning. However, cause of death figures often do not take into account the effect of heat, instead ascribing death to other factors, for example respiratory illness.

3.2.1.7 Medications for physical conditions

Numerous residents revealed that the extreme heat negatively affects their medication. One stated that:

"Those medications are often not designed to work in that kind of extreme heat or temperature, so it just made it a lot worse..."

One resident who has been taking strong pain relief medication said that the medication doesn't work effectively during extreme heat, and as a result had to be transferred to hospital by ambulance during a period of extreme heat last summer as her pain became too severe. Another stated that the extreme heat affected her medication so that it made her lose balance, and therefore was not able to walk and instead had to crawl on her knees. Medication impacting on appetite was brought up by a resident who said that lack of appetite as a result of medication for a thyroid disorder was made worse by periods of extreme heat.

3.2.2 Indirect physical impacts of heat

3.2.2.1 Nutrition

Extreme heat impacting upon residents' nutrition was brought up as a theme in all focus groups, as well as an interview. Numerous residents said that having no air conditioning makes it is impossible to cook at home during heatwaves, as it is simply too hot inside and cooking using the stove or oven heats the house up even more. One resident stated:

"I try to avoid using the oven at all. Or I'd cook in my bathroom in my conventional oven thing, so it didn't heat up the rest of the house."

To avoid or reduce cooking, many residents said that they heat up readymade food, such as meat pies, in the microwave, or order takeaway, which can be very expensive. As one resident mentioned, many public housing tenants do not own cars and are therefore not able to drive to eat out.

A recurring theme spoken about by residents was lack of appetite during periods of extreme heat, with one resident saying:

"If you cook in the house you can't even eat cause you're so hot and bothered."

Another said that as her appetite was reduced during periods of extreme heat, she would eat very lightly and hence have less energy. Furthermore, appetite loss as a side effect of taking medication is more severe during extreme heat. In particular, children's reduced appetite was a significant concern for a number of residents, who said that their children refuse to eat when it becomes very hot or will only eat ice blocks or icy poles.

Service providers agreed that extreme heat has potential nutritional impacts, since people *"take the easy way out"* and buy takeaway rather than cooking at home.

3.2.2.2 Physical activity

Several of the residents involved in focus groups spoke about the fact that they reduce their levels of physical and outdoor activity during periods of extreme heat. However, this means that many of them are forced to stay in hot, non-air-conditioned spaces at home.

3.2.2.3 Danger to physical health resulting from lack of sleep

One resident identified that her lack of sleep during periods of extreme heat due to living without air conditioning meant that she was less alert and therefore believed it was too dangerous for her to drive.

3.3 Mental health

Changes in mental health was one of the dominant themes in all focus groups and interviews. All groups seemed to speak openly about mental exhaustion, mood changes, and feelings of worry and despair. Many residents seemed comfortable disclosing that they had a mental health condition, however only a few went into detail or revealed which type of mental health issue they experienced. It is possible that some residents were not willing to share this type of information in front of the focus group.

‘...many children and teenagers roam the streets at night as it is too hot in their homes’

3.3.1 Mental health conditions impacted by heat

All residents who did reveal that they or a family member had a mental health condition agreed that during extreme heat their condition becomes worse, and they feel less able to cope with the heat and with their condition. Depression was specified by a number of residents as a mental health condition that becomes notably worse during periods of extreme heat, with disrupted sleep and routines making it difficult to cope. One resident said that, as her children become more demanding in the heat, her depression worsens.

Another resident touched upon her daughter’s attention-deficit/hyper-active disorder (ADHD) worsening during extreme heat:

“Everyone gets agitated when it’s hot, especially my kid with ADHD. She just scream and yell and punch things, like when she gets too hot you can see it in her face that she just overly hot.” “She used to go crazy and she’d like trash the entire house...”

3.3.2 Medications for mental illness/disorders

Several residents revealed that extreme heat impacted upon their prescribed medication. Some residents discussed the fact that being physically and mentally tired from lack of sleep during periods of extreme heat impacted upon the effectiveness of their medication.

Other residents disclosed that they would experience exacerbated side effects from their medication during periods of extreme heat and felt that they were less able to cope with the heat. A resident on heavy medication for her mental health conditions described how her medication affected her during extreme heat:

“I’d experience shaking in my body and just like my whole body is on fire, not just my skin but my bones were feeling like they were on fire and the only thing I could do was just get under the shower until I felt that yeh ‘okay you’re alright now [name of resident], you can move and have heaps of water to drink and stuff like that’. My symptoms were extended, put it that way, and the doctors were very concerned about that, and yeah so I found it quite a challenge trying to just keep my body cool.”

The same resident said that the drug effects would become stronger, adding that:

“I was just so confused and I didn’t have a clue what day it was. It was just horrific.”

Another resident has a grandson with bipolar disorder, and his prescribed medication makes him experience sleep deprivation and appetite loss, both of which are more prominent during periods of extreme heat.

Service providers noted that, in the light of increased alcohol intake during extreme heat, the interaction of alcohol and drugs such as antidepressants can lead people to behave in unexpected ways.

3.3.3 Mental exhaustion

All residents agreed that extreme heat and resulting lack of sleep left them mentally drained and unable to think or cope with daily tasks. Two of the residents stated:

“...it’s heavy and you know the next day’s going to be hotter... and you can’t escape it cause there is no way to cool you down. It’s just heaviness.”

“You feel fatigued, you’re just fatigued... drained from the moment you wake up.”

3.3.4 Mood changes

Changes in mood from extreme heat was a recurring theme, with increased irritability and agitation frequently mentioned in all groups and interviews. One resident explained how lack of sleep during periods of extreme heat would make her *“turn into a devil”*, causing her to be overtired, emotional, unsettled and unable to cope. Other residents said:

“You can’t function, it’s that hot. And people get really miserable and really cranky too when the hot weather comes.”

Residents particularly talked about children becoming more grumpy, uncomfortable and agitated during periods of extreme heat since they were unable to cool down and settle at night. One member spoke about this leading to antisocial behaviour amongst children.

3.3.5 Feeling like giving up

Many residents mentioned that living through these periods of extreme heat without being able to cool down made them feel like giving up. This hopelessness is revealed in the following quotes by residents:

“I just wanted to die. I just gave up, I really did, I gave up. I thought I don’t wanna do this anymore, this is just beyond words.”

“You get to the stage where you just don’t want to deal with anything, you’ve just had it.”

“You’re so totally over it, you’re over everything. Extreme heat, it’s so draining.”

One resident noted that during periods of extreme heat, she would turn on the cold water and just sit in the bottom of her shower with her clothes on, saying that:

“It was like it was just too much, and that was the end of it for me... You cannot function like you normally would.”

3.3.6 Concern caused by extreme heat

Residents voiced their concerns about future heat, especially in regards to climate change, which they seemed to understand well as a serious issue. Many agreed that temperatures are becoming much more extreme and heatwaves lasting longer and becoming more unbearable as time progresses, prompting fears for the future of their children and their life in Mildura. Frustrations were evident because residents noted that global heating is out of their control, and they are already struggling to cope with the current extreme temperatures.

“Concerned that it’s gonna get even hotter... If this is what it’s like in 2019, what is it gonna be like in the future?”

“I’m 65, what about the 70. I think about the 70 without air conditioner. I think it might be very hard life for the 70’s.”

Numerous residents discussed their worries about the health effects of extreme heat. Many of these worries were aimed at the health of people vulnerable to the effects of extreme heat, such as elderly residents, children, homeless people and people with health conditions or disabilities. It was evident that many residents worried about family members with health conditions, such as those with epilepsy, who need to be checked on regularly during periods of extreme heat. One resident, an Aboriginal woman, expressed her constant concerns for her Elders, especially those living without air conditioning as she worries about them fainting. Several residents also spoke about their concerns for their children’s health as well as their safety, as many children and teenagers roam the streets at night as it is too hot in their homes. One resident

‘Feelings of safety in the community change during periods of extreme heat’

who has a child with ADHD said that she also worries about how the extreme heat will affect her behaviour, attention and learning at school, as she already struggles with attention and behaviour issues even without the heat. Some residents also spoke about their concerns for the wellbeing of their pets, who suffer when it becomes too hot.

3.4 Social wellbeing

3.4.1 Isolation

The majority of residents agreed that they spend considerably more time secluded in their homes during periods of extreme heat, which leads them to feel isolated. However, for residents without air conditioning, remaining at home comes with its own set of problems.

3.4.2 Family wellbeing

Family unity and wellbeing were themes touched on by a number of residents. Family members being irritable in their hot homes and disrupted routines all impact on family unity. Children and teenagers staying out at night to avoid indoor heat is a cause for concern for parents. A few residents alluded to heat-induced aggression leading to domestic violence. However, it is possible that this is experienced by others who may not have been comfortable sharing this information with the group.

Another resident also spoke about her shame when she repeatedly found her father sleeping on a bench at the mall to escape the heat, causing others to look down on him. One resident who lived through many summers in public housing without air conditioning, but now has air conditioning in her home, spoke about the positive improvements to her family’s wellbeing as a result of now having air conditioning:

“It’s made a huge difference now that we have aircon. We are calmer, have a better family life. We can sit down and have a meal properly without rushing. We can sit down and have a discussion. Everyone’s calm and it’s just so so comfortable, it just makes living so much easier and more comfortable and you can think properly. I actually look forward to coming home now.”

3.4.3 Antisocial behavior in the community

Spikes in antisocial behavior during periods of extreme heat was a key theme talked about by residents. It was identified by many that not having respite from the heat makes people more likely to roam the streets at night as their homes are too hot to sleep in, which, paired with increased alcohol consumption, leads to more instances of violence and crime in the community than in cooler periods.

3.4.3.1 People roaming the streets at night

Many residents raised their concerns about people roaming the streets at night because their homes become too hot. During the day, they are mostly indoors to stay shaded from the sun, and as soon as it becomes dark, they feel they need to get out of the house.

In particular, increases in children and youth on the streets during extreme heat was agreed upon by residents. One resident mentioned that he sees 10-year-olds on the street until midnight during periods of extreme heat. Several residents agreed if there was cooling in the home, they’d be less likely to go outside roaming the streets at night. One resident said:

“If they had cooling they’d be like, no I’m too hot I’m gonna chill at home, it’s too hot, it’s true.”

3.4.3.2 Increased crime and vandalism

Some residents stated that the increase in people roaming the streets at night during periods of extreme heat results in more break-ins and assaults.

Some residents said that there was more youth crime during these periods due to young people being awake late at night, with one resident saying that:

“I guess it’s the only time kids can go out and do anything and it’s at night and that causes a lot of conflict you know. Lot a little kids get up to mischief too because it’s night time.”

3.4.3.3 Increased substance use

There was general agreement that alcohol consumption and drug use increase in Mildura during periods of extreme heat, particularly amongst youth. Increased alcohol consumption was attributed by many residents to the heat. Some even suggested that people drink more in order to be better able to sleep as their home is *“like a sauna.”* It was mentioned that particularly at night time, many people meet at the river to drink beer with friends. As a result of increased alcohol consumption, spikes in alcohol-specific injuries were also evident during these periods, as noted by one resident. Residents also noted that during summer, pubs and bars are packed with people drinking as they find respite from the heat. Increased drug use during extreme heat was also mentioned as a way of being able to sleep in hot homes, and as a way of numbing reality:

“There’s nothing else to do. To numb their reality of what’s really happening they turn to drugs.”

3.4.3.4 Increased community violence

Residents discussed increased rates of violence in the community during periods of extreme heat. Some noted the heat causing tempers to flare, with one resident stating:

“Well they’ve been getting into fights cause you’re hot your bothered like you’re tired, you’re frustrated”

Many spoke about violence resulting from increased alcohol consumption as well as staying out late. One resident, when speaking of more people drinking at pubs during periods of extreme heat, said:

“And that’s when the violence comes in, the domestic fights. When the husbands have been drinking or over drinking and they come home and take it out on their family.”

Violence amongst youth was also mentioned, with a resident stating the following:

“I’ve called the police on children in this area 3 o’clock in the morning cause I’ve seen one kid smash another kid in the head with a scooter. I was mortified.”

Service providers commonly see irritability and indeed violence resulting from sleep deprivation, particularly when high overnight temperatures don’t allow people to catch up on missed sleep. They state that many of their clients have limited capacity for self-control.

3.4.5 Feelings of safety in the community

Feelings of safety in the community change during periods of extreme heat. Some residents are reluctant to go out after dark, for example to walk the dog or simply to cool down, because of *“drunks”* in the street. Many lock their doors as they have noticed an increase in crime. Residents identified safer and less safe parts of the city, but do not have the means to move.

Knowing that heat is a risk factor for aggressive behaviour, service providers are concerned for

‘...some children are sent to the sick bay at school to catch up on sleep’

the safety and welfare of children during periods of extreme heat. One service provider noted that normally nice people become extremely violent in extreme heat, and that one small trigger sets them off. He has observed that the number of police reports regarding family violence and hospital admissions for mental health also rise during periods of extreme heat.

3.4.6 Services in the Community

Service providers reported a decline in clients accessing services during periods of extreme heat. Clients living in *“sweatboxes”* don’t attend appointments as they are simply too exhausted and sleep-deprived. Providers are unable to locate such clients (adults and youth, even whole families) as they have left their homes to seek cooler locations in the community, for example the shopping centre, library or river.

Failure to attend appointments can have serious implications. Where clients fail to attend appointments for alcohol and other drugs counselling, they become disengaged and eventually discontinue the program altogether, since providers cannot keep a place open for clients who repeatedly fail to attend. Even if clients reconnect in colder weather, there has been a gap and possible relapse. Where there are court orders in place, clients are considered to be non-compliant and are penalised when they do not attend appointments because extreme heat renders them unable to function normally and meet their obligations.

These factors in turn impact on the service providers themselves, who are attempting to provide the services they are committed to providing but find themselves challenged, frustrated and stressed in periods of extreme heat, for example when clients cannot be found and disengage from the service.

In addition, service providers noted there are Work, Health and Safety (WHS) implications when staff go to non-air-conditioned houses, because of the heat and potentially unsafe situations involving clients. Organisations may not meet their service targets, but worker safety is important. Alternative arrangements for appointments, for example in-office meetings, generally are not a viable solution as clients still need to travel to the office in the heat. Service providers commented that having air conditioning in public housing would resolve this and enable continuity of service.

3.4.7 Education

Heat’s impact on schooling and education was a major theme discussed by residents with children. Many residents mentioned that their children’s schooling is affected because they are too tired from being up all night due to the extreme heat. The fact that Mildura’s schools have air-conditioning is an incentive to come to class, however lack of sleep means that many children do not come to school during these periods. Attendance is especially an issue for children who have to walk or catch the bus to school in the heat. According to one resident, some children are sent to sick bay at school to catch up on sleep, as they are simply too tired. Low attendance as well as minimized attention levels in turn impact on their learning and social integration, according to residents.

“Too tired to get up and go to school or sit and concentrate in the weather... bugged... harder to concentrate.”

“They’ve gotta come into school the next morning so you know they’re disengaging from stuff like that [school work] because they can’t cope because they’re tired from the heat.”

An issue with schooling, identified by one resident, is that when Mildura reaches above a certain temperature, children are sent home from school because it is too hot. However, for children residing in public housing without air conditioning, this means that they are sent home to an environment that is hotter than their schools, ironically preventing them from getting the respite they would normally have had due to the air conditioning at school.

Service providers explained that the impact of heat on students’ school attendance has far-reaching consequences. Although schools are air conditioned, the attendance rates of students living in non-airconditioned premises are consistently down because of lack of sleep due to elevated overnight temperatures and lack of suitable transport in hot conditions. If they do attend, they are sleepy and find it hard to concentrate, which in turn affects teachers’ and fellow students’ attitudes to them. According to one service provider, this becomes a long-term systemic issue, where those children grow up to have lower levels of education and are less able to articulate their concerns and advocate for themselves or even to understand their options. As young adults and parents, these students are now embarrassed by their lack of education. Lack of sleep is also thought to impact cognitive development.

3.4.8 Inter-related factors

Service providers point out that there is a complex interplay of factors working to reduce social wellbeing and even safety in public housing communities during periods of extreme heat. These become self-perpetuating. Lower levels of education, reduced communication and problem-solving skills, unrelenting heat, frustration and the use of alcohol and other drugs are a potent mix that leads to violence, including domestic violence, which spirals over a period of months. This is magnified when numbers of sleep-deprived children and adults congregate and roam in areas outside their homes.

According to service providers, interventions exist to help break the vicious cycle around mental health, substance use and violence but treatment and rehabilitation options are limited in this area. In this case, and if there is heat on top of that

“it’s almost like you are asking for the violence to continue.”

Service providers believe there are costs to society from not providing air-conditioning which flow on, for example, from reduced access to education, increased emergency department admissions for mental and physical health reasons, increased crime rates and the human costs of domestic violence. From this perspective, an investment in air conditioning in public housing would be cost effective.

3.5 Economic Impact

Residents spoke of the economic costs they had to bear as individuals when trying to combat extreme heat in their homes, in terms of implementing different forms of cooling as well as their own ability to work.

3.5.1 Costs of Cooling

Residents can’t afford to install split system air conditioning but may purchase alternatives, often needing to borrow money to do so. Running air conditioning or cooling units increases electricity bills, and the cost of electricity has risen while wages and pensions have remained steady. Some residents are reluctant to use such systems because of the running costs:

“By putting on one air con, it really uprises the cost of electricity.”

‘A number of residents spend whole days at their local shopping centre’

Service providers confirmed the financial costs to individuals who live in non-air-conditioned housing. If they use hosing, misting and extra showers and baths to cool down, water bills increase, likewise expenses for petrol if they are running air conditioning in their cars to keep cool. Some people can afford to purchase window mounted or other smaller-scale units, since these are affordable. In periods of extreme heat, however, their use of power is much higher than normal, especially if they are using the unit in closed a room and *“running it 24/7”*. Three months later the power bill comes in, for example for $2000, and they face the issue of how to pay it.

According to service providers, since the expense of running air conditioning is crippling for a family already struggling financially, some financial assistance would help alleviate the negative outcomes of living in non-air-conditioned premises outlined previously.

3.5.2 Ability to Work

Several residents explained that extreme heat in non-air-conditioned premises affects their ability to work. They mentioned the mental and physical challenges resulting from lack of sleep. Parents who work and are awake all night with children who don’t cope well with the heat find it more difficult to cope at work the next day. Personal hygiene becomes more difficult and this is compounded for those looking for work: if they have an interview after a sleepless night, they feel they don’t have much chance of landing the job.

3.6 Solutions for managing extreme heat

Five major themes emerged when residents were asked *“What do you/your family do to manage extreme heat in your home?”*. These include home cooling methods, using cooling devices other than air-conditioning in the home, visiting or staying with other people who have air-conditioning, and going to public cooling areas.

3.6.1 Home cooling methods

In an attempt reduce interior heat, many of the residents close the blinds on their windows or, in the absence of blinds, cover windows with towels, blankets and aluminium foil. One resident noted that, as a public housing tenant, she is unable to make changes to the exterior of the home such as using shade-cloth to shield areas of glass. Residents identified that the building materials of their homes, which included brick and fibro, retain a lot of heat even throughout the night. As well as this, one resident mentioned that the tin fences surrounding her property are a major issue throughout the summertime as they reflect heat.

Some residents keep doors and windows locked for safety reasons and to avoid the hot north wind and potential dust blowing in from paddocks. However, this increases internal heat and restricts air circulation.

The majority of residents use water in various forms as their way of keeping cool during periods of prolonged extreme heat. Many residents spend time in their (cold water) shower or bath and need to do this repeatedly as the relief gained only lasts for a limited time. However, numerous residents noted that the cold water that comes out of their pipes is warm for an extended period of time before cooling down at all since the water pipes run at shallow depth.

Multiple residents have bought blow-up paddle pools to use inside their homes, for themselves or their children to sit or even sleep and stay cool.

Other solutions include outdoor sprinklers and wet or frozen towels or sheets during the day or at night. Water consumption also increases with one resident explaining that she is unable to keep up with the supply of ice and cold water in her refrigerator.

Despite concerns around wildlife, insects and safety, several residents revealed that they resorted to sleeping outdoors during periods of prolonged extreme heat.

3.6.2 Cooling devices in the home

Most residents have installed one or more cooling devices in their home in an attempt to alleviate the heat they experience. Devices mentioned include but are not limited to fans, evaporative coolers (swampies), window mounted air conditioning, portable air conditioners and water coolers.

Residents noted that the various forms of cooling devices were not particularly efficient or effective. Specifically, fans just push hot air around the room and swampies don’t work over 37°C or on (rare) humid days, or when ducting is inadequate. Window mounted air conditioning devices are only able to cool one (closed) room at a time. The residents alluded to the fact that their entire family is usually packed into one room for long periods of time, including at night, stating that *“this experience is very limiting”*, especially with young children being confined to one space. Two residents explained that portable air conditioners require a lot of power, creating a dramatic increase in their power bills. One resident stopped using this device as she couldn’t justify the power bill. Portable evaporative air coolers need water to be added every two hours, meaning they cannot be used during the night, and were not considered to be very effective.

Overwhelmingly, residents agreed that refrigerated, split-system air conditioning is the most effective way of cooling down their houses, especially when ductwork travels into each room. This is emphasized by one resident stating:

“...refrigerated air conditioning... it’s really the best and most useful way.”

3.6.3 Spending time at family and friends houses with air conditioning

A significant number of residents spoke about visiting friends or family with better functioning cooling systems during periods of prolonged extreme heat, including to catch up on sleep or keep cool while pregnant. This was generally only possible during the day. Focus group members felt ambivalent about this and one resident noted:

“sometimes family members don’t want you to actually invade their privacy... you know like you’re trying to do your own thing in your house and then you have people coming around cause they’re hot... you know how it feels to be in like that predicament.”

Another resident remarked:

“By the time we all go up there, there’s over 15, 16 people in the house... and then nan has to organise dinner and that sorta thing in the heat... it’s a simple thing but it’s not right.”

3.6.4 Public cooling areas - shopping centre, library, river, public pool, local cinema, hospital

In an attempt to further understand coping mechanisms used during periods of extreme heat in Mildura, residents were asked to discuss their insight into *“any public areas where people can go to cool down during periods of extreme heat?”*. Residents all discussed a range of areas and services that people tend to use. Common areas that were widely listed included the shopping centre, library, river and public pool.

'...you have to be practically dying to be considered for air conditioning'

Other areas mentioned included the movies, the hospital, the Returned Services League (RSL) and the pub.

Every focus group and interview mentioned the river as a venue that is used by residents at all times throughout the day and night during periods of extreme heat. However, this solution is only open to those with a car. Multiple residents stated how crowded the river gets on days of extreme heat, especially with limited available shade. One of the most common topics brought up by residents are their concerns over the safety of the river, which appears calm but has strong currents and snags, dramatically increasing the risk of swimming there. Further, many residents mentioned that the youth in Mildura are especially prone to spending time both day and night by the river, with the potential for dangerous behaviours and drinking to emerge:

"...go to the river, have a beer, it's been a tough day in the heat, you know."

The local public swimming pool is used by many residents as an alternative option in trying to gain relief and stay cool during periods of extreme heat. In terms of location, it is a more accessible option but is quite expensive. Further, many residents stated that the pool had limited cooling benefits and was usually overcrowded.

A number of residents spend whole days at their local shopping centre ('Centro') to try and keep cool during periods of extreme heat. They keep up an appearance of looking at *"stuff"* as they don't want to give the impression that they are only spending time at the centre for cooling purposes.

Mildura public library was mentioned by a couple of residents and some service providers as a location people choose to escape the heat, particularly to sleep. One resident stated:

"Free place where they can actually get some respite. Go in there on a 45-degree day and you'll see a lot of public housing tenants resting."

Residents indicated that this was tolerated by library staff but wasn't considered the function of the library as it may interfere with other patrons. Residents can only use this respite until 5.30pm. Other than these major locations, a number of alternate sites were mentioned including the local cinema (comes at a cost), or the hospital, pubs and the RSL. All public places mentioned by residents were deemed overcrowded and insufficient to cater to the needs of all residents.

3.6.5 Warnings

Residents were asked *"How do you find out about coming heatwaves?"*. They spoke about their experience of methods of getting alerts and the content and functionality of these alerts. The majority of residents received warnings regarding high temperatures via television, radio or the weather application on their phone, or random alerts on their mobile phones. Otherwise, residents obtain heat warnings via word-of-mouth from family or friends. All residents agreed that extreme heat health warnings are extremely limited, common sense and repetitive, and not useful in helping them cope during periods of extreme heat. This was articulated by one resident:

"Warnings don't change anything, you're gonna be hot and you know you're gonna cook."

3.7 Applying for air conditioning

3.7.1 Experience of applying and installing their own air conditioning

Residents were asked about their experiences of trying to have air conditioning installed. Several main themes emerged. Residents specified that without the presence of an eligible chronic medical condition, the only other way to get air conditioning is by paying for and installing it themselves. Before installing the air conditioning however, residents stated that approval must be gained from the public housing authority via an application. Many residents discussed that although they are paying for it themselves, the application requires details and quotes from certified plumbers and electricians before it can be processed. Residents brought up that once approved and installed, they have to pay for ongoing running costs and any additional maintenance of their air conditioner out of their own money. Further, multiple residents expressed annoyance that if they take their air conditioner with them upon departure of their residence, they also have to pay for removal and repairs. In contrast, several residents mentioned that, even if they left the air conditioning there for the next residents, the housing authority will take it out, leaving the ducts and vents still installed.

3.7.2 Applying for air conditioning on the basis of medical conditions

Residents discussed in significant detail the many discrepancies and ambiguities around the criteria needed for them to have air conditioning installed in their homes. They applied on the basis of medical and mental health conditions that worsen during periods of extreme heat. However, these weren't deemed severe enough or could not be directly associated with the heat, so they were denied. Further, even where residents fulfilled the stringent requirements of the application process, including multiple forms and medical certificates, their application was unsuccessful. One resident noted that you have to be *"practically dying"* to be considered for air conditioning. Even then, another resident spoke of her experience with both parents having life-threatening chronic conditions and still being denied access.

3.7.3 Other experiences of trying to acquire air conditioning

A few residents also revealed other experiences of trying to acquire air conditioning for their home, with limited success, for example applying on behalf of a parent but being refused, completing all paperwork but receiving no response and asking to be transferred to a vacated unit with air conditioning and being refused.

3.7.4 Feelings associated with being denied access to air conditioning

Strong feelings were expressed by the majority of residents regarding not being granted access to air conditioning on medical grounds. Many residents perceived this as a denial of their basic human rights. This denial, for many residents, evoked feelings of anger and frustration towards the government for their lack of compassion, and further, reduced their trust in the government and the public housing authority. Residents state also, that the lack of response left them feeling stigmatised and isolated and affirmed the belief that they were treated as *"second-class citizens"*. A number of quotes spoken by the residents supports these views:

"They look at you like you're stupid and treat you as an imbecile."

"...you are dealing with the life of the people. The house, the air con you can replace. Money you can replace. But the life of people you cannot replace."

Service providers felt it was ironical that the *"threshold for getting aircon"* has been raised despite increased periods of extreme heat.

3.7.5 Reasons for successfully getting air conditioning installed

A few residents reasoned that they or residents they knew, had been successful in gaining installation of split-system air conditioners because they were taking care of very young grandchildren or because of extreme illness.

‘...summers were becoming increasingly unbearable compared to historical summers’

Service providers have seen tensions emerge amongst neighbours when some have split systems and some don’t, for example in the case of smoking-induced emphysema (eligible) versus having three children (not eligible on these grounds). Service providers stated that tenants feel discriminated against; and some say that residents don’t understand the guidelines, which are in themselves opaque and hard to comprehend for those with lower levels of education.

3.7.6 Opinions on cooling versus heating provisions

Several residents voiced their opinions on the compulsory provision of heating in their homes by the Victorian Government and its contextual relevance to Mildura. They believe heating is not an essential requirement in Mildura as periods of cold are short in comparison with the lengthy periods of extreme heat they experience. Further, many residents believe that it is much easier and cheaper to stay warm during the colder temperatures than be cool in the heat, with simple solutions such as clothing or blankets being preferred over non-energy-efficient heat banks. Residents agreed that they would prefer cooling devices to be made compulsory over the heating provisions that currently exist. Some service providers saw it as ironical that various measures to heat homes are implemented whereas cooling is more critical.

4. Discussion

In the face of the increasing incidence of temperature extremes driven by the current climate emergency, it is important to understand the health and wellbeing impacts of extreme heat on populations and to ensure policy remains responsive to these impacts (Hughes et al., 2016). This is particularly vital for vulnerable populations, who are more susceptible to the negative impacts of extreme heat. The public housing residents living without air conditioning involved in this research represent a population vulnerable to the harmful effects of prolonged extreme heat, a risk further amplified by socioeconomic disadvantage, and membership of other heat-vulnerable groups (e.g. the elderly, infants and children, pregnant women, people living alone, and those living with physical or mental health conditions).

Mildura has always been hot in summer. However, as a result of the climate crisis the situation is steadily worsening, with periods of extreme heat lasting longer and occurring more frequently than in the past. They are characterized by higher daytime and nighttime temperatures which commonly do not fall below the healthy sleeping threshold of 20°C (see Appendix 1 for detail). This situation was reflected in resident comments that summers were becoming increasingly unbearable compared to historical summers and that they were concerned that global heating would make it increasingly difficult to cope in Mildura’s summer months in future.

4.1 Evidence of the impacts of extreme heat on physical and mental health

The research literature strongly supports the idea that the health and wellbeing of individuals and their communities are heavily influenced by climate and exposure to extreme weather events (Zhang et al., 2018). Focus group data confirm the deleterious impact of extreme heat on the physical and mental health of residents living in public housing without air conditioning. Physiological impacts were commonly discussed, covering heat stroke, heat exhaustion, sweating, dehydration, headaches, breathing problems and lack of appetite, exacerbated by the failure of homes to cool down overnight. Infants, children and pregnant women were identified by residents as being particularly at risk.

Duplicating past findings (e.g. Campbell, Remenyi, White & Johnston, 2018; Bouchama et al., 2007), residents with pre-existing physical and mental health conditions indicated that the extreme heat exacerbates their symptoms, leading them to be especially vulnerable to heat-related morbidity.

Residents also confirmed the findings of Hansen et al. (2008), that medications heighten their susceptibility to the physiological impacts of extreme heat. For many residents, their medications would become less effective during periods of extreme heat, not effective at all, or in some cases detrimental to their health.

Past research has found evidence of spikes in suicide and hospitalizations for psychological conditions (The Lancet, 2018). Suicide attempts or hospitalizations for mental health conditions were not specifically mentioned by residents, although this may stem from unwillingness to share this information in a focus group setting. A number of residents did refer obliquely to personal experiences of wanting to give up or wanting to die.

4.2 Social costs of living in extreme heat

Previous research focuses predominantly on the physical and mental health impacts of extreme heat, whereas data collected in this research also shows the detrimental impact of living in extreme heat on a person’s social wellbeing, including feelings of isolation, reduced safety, and of being less valued, as well as educational disadvantage and the denial of basic human rights.

Past research has found some evidence of adverse social wellbeing effects of prolonged extreme heat exposure, duplicated in the current study. Mood changes resulting from the heat, such as feeling irritable, agitated, and distressed, heightens risky behaviours amongst residents such as alcohol consumption and violence. Increased alcohol consumption, aggression and violence during periods of extreme heat was repeatedly discussed by both residents and service providers, confirming the findings of Bambrick et al. (2011) and Williams et al. (2013). Many indicated that their safety concerns made them less comfortable keeping their windows open or walking outside at night, adding to their feelings of isolation. These concerns stem from more people roaming the streets during periods of extreme heat, in particular youth living in public housing.

Another theme identified in this study is the impact of prolonged extreme heat exposure on the wellbeing of families. Family unity is impacted when routines are disrupted, and family members are experiencing changes in mood from the extreme heat. Spikes in domestic violence was touched upon briefly by residents involved in the study, supported by comments from service providers.

One of the most significant new themes identified by both residents and service providers is the impact of prolonged exposure to extreme heat on education. It was clear that children living in public housing experience educational disadvantage from not being able to sleep or recover from days of extreme heat. Due to lack of sleep, children’s school attendance is less frequent, and their attention is reduced when they do come to school. Thus, their inability to concentrate stemming from not getting relief from the heat at night in turn impacts upon their learning, behaviour and overall cognitive and social development. Similarly, residents who work have comparable issues resulting from lack of sleep, which in turn impacts on their ability to work. Attempts to gain employment are compromised by mental exhaustion due to prolonged exposure to extreme heat.

Many residents revealed feelings of anger and helplessness when speaking of lack of adequate cooling as a denial of their human rights.

‘...crucially, mental health conditions are not included in the criteria’

This is supported by the United Nations’ Right to Adequate Housing legislation, detailing that housing *‘must be habitable, in terms of: ...protecting them from cold, damp, heat, rain, wind or other threats to health, structural hazards and disease vectors’*. Thus, forcing residents to live in housing without adequate cooling protecting them from extreme heat is a denial of their human rights.

Service providers reflected residents’ sentiments regarding the negative impacts of extreme heat on both health and wellbeing. A specific topic highlighted by them was the ongoing impact of extreme heat on service provision. This was partly because clients were too exhausted and sleep-deprived to attend appointments or could not be located, as they had left their homes to cool down elsewhere. It also flowed from Workplace, Health and Safety concerns regarding service providers entering overheated hence unsafe premises for client meetings. It is ironic that the most vulnerable members of society, who most need support from service providers, are prevented from accessing these very services in periods of extreme heat due to their housing. Further, it is ironic that staff members are not permitted to enter these non-air-conditioned homes due to these extreme heat safety concerns, while governments allow residents to live in such conditions. The double standard implied here can only widen gaps in social equity.

4.3 Housing as a factor in health and wellbeing

Research (e.g. Howden-Chapman, 2004) strongly suggests that adequate housing is a key determinant of an individual’s ability to cope during periods of extreme weather. Thus, housing that is unsatisfactory in protection during periods of prolonged extreme heat, as described by residents, significantly increases the impact of heat on their health and social wellbeing and continually increases their exposure to risk as detailed above. Although some residents mentioned poor ventilation in passing, all residents interviewed emphasized that their problems were a result of the lack of adequate cooling in their homes.

The variety and quantity of physical and mental health conditions mentioned by residents is consistent with the literature (e.g. Toohey, 2010), which suggests that individuals living in public housing are generally more vulnerable than the general population and suffer more socioeconomic disadvantage, which means they find themselves in substandard housing, amplifying their vulnerability. Residents indicated that unbearable living conditions impacted their ability to be productive on a day to day basis, echoing Ding, Berry and Bennett (2016). Further, several residents mentioned their nutrition was compromised as they had no wish to prepare food in their homes.

Residents made it quite clear that having adequate cooling in their homes would reduce or remove many of the issues they currently face during periods of extreme heat. For example, having a safe cool home to recover from the heat would make youth more likely to come home for respite at night, rather than roaming the streets at night and as a result reduce their likelihood of being involved in antisocial behaviours. It was clear from one resident who now has adequate cooling installed that this has led to marked improvements to the family’s unity and wellbeing.

4.4 Actions undertaken by public housing residents

Residents did not passively accept their situation but tried to improve it, both by applying for air conditioning and by trying alternative means of cooling themselves and their homes.

Victorian State policy regarding minimum standards or requirements for cooling homes has not been revised since 1997 (Victoria State Government, 1997). However, data collected as part of this research into summer temperature changes indicate weather patterns have changed significantly since this time which suggests that these changes should be reflected in policy.

Criteria and processes allowing public health tenants to apply for air conditioning are limiting and opaque, resulting in overwhelming evidence of rejection and feelings of frustration from residents. The difficulties experienced by many residents are similar to experiences expressed in the research, where the process of applying for air conditioning is time consuming, ambiguous and stressful, often resulting in rejection. Since selection is restricted to only a limited number of physical chronic illnesses, many other such illnesses triggered by the heat are not considered eligible for air conditioning approval. Crucially, mental health conditions are not included in the criteria. Residents stated quite clearly that extreme heat severely impacts managing their mental health conditions.

The experience of feeling belittled and stigmatised in the process of applying for air conditioning makes residents feel worthless and isolated. Further, these unsuccessful attempts at applying for air conditioning has evoked high levels of frustration and scepticism regarding the intentions of the government.

Public housing residents respond to extreme heat in their non-air-conditioned homes in a variety of ways. They may go elsewhere (shopping centre, library, river) to cool down, however these places are generally regarded as dangerous, inconvenient, overcrowded or expensive, as well as in some cases time-limited. Alternatively, they may use showers, baths, misting or paddle pools, leading to increased water bills. They may buy cheaper but less effective cooling units, incurring upfront and running costs. This economic burden could be alleviated by introducing subsidies linked to extreme heat exposure, as research suggests that the decision to purchase cooling devices is a cost many residents cannot justify (Saman et al., 2013). Split-system, reverse cycle air conditioners were the only type of cooling method considered to give any major relief from the harsh heat in Mildura, and as such residents sought public areas with these facilities to cope in these conditions.

4.5 Inter-related and perpetuating factors

Many of the key themes raised during the semi-structured focus groups and interviews are highly interrelated and exist in causal relationships which render an already vulnerable population more so.

As highlighted in our analysis and also identified by Ding, Berry and Bennet (2016), extreme heat-related sleep disruption reinforces lethargy and reduced functioning, which further amplifies daily stresses and routine disruptions. Lack of focus due to this lethargy impacts schooling, work productivity, safety and mood. Family unity is also impacted by these factors, in particular mood changes, fuelling issues such as domestic violence. Lack of sleep also promotes anti-social behaviour at night times. The interrelation of these factors makes it evident that a lack of adequate cooling during prolonged periods of extreme heat impacts many sectors of society.

Service providers explained that the increased need for services such as ambulance callouts, medical visits, health services and police enforcement during periods of extreme heat, which places a substantial annual economic burden on the Victorian Government.

The correlation of lower levels of education, reduced communication and problem-solving skills, frustration and the use of alcohol and other drugs

leading to spiralling violence comes at a social cost and increases the risk of residents in public housing continually having poorer outcomes from one generation to the next. Although these poorer outcomes are due to many factors, by addressing prolonged exposure to extreme heat, many of the effects of these problems can be alleviated and better opportunities provided for the good of society at large. The cyclic nature of the current situation in Mildura has the potential to progressively worsen.

5. Recommendations

Based on qualitative feedback from public housing tenants in Mildura, properties without adequate cooling provisions are not ‘fit for habitation’ and potentially contravene the legal responsibilities of landlords to their tenants. In support of this statement, we draw attention to the precedent set by the NSW Aboriginal Housing’s policy regarding provisions for air-conditioning for tenants in locations where the Isotherm boundary is above 33 (BoM, 2016; Aboriginal Housing Office, 2016), which Mildura currently exceeds.

In light of the findings within this research, we make the following recommendations:

1. That the Victorian State Government acknowledges the increased incidence and severity of periods of extreme heat in Mildura since 1997 and urgently reviews the current policy regarding access to air conditioning for public housing tenants.
2. That the Victorian State Government acknowledge access to adequate cooling as a basic human right, particularly for those experiencing chronic physical and mental health conditions.
3. That the Victorian State Government urgently review the policy and practice for assessing eligibility for appropriate cooling for residents in Mildura on the basis of medical conditions, acknowledging the negative affect heat has on the effectiveness of medications and exacerbation of medical conditions.
4. That the Victorian State Government review their policy regarding the provision of appropriate heating mechanisms in public housing properties, allowing for equivalent cooling mechanisms appropriate to the seasonal climate patterns in specific locations across Victoria.
5. That in assessing appropriate cooling options, considerations be made of their effectiveness, efficiency and cost-effectiveness.
6. While this research is focused on public housing tenants’ access to adequate cooling, which is a basic human right, it is acknowledged that air-conditioning alone may not be the only answer. Consideration into thermal appropriateness of public housing properties, cost effectiveness, sustainable energy resources such as solar power and power usage education for tenants should be included in future policy development.
7. That these recommendations be reviewed with urgency as part of policy and budget preparations by the Victorian State Government for the 2020/2021 financial year.

6. Conclusion

This paper aimed to assess the impact of the increasing exposure to extreme heat, driven by the current climate emergency, on the health and wellbeing of public housing tenants in Mildura, Victoria. Results obtained paint a concerning picture of the situation that exists for residents who currently have limited cooling solutions to gain relief from the heat, with detrimental and uncontrollable ramifications on their physical and mental health and social wellbeing, which are inter-related. Effective solutions should urgently be considered and put in place by legislative bodies to provide adequate cooling solutions for the target demographic to avoid these outcomes, otherwise the ensuing social and economic burden at an individual, societal and government level will be severe and likely to persist for generations.

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8. Appendices

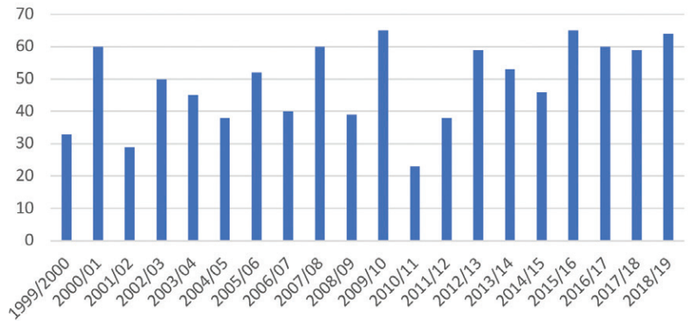
Appendix 1: Mildura Temperature Data

The following tables and graphs have been developed by the authors of this report by obtaining climate data from 'Climate Data Online' on the BoM's website (http://www.bom.gov.au/climate/data/index.shtml). Midnight data was extracted from half hourly temperature data requested and sent from the BoM, commissioned by Mallee Family Care.

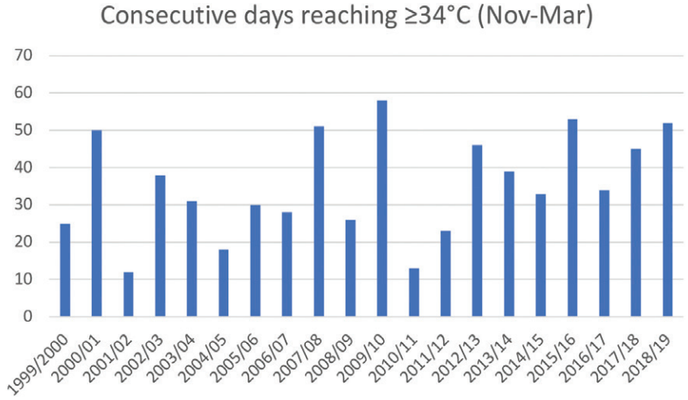
	EXTREME HEAT STATISTICS (NOV-MAR)																					
	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19
Days of ≥34°C	41	33	60	29	50	45	38	52	40	60	39	65	23	38	59	53	46	65	60	59	64
Consecutive days of ≥34°C	30	25	50	12	38	31	18	30	28	51	26	58	13	23	46	39	33	53	34	45	52
Heat waves (periods of 3+ days ≥34°C)	6	6	9	4	9	6	4	6	6	7	4	13	3	4	9	6	9	10	7	8	9

	MONTHLY AVERAGES PER YEAR																				
	98/99	99/00	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19
Nov	27.0	24.6	29.9	26.5	29.8	29.9	27.4	28.3	29.8	30.5	26.8	32.5	26.2	29.3	30.8	27.7	30.8	30.6	28.0	30.5	28.2
Dec	31.4	28.3	32.3	28.1	32.0	32.4	30.3	32.2	31.1	31.5	28.7	31.5	28.3	30.5	32.4	32.0	32.1	34.6	31.8	31.2	33.2
Jan	35.4	31.1	37.1	31.7	33.8	30.5	32.4	36.4	32.3	33.7	35.3	34.7	32.0	32.7	34.7	35.7	31.6	33.3	34.5	36.2	37.8
Feb	31.3	33.6	34.1	30.3	32.4	34.5	30.3	32.1	34.6	30.0	33.8	33.6	30.2	31.3	34.2	33.5	35.6	33.8	32.7	33.9	32.8
Mar	27.4	28.5	27.8	28.6	27.0	29.3	28.4	30.2	28.9	31.7	28.6	28.9	26.0	26.7	30.3	29.8	28.3	31.9	32.5	30.2	30.3

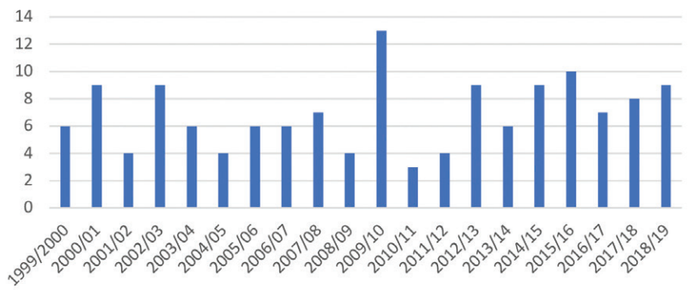
Days reaching ≥34°C (Nov-Mar)



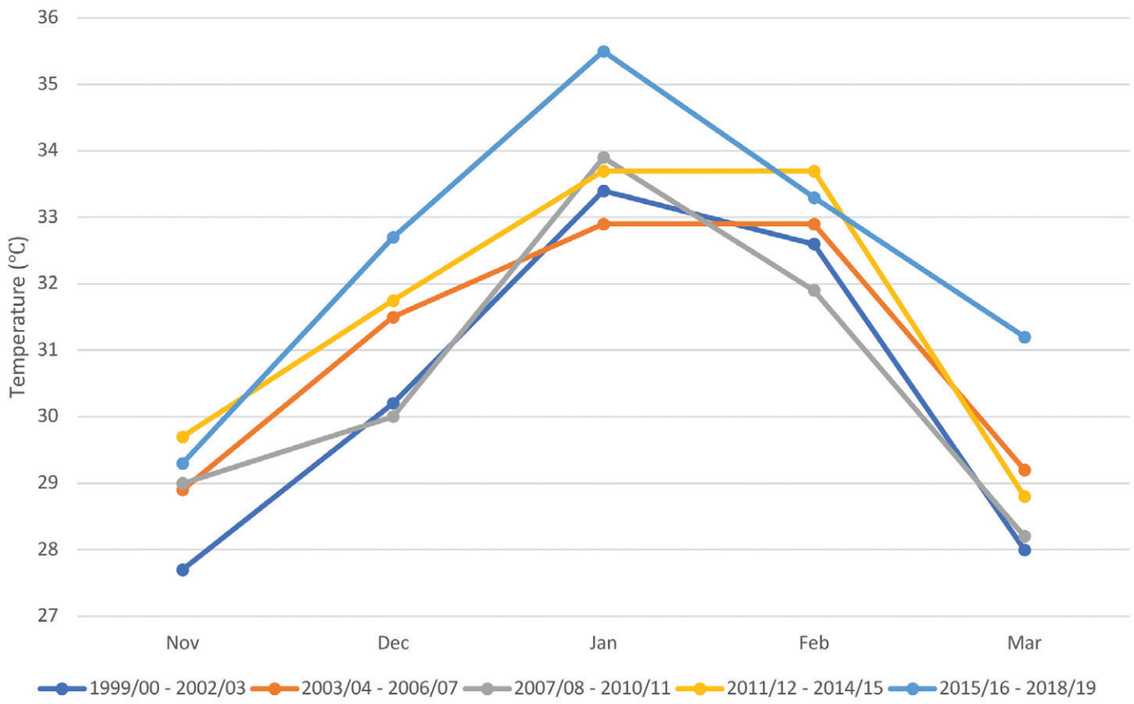
Consecutive days reaching ≥34°C (Nov-Mar)

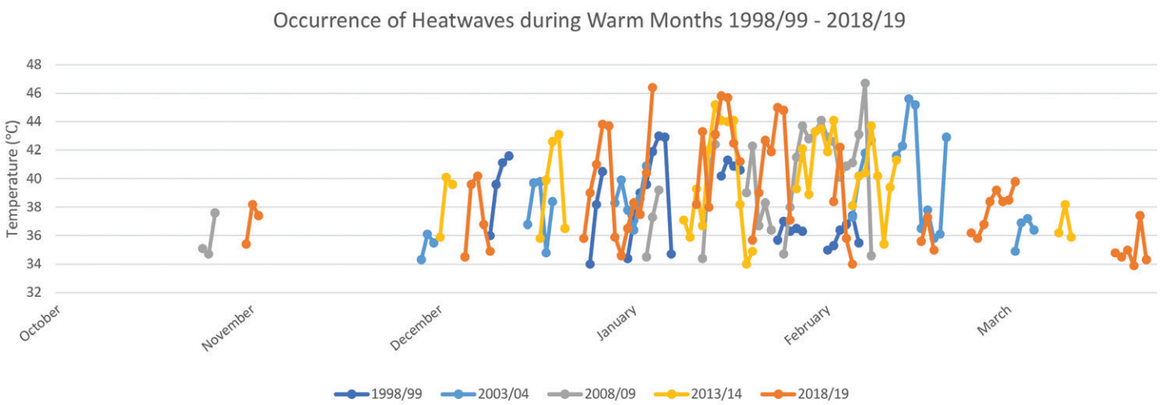


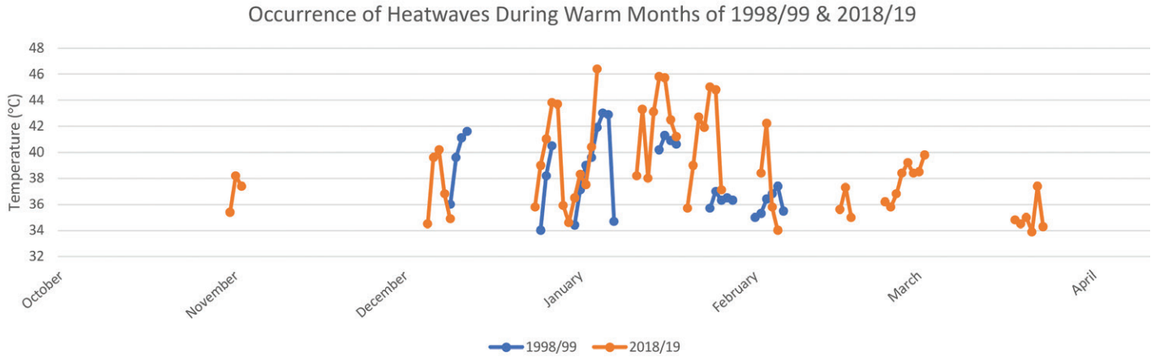
Number of heatwaves (periods of 3+ days ≥34°C) (Nov-Mar)

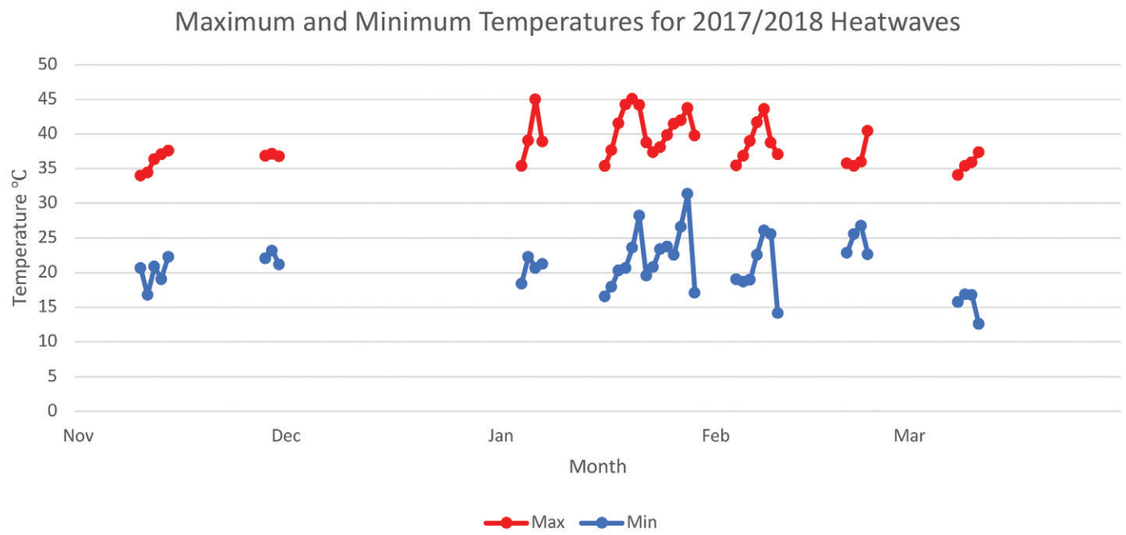


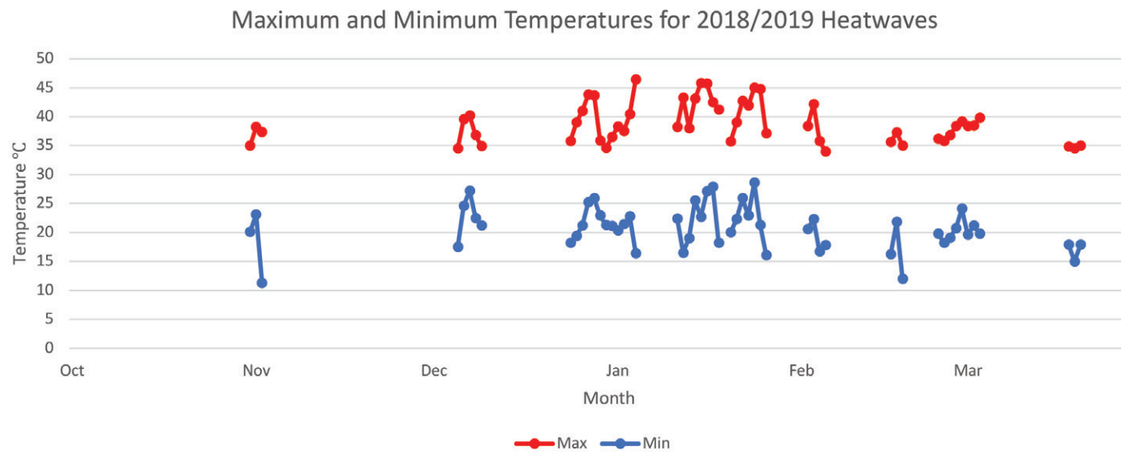
Average Monthly Temperatures (Grouped by 4 year periods)

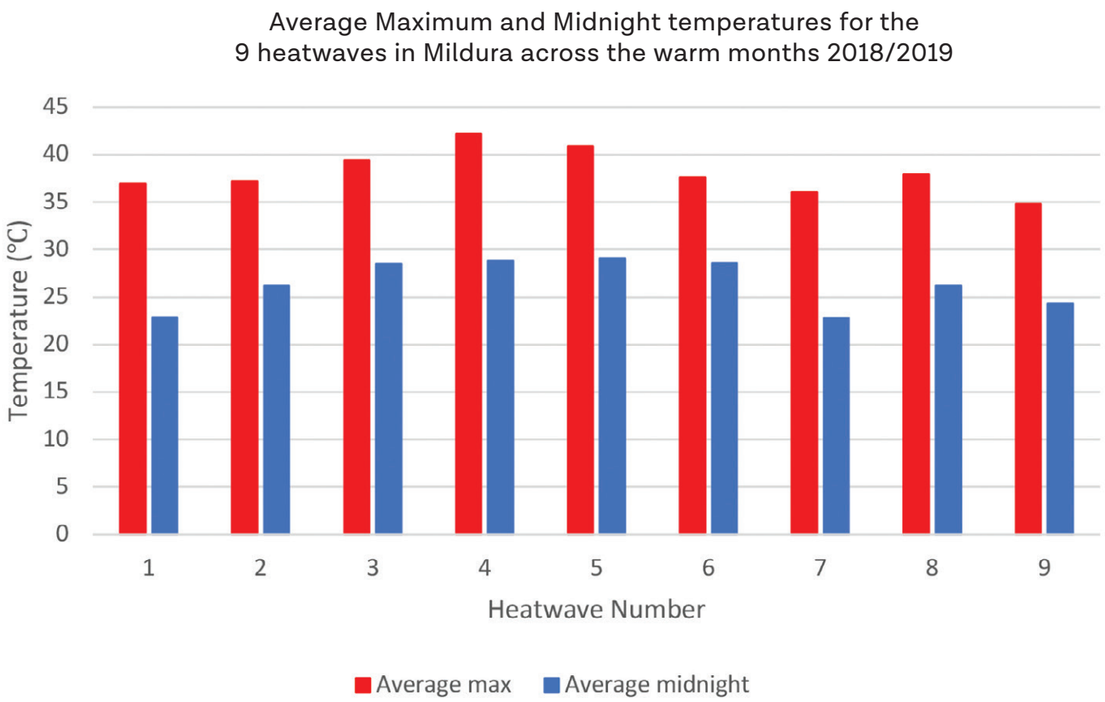


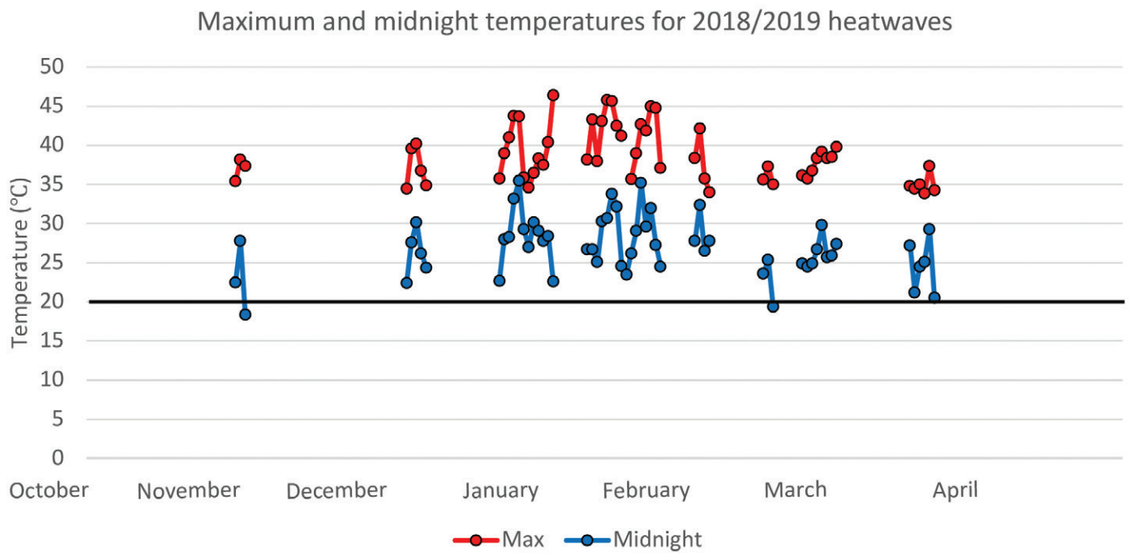

Occurrence of Heatwaves during Warm Months 1998/99 - 2018/19
Temperature (°C)
48
46
44
42
40
38
36
34
32
October
November
December
January
February
March
1998/99
2003/04
2008/09
2013/14
2018/19

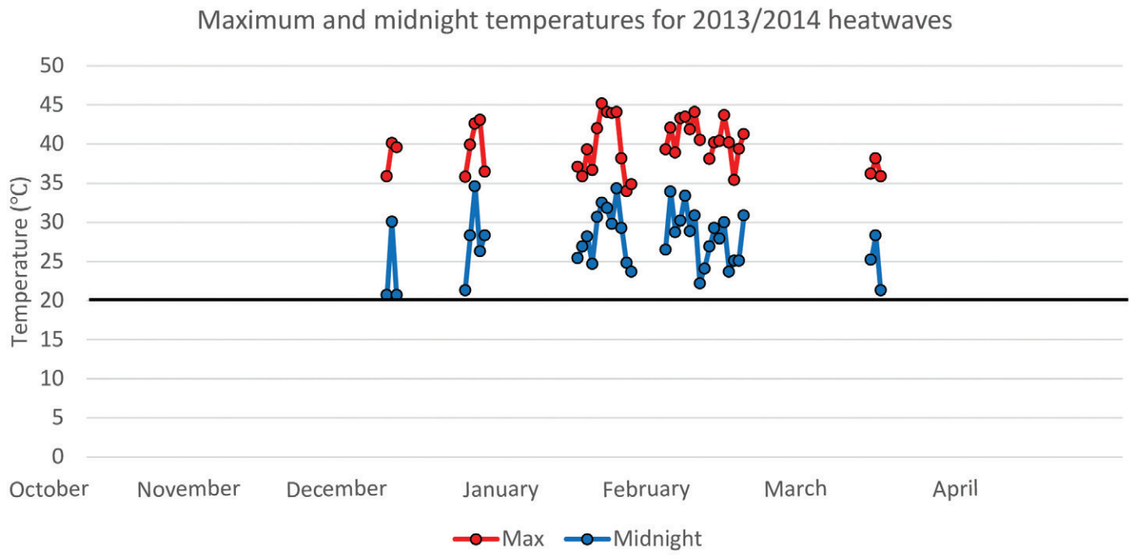

Occurrence of Heatwaves During Warm Months of 1998/99 & 2018/19
Temperature (°C)
48
46
44
42
40
38
36
34
32
October
November
December
January
February
March
April
1998/99
2018/19

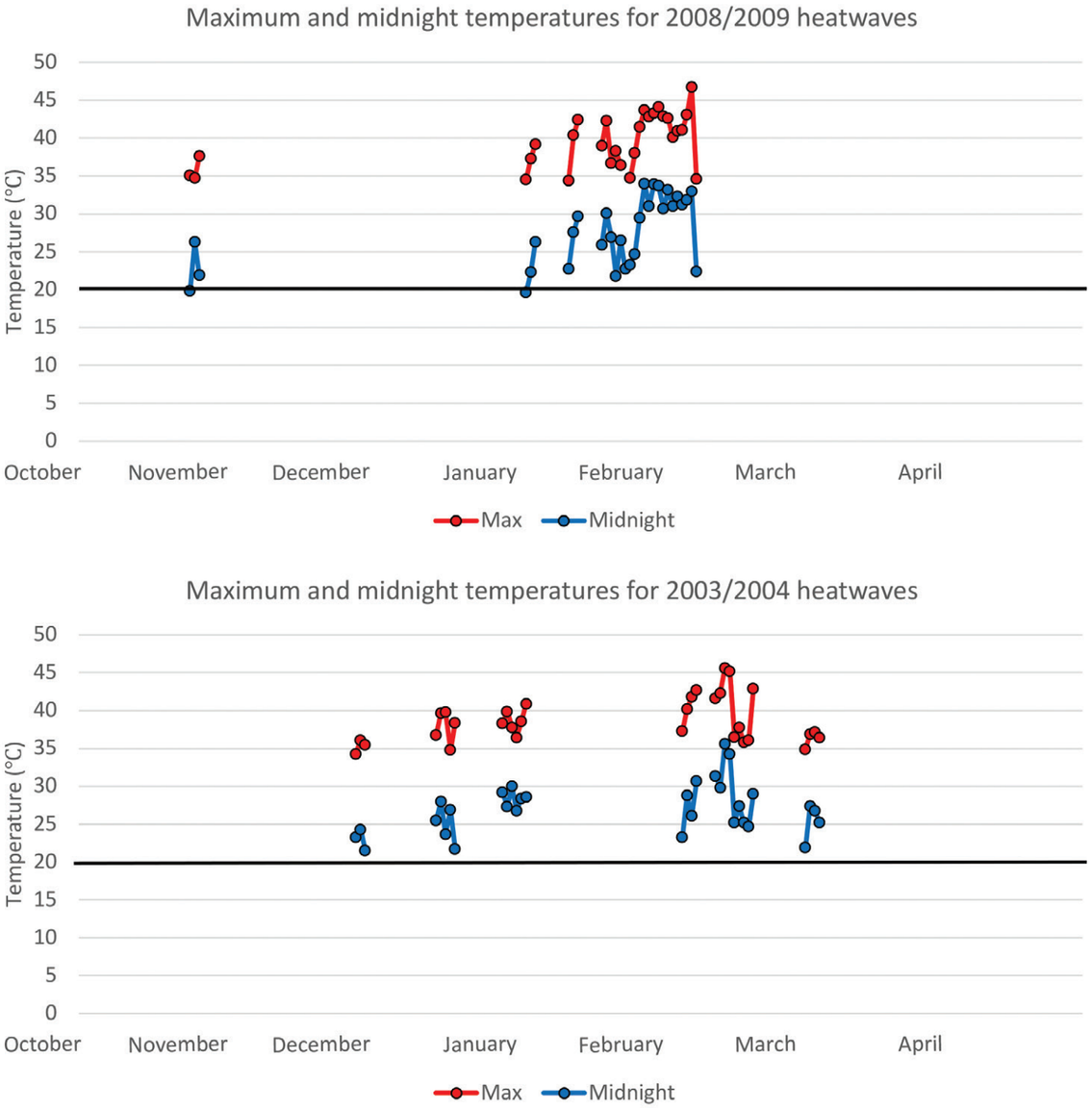

Maximum and Minimum Temperatures for 2017/2018 Heatwaves
Temperature °C
50
45
40
35
30
25
20
15
10
5
0
Nov
Dec
Jan
Feb
Mar
Month
Max
Min


Maximum and Minimum Temperatures for 2018/2019 Heatwaves
Temperature °C
50
45
40
35
30
25
20
15
10
5
0
Oct
Nov
Dec
Jan
Feb
Mar
Month
Max
Min

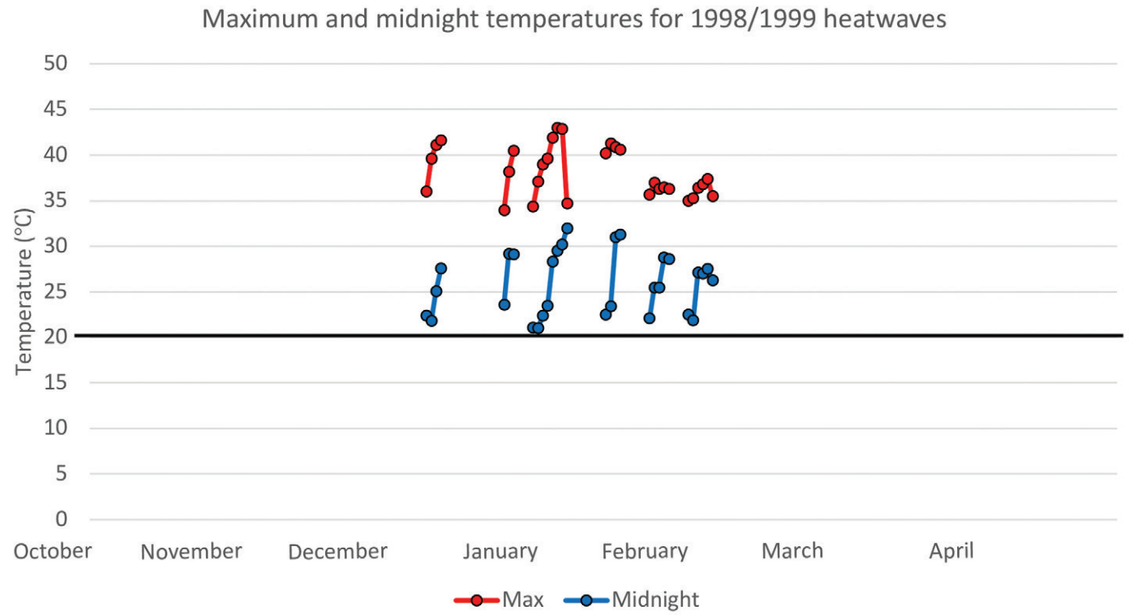

Average Maximum and Midnight temperatures for the
9 heatwaves in Mildura across the warm months 2018/2019
Temperature (°C)
45
40
35
30
25
20
15
10
5
0
1
2
3
4
5
6
7
8
9
Heatwave Number
Average max
Average midnight


Maximum and midnight temperatures for 2018/2019 heatwaves
Temperature (°C)
50
45
40
35
30
25
20
15
10
5
0
October
November
December
January
February
March
April
Max
Midnight


Maximum and midnight temperatures for 2013/2014 heatwaves
Temperature (°C)
50
45
40
35
30
25
20
15
10
5
0
October
November
December
January
February
March
April
Max
Midnight


Maximum and midnight temperatures for 2008/2009 heatwaves
Temperature (°C)
50
45
40
35
30
25
20
15
10
5
0
October
November
December
January
February
March
April
Max
Midnight

Maximum and midnight temperatures for 2003/2004 heatwaves
Temperature (°C)
50
45
40
35
30
25
20
15
10
5
0
October
November
December
January
February
March
April
Max
Midnight


Maximum and midnight temperatures for 1998/1999 heatwaves
Temperature (°C)
50
45
40
35
30
25
20
15
10
5
0
October
November
December
January
February
March
April
Max
Midnight

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