Heatwaves, Homes & Health

Why household vulnerability to extreme heat is an electricity policy issue

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November 2017

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Acknowledgements

We appreciate the time and contribution of all the householders, and health and community sector workers who participated in this research and shared their valuable insights.

We gratefully acknowledge the organisations who assisted with participant recruitment, with special thanks to: Brotherhood of St Laurence, cohealth, the Connie Benn Centre, Council of the Ageing (COTA), Council of Single Mothers and their Children (CSMC), Dubbo Photo News, Kildonan UnitingCare, Marlin Coast Neighbourhood Centre, Cairns Men's Shed and the Marlin Coast Men's Shed.

This project was funded by Energy Consumers Australia Limited (www.energyconsumersaustralia.com.au) as part of its grants process for consumer advocacy projects and research projects for the benefits of consumers of electricity and natural gas. The views expressed in this document do not necessarily reflect the views of Energy Consumers Australia.

Suggested citation for this report

Nicholls L., McCann H., Strengers Y. & Bosomworth K. 2017. Heatwaves, Homes & Health: Why household vulnerability to extreme heat is an electricity policy issue, Centre for Urban Research, RMIT University, Melbourne.

Summary

Heatwaves and extreme heat are a significant risk to household health. As electricity costs rise, more households are experiencing difficulty paying energy bills. Householder concerns about energy bills already contribute to self-rationing of heating and negative outcomes for health and wellbeing in cold weather.

During hot weather, the electricity sector aims to reduce peak electricity demand via 'price signals' – higher prices for electricity used at times when many households use air conditioning to cool their homes. To manage the risk of electricity outages at peak times, public messages to reduce consumption are also used.

Little is known about how current electricity costs and messaging impact heat vulnerable households or what effects pricing reforms could have on household practices during hot weather and health outcomes. The Heatwaves, Homes, & Health project sought to address this knowledge gap. The role of electricity costs, price signals and messaging in shaping household cooling practices and strategies during extreme heat, and outcomes for health and wellbeing were investigated.

The project aimed to:

- provide evidence regarding potential financial and health implications of electricity pricing and messaging for heat vulnerable households;
- build knowledge among advocates and industry decision makers; and
- develop strategies to help minimise adverse outcomes for households.

The project was conducted in three stages:

1. **A critical review** of energy sector cost-reflective pricing documents to identify current engagement with household vulnerability, particularly during and as a result of extreme heat. See *Electricity pricing, heatwaves and household vulnerability in Australia* briefing paper.
2. **Research with 'key informants'** from health and social services sector who work with heat vulnerable households.
3. **Research with households** who may be more at risk in hot weather.

This report presents the findings from Stages 2 and 3 and recommendations from the project.

METHODOLOGY

The mixed methods project was conducted between December 2016 and September 2017. The research activities and locations are summarised below. All health data were self-reported.

Key informant research	Household research
Key informants: people who work in health and social service agencies assisting households with occupants who may be vulnerable to heat • Online survey about heat and financial vulnerability in client households (52 responses) • 18 in-depth interviews	*Householders*: (65+ years) and parents of infants (<2 years old) • 36 in-home interviews with 42 participants • 3 locations: Melbourne, Dubbo, and Cairns • Including households with chronic illnesses • Including 25 (70%) low-income households

Location	Hot weather description	Climate Zone
Melbourne, Vic Large coastal capital city	Average high temperature for summer days is about 25°C. Occasional periods of extreme heat with highs over 35°C (or less often 40°C). Hot nights during heatwaves add to thermal stress.	Zone 6 Mild temperate
Dubbo, NSW Small inland city (Great Western Plains)	Average summer high is about 32°C. Area is prone to extended periods of extreme dry heat: in the 2016-17 summer 49 days reached over 35°C, 14 were over 40°C (highest 46°C).	Zone 4 Hot dry summer, cool winter
Cairns, Qld Medium-sized coastal city (Far North Qld)	Hot weather throughout the year, including 5 months with average highs around 31°C. High relative humidity adds to thermal stress.	Zone 1 Hot humid summer, warm winter

KEY FINDINGS AND IMPLICATIONS

These findings refer specifically to the heat vulnerable households targeted by our research.

Exposure to heat and health impacts

- **Households living in poor quality housing have limited capacity to reduce their exposure to extreme heat – particularly renters.**
  → Poor quality housing exacerbates discomfort and potential health risks during extreme heat.
- **What's 'hot' differs between climate zones.**
  → Regional differences in experiences of heat are important for understandings of vulnerability and equitable energy policy.
- **Older households may underestimate their own vulnerability in extreme heat despite experiencing health and wellbeing impacts.**
  → Underestimation of own vulnerability increases the risk of adverse health outcomes.
- **Chronic health conditions exacerbate the impacts of extreme heat and reliance on air conditioning.**
- **Staying home in very hot housing can exacerbate vulnerability during extreme heat.**
- **Leaving the home to seek cooler places may not be viable and can exacerbate financial vulnerability, but can also have co-benefits.**
  → Both staying at home and leaving the home present health and financial risks for some households.

Practices to manage the heat at home

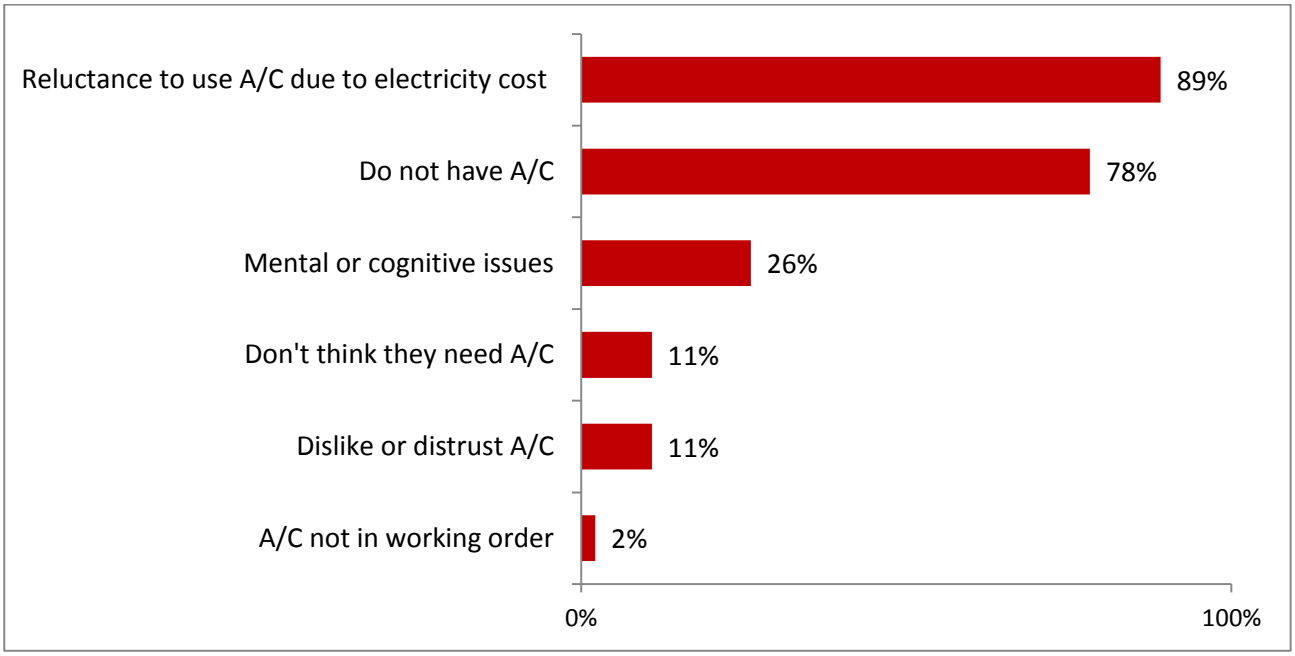
- **Parents' understandings of their infants' vulnerability contribute to a reliance on air conditioning.**
- **Concern about high electricity bills contributes to potentially unhealthy self-rationing, particularly in older households.**
  → Unhealthy self-rationing of air conditioning and fan use is likely to be exacerbated by rising electricity costs.

  - *11/16 older household participants who had air conditioning severely restricted or carefully managed use due to electricity costs.*
  - *88% of key informant survey respondents were aware of at-risk clients that do not use air conditioners during heatwaves, and electricity cost was the main reason.*
  - *Half of key informants were also aware of clients who did not use fans during heatwaves and electricity cost was the most common reason.*
  - *Most key informants were aware of households experiencing adverse physical health impacts and/ or declining mental health, as a result of restricting use of fans or air conditioning.*

KEY FINDINGS AND IMPLICATIONS (continued)

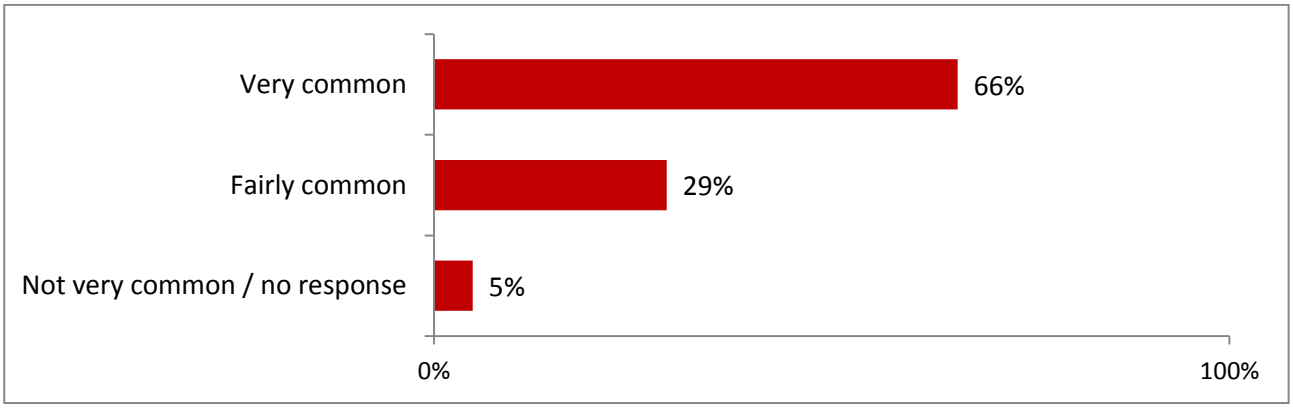
- **Households rarely rely on air conditioning alone to stay cool.**
  → Low-/no energy practices can be under- or over-utilised in households and can both alleviate or contribute to financial or health risks.
- **Ceiling fans reduce discomfort in hot weather and reliance on air conditioning.**
- **Caring for pets in hot homes can increase air conditioning reliance**. Half of the households with pets said they left the air conditioning on exclusively for their pets.

Main reasons survey respondents' clients do not use air conditioning during heatwaves



Respondents could select multiple responses, n=46

How common is it for electricity costs to contribute to client reluctance to use air conditioning?



n=41

Financial and health considerations for energy policy

- **Households are struggling to pay high electricity bills associated with air conditioning use.**
  → Tariff changes that result in higher bills for financially constrained households who rely on air conditioning will exacerbate existing financial stress.

  - *14/36 households interviewed were financially stressed and 9 of these were either behind on their bills or on energy hardship programs.*
  - *Three quarters of key informant survey respondents said it was either 'very common' (34%) or 'fairly common' (41%) for households to be experiencing financial stress as a result of using air conditioning for health and wellbeing reasons.*

- **Financial stress associated with high electricity bills is impacting household wellbeing.**
- **Medical cooling concession arrangements are not sufficiently addressing the health and financial risks for those reliant on air conditioning.**
- **Peak pricing is likely to exacerbate unhealthy self-rationing of air conditioning and fans in some households.**
  → Peak pricing is likely to encourage demand responses which could be detrimental for health in some households, without significantly helping the electricity grid at peak times – because the households most likely to respond are already conservative with energy use.
- **Peak pricing is unlikely to substantially impact air conditioning use in households who consider it integral to daily life (regardless of the financial impact).**
  → Peak pricing is unlikely to encourage a substantial demand response from higher users of air conditioning and may exacerbate financial hardship for some of these households.
- **Household responses to peak demand issues and public messaging are undermined by distrust and confusion arising from recent public debates about energy issues in Australia.**
  → Households' trust and fairness concerns limit the effectiveness of public messaging and current demand management initiatives.
- **Some of the most vulnerable people may further restrict cooling in response to public messaging to reduce electricity use in extreme heat.**
  → There are risks associated with public messaging that does not identify differing health needs for cooling.
- **Electronic billing and direct debit arrangements may further reduce household engagement with energy bills and communications.**
  → Technological shifts to electronic billing and direct debit payment may undermine energy literacy aims and potentially compromise outcomes for households and the energy sector.
- **Culturally and linguistically diverse (CALD) households have diverse responses to extreme heat and face extra challenges navigating electricity costs and tariff reform.**
  → CALD communities are likely to face additional challenges when navigating extreme heat, cost-reflective pricing and public messaging. These challenges are insufficiently understood.

RECOMMENDATIONS

Mitigating the impact of future heatwaves on household health is a complex social problem which calls for cross-sectoral policy attention. The Heatwaves, Homes & Health study focused on the role of electricity policy and demand management in heatwave vulnerability.

Many of these recommendations require the electricity sector to engage and collaborate with other relevant sectors and jurisdictions, particularly the housing, urban planning, community development and health sectors. Engagement with households, communities and other sectors is also necessary to build trust, identify widely acceptable approaches, and build support for, and productive responses to, demand management initiatives.

Further discussion on these recommendations, along with suggested programs and actions needed to implement them, are provided in the main report.

Messaging about hot weather and electricity

1. **Consistently embed messaging about health inequities in public communications about hot weather peak demand and electricity conservation.**
2. **Promote climate-appropriate low-/no energy ways to stay cool and minimise messaging that positions air conditioning as a necessity regardless of age and health.**
3. **Raise public awareness regarding the role of peak demand and household air conditioning in contributing to electricity price rises.**

Cost-reflective pricing and alternatives to tariff-based demand management in extreme heat

4. **Expand understandings of vulnerability in energy policy and explicitly include heat vulnerability as a key consideration in hot weather demand management strategies.**
5. **Develop a strategy to minimise adverse health and financial outcomes on heat vulnerable households as a result of cost-reflective pricing.**
6. **Ensure medical cooling concessions are able to assist people with a range of heat health needs – both in terms of eligibility and accessibility.**
7. **Undertake research into the impacts of electronic billing and direct debit on household engagement and tariff understandings.**
8. **Prioritise demand initiatives that are less likely to have adverse health and financial impacts on heat vulnerable households.**
9. **Collaborate with state and local governments to engage communities and develop local demand and supply solutions.**
10. **Increase access to cool public places and conduct research into the needs and delivery of heat refuges.**

RECOMMENDATIONS (continued)

Housing stock, appliances and retrofits

11. **Improve housing quality and energy efficiency for heat vulnerable households, including strategies for public and private rental housing.**
12. **Integrate heat vulnerability assessments into existing housing programs and services such as energy efficiency assessments and public housing maintenance inspections.**
13. **Improve access to home air conditioning for households in extreme circumstances e.g. poor quality public housing, elderly and frail residents, chronic conditions exacerbated by extreme heat.**

Integrating energy into health service-based approaches

14. **Expand capacity to deliver hot weather reminders and welfare checks for heat vulnerable households.**
15. **Develop resources which raise awareness of healthy *and* energy efficient ways to stay cool.**
16. **Up skill service providers in energy efficiency and heat health.**

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Glossary and Acronyms

°C	Degrees Celsius
ABS	Australian Bureau of Statistics
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
Air conditioning	Air conditioned cooling
CALD	Culturally and linguistically diverse
COAG	Council of Australian Governments
Cost-reflective pricing	A tariff is one which better reflects the true cost of supplying electricity at different times of the day or year, e.g. higher charges for usage at peak times.
Critical peak pricing	High electricity prices (per kWh) on 'critical event' days (when system-wide demand for electricity is highest), combined with a lower price for electricity at other times of the year.
Electricity sector	May include government, sector agencies, regulators, industry businesses, and advocates
Extreme heat	The minimum mean temperature that is likely to impact on the health of a community (DHHS, 2015, page 3)
Heat event	Extreme heat, heatwaves, including hot and humid weather often experienced in northern parts of Australia during the 'build up'[1]
Heat vulnerability	A complex, social condition arising from a combination of exposure, sensitivity and capacity to respond to heat and maintain health during hot weather or conditions
Heatwave	Three days or more of high maximum and minimum temperatures that is unusual for that location (BoM, 2014)
HH / HHs	Household / Households
Infant	Babies and children under two years of age
KI	Key Informant - those surveyed or interviewed for this project that work in the health, community or energy sector
Older householders	Over 65 years of age
Peak demand	Times of the day or year when electricity usage on the network is highest, including as a result of weather extremes such as heatwaves
PV	Photovoltaic (refers to solar PV)
ToU tariff	Time-of-Use (3-part) electricity tariff; refers loosely to all 3-part ToU tariff times as advertised in different Australian states or by different Australian retailers
VCOSS	Victorian Council of Social Services

[1] Several months of high humidity between the wet and dry seasons in tropical areas. The humidity continues day and night with no respite. http://www.australia.gov.au/about-australia/australian-story/austn-weather-and-the-seasons

A. Introduction

Heatwaves and extreme heat[2] are a significant risk to household health in Australia. As electricity costs rise, more households are experiencing difficulty paying energy bills. Householder concerns about energy bills already contribute to self-rationing of heating and negative outcomes for health and wellbeing in cold weather (Cornwell et al., 2016). During hot weather, the electricity sector aims to reduce peak electricity demand via 'price signals' – higher prices for electricity used at times when many households use air conditioning to cool their homes. However, little is known about how current electricity costs and messaging impact heat vulnerable households or what effects pricing reforms could have on household practices during hot weather and health outcomes.

The Heatwaves, Homes, & Health project sought to address this knowledge gap by investigating the role of electricity costs, price signals and messaging in shaping household cooling practices and strategies in extreme heat, and outcomes for health and wellbeing. The project aimed to:

- provide evidence regarding potential financial and health implications of electricity pricing and messaging for heat vulnerable households;
- build knowledge among advocates and industry decision makers; and
- develop strategies to help minimise adverse outcomes for households.

The project was conducted between December 2016 and September 2017 and comprised three stages:

1. **A critical review** of energy sector cost-reflective pricing documents to identify how they engage with issues of household vulnerability, particularly during and as a result of extreme heat. This stage resulted in the *Electricity pricing, heatwaves and household vulnerability in Australia* briefing paper.
2. **Research with 'key informants'** from the health and social services sector via an online survey and interviews; and
3. **Research with households** including older people (65+ years) and parents of infants (<2 years) in Melbourne, Dubbo, and Cairns.

This report presents the findings from Stages 2 and 3 and is organised as follows: Section A (Introduction) outlines the project and policy background, scope, aims and rationale and provides guidance on how to read this report. Section B describes the project methodology. Section C discusses the project's key findings in three chapters:

- Exposure to heat and health impacts
- Practices to manage the heat at home
- Financial and health considerations for energy policy

Section D discusses the findings and presents recommendations from the project.

[2] BoM defines heatwave as 'three days or more of high maximum and minimum temperatures that is unusual for that location' (BoM, 2014). One definition of extreme heat is 'the minimum mean temperature that is likely to impact on the health of a community (DHHS, 2015, page 3). For the purposes of this study these terms are used interchangeably to describe hot weather that may be a risk to household health.

A.1 Peak demand and electricity pricing reforms

In the past 30 years, air conditioning has rapidly become common in Australian homes, increasing electricity use for cooling by about 500% (DEWHA, 2008). This rapid increase has been attributed to changes in air conditioning affordability and efficiency; inadequate urban planning and housing design; changing cultural and building norms; and a changing climate (EES, 2006; Strengers, 2010; Wilkenfeld, 2004). To meet 'peak demand' for electricity on very hot days, the electricity network has undergone extensive capacity upgrades (Smith et al., 2013), contributing to a doubling in the price of electricity in the last 8-10 years (Wood and Blowers, 2017). It is estimated that under 'flat-rate' electricity tariffs households who own and use air conditioners at peak times are cross-subsidised by others by around $350 per year (Productivity Commission, 2013).

Price signals, including higher electricity prices for times when weather and homes are hot, are central to the electricity sector's strategy to stabilise electricity prices and reduce cross subsidies between consumers (AEMC, 2012). Distribution businesses have been developing and implementing 'cost-reflective' network tariffs in response to the Australian Energy Market Commission's Distribution Network Pricing Arrangements Rule Change (AEMC, 2014b). Cost-reflective retail tariffs include: three-part Time-of-Use (ToU) tariffs; and critical peak pricing (CUAC, 2015). In 2012, the Standing Council on Energy and Resources (now the COAG Energy Council) stipulated the introduction of cost-reflective pricing should be 'accompanied by consumer engagement and education for all consumers and protections for vulnerable consumers' (SCER, 2012, page 7).

Despite concerns about impacts on vulnerable households, cost-reflective pricing is being rolled out in the absence of a definition of vulnerable households in Australian energy policy (AEMC, 2014a), including in the National Energy Customer Framework. Over the past five years, cost-reflective pricing policy, and the research commissioned to inform it, has predominantly considered vulnerability a financial condition (Nicholls et al., 2017a). The outcomes of cost-reflective pricing for low-income and hardship households are often considered favourable because, on average, these households have less 'peaky' electricity use patterns and a greater number are predicted to have lower bills on a cost-reflective tariff (Australian Government, 2015; Simshauser and Downer, 2014). However, there has been little policy attention to household vulnerability to extreme heat, reliance on air conditioning for wellbeing, and/or the households likely to have higher bills under cost-reflective pricing policy (Nicholls et al., 2017a).

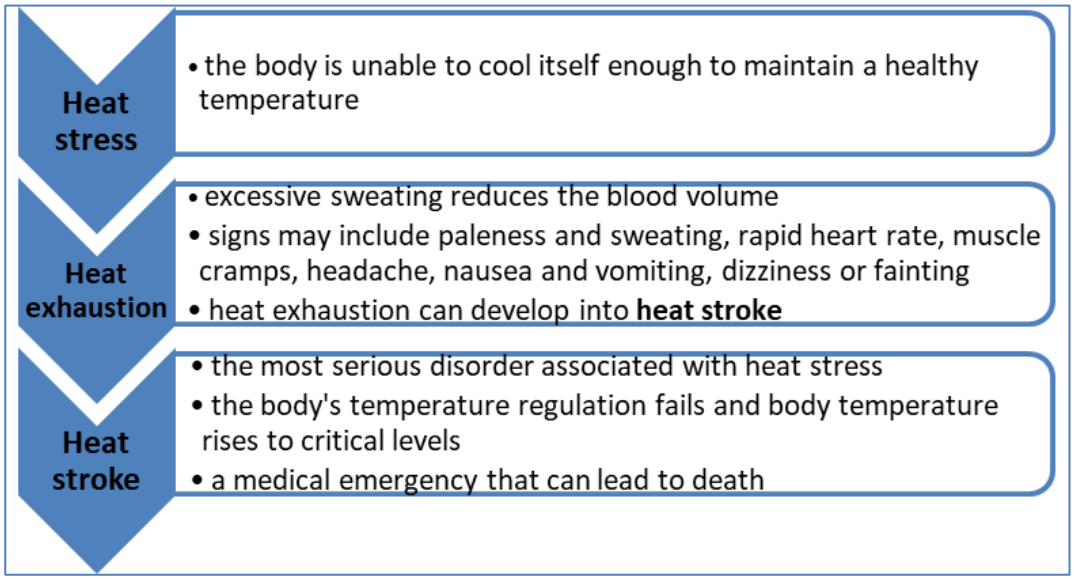
A.2 Household vulnerability in hot weather

Heatwaves kill more people in Australia than all other natural hazards combined (Coates et al., 2014). Build-up of ambient heat increases the health risks in urban environments (O'Neill and Ebi, 2009). Older people, infants, and people with common chronic physical and mental health conditions are among those most at risk (Hansen et al., 2008; Li et al., 2015). However, heat vulnerability is a complex, social condition generated by a combination of:

- heat exposure (e.g. location, housing);
- heat sensitivity (e.g. physiology, health status); and
- capacity to respond (e.g. socioeconomic status, access to transport, electricity and ways to cool down) (Wilhelmi and Hayden, 2010).

Prolonged exposure to heat and dehydration causes progressive heat-related illness (see Figure 1). Health services have struggled to cope with the increase in patients during extreme heat (Hanna and Hughes, 2016).

Figure 1. Summary of heat-related illness



Adapted from https://www.betterhealth.vic.gov.au/health/healthyliving/heat-stress-and-heat-related-illness

Australian households face increasing risks from heat because:

- Australia's population is ageing;
- heatwaves are getting longer and hotter with climate change (CSIRO, 2015); and
- shortcomings in Australia's housing are not being adequately addressed (e.g. due to lax building regulations; limits to tenants' rights, and financial disadvantage (BSL, 2016; Gabriel et al., 2010; Pitt & Sherry, 2014).

Research on health impacts from heatwaves in the United States and Australia has shown air conditioning to be a 'protective factor' (Semenza et al., 1996; Zhang et al., 2016). However, researchers, medical professionals and social service organisations have raised concerns about at-risk individuals avoiding using air conditioning due to electricity cost concerns (Parnis, 2016; Sheridan, 2007; VCOSS, 2013). Even self-restriction of fan use due to electricity cost has been reported (Farbotko and Waitt, 2011).

In addition, electricity affordability and security of supply during heatwaves have now become high profile issues, and the subject of various reviews including the Independent Review in to the Future Security of the National Electricity Market (Finkel et al., 2017) and the Independent Review into the Electricity and Gas Markets in Victoria (Thwaites et al., 2017). Demand management is receiving government, energy sector and media attention as a potential response. For example, when demand was forecast to exceed supply in February 2017, households in New South Wales and South Australia were asked to assist in the following ways:

> *Where you can please do your best to save energy - turn up your aircon to 26 degrees, adjust fridge temperatures, switch off unused electrical appliances and turn off lights where it's safe to do so.* (Hannam et al., 2017)
>
> *If consumers can safely reduce their electricity consumption during periods of high demand, this can ease the supply/demand balance and can mitigate the need for load shedding.* (AEMO, 2017)

As a result, households are hearing various messages about electricity use during extreme heat which may be concerning, particularly for those that are financially stressed. These include messages that:

- electricity is expensive and costs will continue to increase;
- cost-reflective tariffs could reduce household bills;
- electricity will be very expensive during hot weather; and
- households can help avoid outages by reducing electricity use, including air conditioning.

While demand management has an important role to play, the public messages around it are not without risk. Older households show a propensity to underestimate their own vulnerability to heat (Wolf et al. 2010), and an investigation into the health outcomes of the 2014 heatwave in Victoria was concerned that messages to the community to conserve electricity resulted in heat-vulnerable households restricting their use of air conditioners (Victorian Auditor-General Office 2014). More public messaging to encourage demand reductions is anticipated in forthcoming summers in an attempt to manage electricity shortfalls and avoid outages (NSW Government, 2017).

This Heatwaves, Homes & Health project explored the possible impacts of electricity pricing policy and peak demand messaging for households who may be vulnerable to extreme heat.

B. Methodology

B.1 Overview of project methodology

The project employed mixed methods and was conducted in three stages between December 2016 and September 2017. The research activities are summarised in Table 1.

Table 1. Overview of project methodology

Stage 1. Critical review	Stage 2. Key informant research	Stage 3. Household research
Review of relevant literature and Australian energy sector cost-reflective pricing documents • Summary of policy engagement with household vulnerability, particularly during and as a result of extreme heat. See briefing paper: *Electricity pricing, heatwaves and household vulnerability in Australia*	Key informants: people who work in health and social service agencies assisting households with occupants who may be vulnerable to heat • Online survey about heat and financial vulnerability in client households: 52 responses included in analysis • In-depth research: 18 interviews (face-to-face and by phone/Skype)	Householders: (65+ years) and parents of infants (<2 years) • 36 in-home interviews • 3 locations: Melbourne, Dubbo, and Cairns • Including households with chronic illnesses • Including 25 (70%) low-income households

The research project was approved by RMIT University's Human Ethics Committee[3] and conducted in accordance with the University's research ethics guidelines.

B.2 Key informant survey

The survey was designed and delivered using the Qualtrics web-based survey tool. An invitation to respond to the survey and a weblink were distributed via email to local, state and national organisations that provide services, policy and advocacy in the following areas:

- health (maternal, aged, disability and chronic illness);
- emergency management;
- energy;
- financial assistance; and
- culturally and linguistically diverse communities.

[3] Project approval number DSC CHEAN A 0000020502-10/16

Contact details for relevant organisations were obtained online, and via professional networks and snowballing.

The survey asked about respondents' perspectives and experiences regarding household vulnerability to extreme heat, health, cooling practices, and related financial wellbeing issues. The survey used multiple choice and open-ended questions (see Appendix E.1). It did not contain forced responses so that respondents without experience or knowledge on particular topics could advance to the next question. Survey responses with less than three of the core questions answered were discarded. A total of 52 valid responses were included in the analysis.

Respondents fulfilled various roles within the organisation they worked for, including service delivery, project or program management, research and advocacy. Table 2 lists the types of services provided by the organisations where key informants worked.

Table 2. Types of services and activities delivered by survey respondents' employer/ organisation

Service or activity*
In-home health, care or support: 17 In-home financial or energy advice: 10 Other in-home services: 1 Health, care or support services by phone or in office, medical practice or community facility: 13 Hospital-based health service: 2 Financial or energy advice service by phone or face-to-face in office or community facility: 20 Online or other information for vulnerable or disadvantaged household: 12 Advocacy for vulnerable or disadvantaged households: 32 Policy or research: 7 Other: 6

*Many of the organisations delivered a range of services and activities

B.3 Key informant interviews

Key informants were recruited for interviews via a 'willing to be interviewed' check box in the online survey and by contacting relevant organisations (as per Section B.2 above). Eighteen people working in a range of roles and sectors were interviewed (see Table 3). Semi structured interviews were conducted in person or over the phone and lasted approximately one hour. See Appendix E.2 for a list of interview topics and questions. Interviews were audio recorded, professionally transcribed, and analysed in combination with the key informant survey data.

Table 3. Summary of key informant interview participants

Organisation type	**Participant role**	**Target client group/s**
Health services: 5 Energy efficiency in home advice: 3 Policy, programs or projects: 2 Research and or advocacy: 2 Social services: 6	Client facing: 12 Policy, programs or projects: 3 Research or advocacy: 2 Managerial: 1	Low income: 6 Older people: 5 CALD communities: 3 Chronic Health: 1 New parents: 1 Cross cutting: 2

B.4 Households interviews

Thirty-six households living in and around Melbourne (10), Cairns (12) and Dubbo (14) were interviewed. These locations were selected to provide insights into the heat experiences and cooling practices in diverse Australian climates (see Table 4). In some households, two adult members of the household were interviewed together resulting in a total of 42 participants. To be eligible to participate householders needed to be:

- At least 65 years old, or caring for an infant under two years old at home; and
- Responsible for paying their own, individually metered electricity bill (excluded residents of some boarding houses, community housing or aged care facilities).

Table 4. Location and climate characteristics for household research

Location	Hot weather description*	Climate zone**
Melbourne, Vic Large coastal capital city	Average summer high is about 25°. Occasional periods of extreme heat with highs over 35°C (and less often 40°C). Hot nights during heatwaves add to thermal stress.	Zone 6 Mild temperate
Dubbo, NSW Small inland city (Great Western Plains)	Average summer high is about 32°C. Area prone to extreme dry heat: In the 2016-17 summer 49 days reached over 35°C, 14 days were over 40°C (highest 46°C).	Zone 4 Hot dry summer, cool winter
Cairns, Qld Medium-sized coastal city (Far North Qld)	Hot weather throughout year, including 5 months with average highs around 31°C. Typically high relative humidity adds to thermal stress.	Zone 1 Hot humid summer, warm winter

* Australian Bureau of Meteorology climate data (http://www.bom.gov.au/climate/data/) and thermal comfort observations (http://www.bom.gov.au/info/thermal_stress/)
** National Construction Code (NCC) climate zones, see http://www.abcb.gov.au/Resources/Tools-Calculators/Climate-Zone-Map-Australia-Wide

Participants were recruited by various channels including newspapers, newsletters and flyers; social media; and the support of local community organisations that work with low-income households. Some key informants and the organisations they worked for assisted with recruitment (see Appendix E.3 for sample recruitment flyer). Each household was given a $50 grocery voucher to thank them for being interviewed.

Interviews were conducted in participants' homes and lasted between 45 minutes and two hours depending on householder responses and time availability. A questionnaire was used to gather demographic and housing details (see Appendix E.4). Interviews were semi-structured and conducted as an open-ended conversation between the researcher(s) and participant(s) with interview topics and questions used as a guide (see Appendix E.5). Interviews topics included:

- experiences of heat;
- existing home and health conditions;
- daily routines and connections to friends and family;
- cooling practices;
- current electricity costs and management; and
- views on cost-reflective pricing and heatwave public messaging.

The order, wording, and inclusion of questions were adapted for each climate zone, and took into consideration householder answers, understandings, and the flow of conversation. Interviewers assessed a range of non-verbal responses and reactions including avoidance, humour or confusion. In-home interviews also facilitated observations on a range of household and environmental conditions including housing type, structure, shading and cooling appliances.

Interviews were voice-recorded and professionally transcribed. Transcripts were thematically analysed. Consistent with qualitative research methodologies, the sample is not statistically representative and instead investigates emerging research themes in-depth.

B.5 Summary of household participants and housing characteristics

The project aim to conduct at least 65% of interviews with low-income households was met – 25 participant households (70%) were low-income. Table 5 presents a summary of household characteristics. The participant recruitment materials did not explicitly call for participants with chronic health issues but chronic health support services were contacted for recruitment assistance and many participants had heat-relevant conditions (see Table 7).

Table 5. Household participant demographic characteristics

DEMOGRAPHIC CHARACTERISTIC	DETAILS 42 participants in 36 households
Gender of participants	• Women: 28; Men: 14 *Gender imbalance from parents with infants cohort (includes sole parents)*
Household types	• Parents of infants: 17 • Older participants: 19
Cultural diversity	• Born outside Australia: 13 (including China, Malaysia, UK, Canada, Republic of Congo and New Zealand) • Residing in Australia for less than 10 years: 2 • First language other than English: 6
Education level and work	• Post-graduate degree: 3; Bachelor degree: 9; Vocational or other tertiary qualification: 9; Year 12 equivalent: 9; Year 10 or below: 6; Unstated: 6 • Full-time work: 1; Part-time: 2; Casual: 4; Not in paid work (retired/home-maker/looking for work/studying): 35 • Various occupations, work backgrounds
Household structure	• Single parent with infants: 3 HHs • Couple with infants: 14 HHs • Single retirees: 8 HHs • Couple retirees: 9HHs • Single retiree living with adult children: 2 HHs
Dwelling and occupancy	• Free-standing home: 24; Semi-detached home: 5; Apartment/unit: 7 • 1 occupant: 8; 2 occupants: 13; 3 occupants: 6; 4 occupants: 2; 5 occupants: 4; 6 occupants: 2; 7 occupants: 1 • Number of children (under 25): 1 child: 7; 2 children: 3; 3 children: 3; 4 children: 2; 5 children: 2
Tenure	• Private rental: 10 HHs • Public housing: 8 HHs • Own house (with mortgage or owned outright): 16 HHs • Retirement village: 2 HHs
Solar PV	• Melbourne: 2 HHs; Dubbo: 5 HHs; Cairns: 3 HHs
Pool at home	• Cairns: 5 HHs (participants in other locations did not have pools)
Financial situation	• Insufficient income information provided: 3 HHs (8%) • Not low income: 8 HHs (22%) • Low income*: 25 HHs (70%)

* *Where income information was provided, households with annual gross income less than $41,700 or less than $67,600 with two or more dependent children were classified as low-income.*

Most households (88%) had one or more air conditioners[4]. All participants in Dubbo had air conditioning; three had portable units only; evaporative air conditioning was common; and several Dubbo households' air conditioners were not working. Most of those without air conditioning lived in Melbourne (see Table 6). All households had at least one fan or one air conditioner.

Table 6. Air conditioning and fan ownership/access in participant households

Location	No. of HHs	No. of HHs with each A/C type				% with some A/C	No. of HHs with each fan type		% with fan(s)
		Box	Split	Porta-ble	Ducted		Ceiling	Pedestal	
Dubbo	14	2	6	3	8	100%	6	7	86%
Cairns	12	7	7	1	0	92%	12	5	100%
Melbourne	10	1	5	1	0	70%	1	7	90%
TOTAL	**36**	**10**	**18**	**5**	**8**		**19**	**19**	

B.6 Limitations

Householder self-selection. As with all research, the validity of the findings may be influenced by certain sections of the population self-selecting into or out of the project. Recruitment was the most successful via social media for parents, and via print media and community activities for older people. Subsequently, the study attracted participants that were predominately literate, socially active and had access to computers. Participation in the project may have been biased towards households previously affected by extreme heat.

Under-represented households. The following households were under-represented by this study:

- *Households with lower levels of educational qualifications.* Such households potentially confront specific energy literacy challenges requiring differing recruitment approaches in future studies.
- *Households with members born outside Australia*. An additional study with capacity for interpreters and translation services targeted to a range of migrant communities is recommended to capture cultural and ethnic diversity.
- *Indigenous households.* The sample does not adequately represent the circumstances, experiences, and understandings of indigenous households.
- *Households with a disability*: No household participants reported having a disability, further targeted research is required.

Participant self-reporting. The research team are not health or medical experts and could not measure or validate participants' medical conditions as part of this study. Assessments of risk are inferred from self-reported data. Health conditions may have been under or over reported by participants. Evidence of a householders' financial wellbeing and electricity bills was not consistently sighted by the researchers. In some instances the size and status of electricity bills were self-reported. In regards to reported air conditioning use and other cooling practices, there may be some inaccuracies in recall of past events.

Sample size. There is no agreed sample size in qualitative research; however, the numbers in this study are above what is normally expected to achieve data saturation, which occurs when no new themes arise despite continual research (Boddy, 2016). It is therefore likely that the themes and issues identified in this research reflect broader experiences. However, findings from comparisons between the frequency of a particular view or action within this sample size should be verified with a greater number of households.

[4] The Heatwaves, Homes & Health project investigated household use of air conditioning but did not seek to differentiate between the energy consumption of different types of air conditioning.

Understandings of cost-reflective pricing. Participants were asked about hypothetical scenarios and how they may respond to and be affected by cost-reflective pricing. Based on previous research (Stenner et al., 2015) households may not fully understand concepts, tariffs and implications of cost reflecting pricing for their household. Therefore, their answers may not be accurate representations of potential responses and implications of cost-reflective pricing in some households.

B.7 Reading this report

In this report, survey response quotes (from open questions) and interview quotes are represented in italics and are included verbatim. As such, they may contain grammatical or typographical errors. Ellipsis points (…) mark an omission from a quotation. Supplementary text for quotations is provided in square brackets ([ ]) where clarification is required. Quotes included are limited to an illustrative selection.

Household participants are referred to with pseudonyms and a household number (e.g. HH-23). Key informant quotes are referred to by interview number (e.g. KI-I8) or survey response number (e.g. KI-S44). Where relevant, additional research participant information (e.g. age or location) is included with participant codes.

C. Findings

C.1 Exposure to heat and health impacts

C.1.1 Households living in poor quality housing have limited capacity to reduce their exposure to extreme heat – particularly renters

In a heatwave, those living in poor quality housing experience higher temperatures for much longer periods than those living in energy efficient homes (Moore et al., 2016). Most key informants mentioned housing as a key contributor to their clients' vulnerability to extreme heat (see Figure 2, for example *'poor housing design that disregards the climate (& changing climate)'* (KI-S5). Many participants – particularly renters – described their homes as extremely uncomfortable in hot weather and identified contributing features such as:

- lack of insulation and sealing;
- lack of indoor window coverings or external window shading including limited vegetation;
- lack of controllable ventilation; and/or
- poor design and inappropriate or substandard building materials.

As a result of poor housing, participants were exposed to excess indoor heat because their homes heat up quickly, and cool down slowly, in hot weather. A lack of external tree and shrub shading was particularly common in Dubbo.

> *It was very, very hard to keep a happy baby in a very hot house.* (April, Dubbo, HH-35)
>
> *I don't think [the house is] designed for ventilation… It's designed to have air-conditioning.* (Nadine, Dubbo, HH-27)
>
> *Put someone in a fibro house… bare ground around it, no trees, you've got to have that air conditioner going 24/7. They're like tinder boxes. Hot, hot, in the summer and freezing cold in the winter.* (Betty, Dubbo, HH-27)

Public renters, especially those living on upper levels of high-rise public housing were particularly exposed to excess indoor heat.

> *It's small [the window] but sometimes I open it because when it's too hot, oh my God we can't stay inside. You have to go down there in the park. (*Melinda, public high-rise tenant, HH-11)

> *Our tenants report that some of our properties get very hot during very hot days and they experience an exacerbation of their existing medical conditions or have difficulty coping inside buildings that are medium to high density*. (KI-S47, public housing tenancy manager)

Implication: Poor quality housing in Australia exacerbates discomfort and potential health risks during extreme heat, particularly heatwaves.

Figure 2. Word cloud from key informant answers to the question: 'Other than age and medical conditions, what do you see as the key contributors to heat vulnerability in your clients and why?'

Generated in NVivo analysis software

C.1.2 What's 'hot' differs between climate zones

Perceptions of heat-related discomfort differed in each study location. In Cairns, household participants described feeling hot and perspiring but did not reference particular temperatures or humidity levels. In Dubbo participants focused on numbers of consecutive very hot days and often quoted temperatures in the high 30s or 40s as cause for extreme discomfort whereas over 30°C was a common threshold for Melbourne participants.

> *You go outside, come back and you're covered in sweat.* (Barry, Cairns, HH-21)

> *We were having 43 or 44, and it was for a few weeks straight that it was that hot… it was pretty yuck.* (Lily, Dubbo, HH-33)

> *So if it's exce[ding] 30 degrees it's dreadful, I don't like it and it does affect my level of energy.* (Ingrid, Melbourne, HH-1)

Historical experiences of weather or climate shaped perceptions of extreme heat – many in Dubbo spoke of hot weather and being '*used to it*'. Others highlighted the difference in heat experience based on country of origin, or length of time living in a particular climatic condition. Some older Cairns participants who chose to migrate from a colder climate to a tropical climate embraced hot and humid conditions and the need 'to adapt'.

I grew up in a town that's very similar in climate…so I'm accustomed to this kind of heat. For people that live in this area… it's normal to be above 40 in the middle of summer. (Nadine, Dubbo, HH-23)

What's the point of coming here [to Cairns] if you're going to be cold [by putting air conditioning on]? Why not just go down to Melbourne and be cold for nothing? (Phillip, Cairns, HH-20)

Implication: Regional differences in experiences of heat are important for understandings of vulnerability and equitable energy policy

C.1.3 Older households may underestimate their own vulnerability in extreme heat despite experiencing health and wellbeing impacts

Most older participants found it harder to cope with hot weather than when they were younger. Both older participants and key informants were concerned about health impacts of extreme heat in older households including inability to sleep, fatigue, dehydration, confusion, headaches, anxiety, nausea, lack of appetite, increased risk of accidents, and heat stroke.

I feel sick, physically nauseous. I feel very lethargic. My head sort of goes peculiar. I become very agitated, and anxious. (Ester, HH-4)

Some [clients] have suffered heat stroke. (KI-S18)

Hot weather reduced some older people's capacity to look after themselves in hot weather, e.g. drink sufficient water, take medication and manage underlying physical and mental health conditions. Luke described the effect of extreme heat on his capacity to manage diabetes:

I'm supposed to graze during the day. If I don't eat properly I feel quite dizzy and woozy... [but] you don't feel like eating when it's hot and you tend to just skip a bit of food, you know? (Luke, HH-22)

Key informants were also concerned about the '*heightened risk of stroke/heart attack'* (KI-S5) and hospitalisation of older people in heatwaves. They described how shared perceptions of being able to cope in extreme heat may put older people at risk:

People normalise through their peer groups… they say, 'I'm fine, I'm connected,' and as a result that actually puts them at risk as well. (KI-I3)

Consistent with previous research (Wolf et al., 2010) and key informants' observations, some older household participants downplayed, or seemed unaware, that extreme heat can be a serious risk to their own health – even when they reported conditions, symptoms and experiences which indicated that they may be at risk. They often recognised the risk to other people they considered more vulnerable than themselves, but considered their own high level discomfort or distress in hot weather as something they could and should endure.

Suck it up princess. Just opened a window. (Luke, aged 70, HH-22)

Implication: Underestimation of own vulnerability in extreme heat increases the risk of adverse health impacts.

C.1.4 Chronic health conditions exacerbate the impacts of extreme heat and reliance on air conditioning

Many chronic health conditions can be exacerbated by extreme heat and contribute to health risks. The conditions in Table 7 affected not only older people, but also parents and their children in this study. Respiratory conditions which reduced participants' or other family members' ability to cope with extreme heat were particularly common.

Table 7. Heat-relevant conditions in participant households

Condition	Examples
Respiratory conditions such as asthma and hay fever	*My little youngest one, she's 1 [year old], she has asthma and I think if it plays up in the heat, you know, she's wheezing and sweating.* (Lily, HH-33) *But when [my asthma] was the bad heat it was suffocating me, you know?... I felt like I was going to die sometimes.* (Debbie, aged 80, HH-25)
Multiple sclerosis (MS)	*Basically, your MS symptoms increase substantially. And the range of MS symptoms is longer than the page of paper you've got to write on… fatigue… visual disturbances, potentially, people can't even see. A lot of coordination and physical problems… once people cool down, all those problems go away and they go back to baseline, where they were at before they got hot.* (KI-I5)
Spinal cord injury	*Our clients are very vulnerable from their medical condition (Spinal Cord Injury) so doubly unable to control heat/cool as often unable to operate the equipment needed to do so, as well as their body's own inability to thermoregulate.* (K-S28)
Heart conditions	*Clients experiencing stroke/ heart attack.* (KI-S5) *People with heart conditions as well, particularly the heat, their body's taken that massive hit and they're still recovering, but the heat will really knock them around.* (KI-I2)
Anxiety/ mental health conditions	*Distress if unable to stay cool or access cooling (or if air conditioner broken). [It] may have potential to exacerbate mental health condition[s].* (KI-S49)
Diabetes (and others)	*People with diabetes, fatty liver, obesity would suffer from severe heat exposure with no relief.* (KI-S22)

Households with chronic health conditions often relied on air conditioning during hot weather, including to reduce the risk of hospitalisation (see also Nadia Case Study, page 33).

> *Bruce gets a bit short of breath in the really, really close days and you wouldn't turn it [air conditioning] off if he's struggling.* (Jackie, HH-19) *The very hot weather does bring on… medical conditions, asthma and all the rest of it, and you struggle to breath.* (Bruce, HH-19)
>
> *Without having this [the air conditioner] installed during the hay fever season, all the time we had to call the ambulance to the hospital because she [my mother] was short of breath.* (Jain, HH-6)

Implication: A wide range of health conditions may increase reliance on air conditioning and vulnerability to energy prices.

C.1.5 Staying home in very hot housing can exacerbate vulnerability during extreme heat

As usually advised by health authorities, household participants often stayed home during heatwaves despite having extremely hot homes. Social isolation is a risk factor for adverse health outcomes in heatwaves (Vescovi et al., 2005; Wolf et al., 2010; Worfolk, 2000) and older people often cancelled their medical appointments, social activities, shopping trips and exercise on hot days. Isolated heat vulnerable people could miss out on reminders to look after themselves (e.g. drink water, adjust clothing) and welfare checks and reminders from others. Isolation could also contribute to declining mental health which can further compromise self-care capacities:

> *People can literally become isolated in their home as to go outside in a heatwave renders an inability to undertake any activity*. (KI-S26)

Family and friends don't visit when people suffer from anxiety and can't leave the home, this places them at further risk of isolation from their support. (KI-S16)

Living alone at home in an impaired cognitive state & not recognising the importance of drinking & keeping cool. (KI-S7)

Key informants also noted concerns about overcrowding in some homes, the impact of hot and humid conditions on mood and behaviours, and heightened risk of family violence.

Implication: Health advice to stay home during heatwaves may contribute to other health risks in heat vulnerable households.

C.1.6 Leaving the home to seek cooler places may not be viable and can exacerbate financial vulnerability, but can also have co-benefits

Health advice also often suggests that heat vulnerable people without home air conditioning seek refuge in air conditioned public spaces during extreme heat. Some of the young families and older household participants in each study location often went to cooler places beyond the home including:

- air conditioned indoor spaces (e.g. other people's homes, Returned Services League (RSL) clubs, community centres, art galleries, libraries, cinemas, local supermarkets and shopping centres);
- public parks; and
- public pools or other swimming locations (e.g. rivers).

Households mentioned health benefits beyond keeping cool from visiting these places including the social interaction for themselves and their children (with family, friends, other mothers or volunteers) and exercise:

Since my wife died I get out more because I just don't like being at home on my own all the time. There's only so much you can do around home, so I come in to places like this [Men's Shed]. Go to the movies, just go for a walk around the shopping centres where it is cool. (Luke, HH-22)

Key informants also highlighted the positive role of initiatives that provide opportunities for households to seek cool outside the home. A key informant that worked with new families explained:

There's a lot more neighbourhood hubs ... [and] community things happening. We do encourage families [to] go to the library… during the week [we] will run a lot of activities for children. So that's an opportunity for parents to go somewhere cool. Don't have to spend money, you can borrow books… give out vouchers to the local swimming pool or indoor pool. (KI-I11)

However, seeking cooler places beyond the home had negative implications for some households, particularly financially. Entry fees to pools or movies could significantly impact financially constrained household budgets. Alternatively, spending time at places that did not have an entry fee – such as shopping centres or clubs – sometimes resulted in unbudgeted spending including refreshments, entertainment (poker machines) and/ or travel.

If it gets too hot I would just jump in a taxi and go to the club [RSL]. (Veronica, HH-24)

You go off to the club [RSL] and you'd have a nice cold drink and put some money in the pokies… that doesn't help. (Kate, HH-28)

We try not to but you do, cool drinks and that…. you've got these two ones [children]... they want to pick up something and…before you know there you go, it's like $30 is gone on a couple of drinks, and the four drinks and a couple of treats for the kids. (Adam, HH-12)

Key informants also reported being concerned about vulnerable householders spending time and money outside the home on hot days, how this impacts relationships, and the lack of safe or appropriate cool public spaces:

I think they can be spending a lot of time in shopping centres because that's the only cool place they can access. I think negatively it means the kids are spending all day in the shopping centres from a very young age… They do go to the park but not during the daytime… during the day it's too hot to go, so the kids… don't really get to play. (KI-I6)

[Some people] go out and spend money on entertainment in cool places… where it pushes them into financial stress… [and] increases other stresses in the house. [They go] to a shopping centre… where they've got to buy food, or go hungry, or they get harassed by security guards. (KI-I3)

Some particularly heat vulnerable householders could not safely get to public air conditioned spaces due to mobility and transport issues:

No. No [my 91 year old mother can't access public spaces in the heat]. Because she couldn't walk properly… [because of the] mobility problems she has. I have to put her on a wheelchair. (Yo, HH-6)

Some of the people we work with in Vinnies who really would need [a cool public space], but they couldn't trudge along the street there. They don't have cars. The people that really needed it… how would they get there? (Ester, Dubbo, HH-4)

Implication: Both staying at home and leaving the home present health and financial risks for some households

Implication: Accessible, appropriate and free entry cool public spaces are important for the health of many heat vulnerable households

C.2 Practices to manage the heat at home

C.2.1 Parents' understandings of their infants' vulnerability contribute to a reliance on air conditioning

Consistent with common health advice, parents identified babies and infants as more at risk during extreme heat.

Parents' concerns were informed by:

- **Their own experience**

  I did have her weighed every week, because I felt like she wasn't gaining [weight] as well because she was too busy trying to keep her body cool [in summer] instead of gaining that extra fat... So I said to my partner, 'I don't think this is healthy for her'… [It] made it quite difficult. (April, HH-35)

  [My baby] broke out in pimples, like, because she was just hot and then she'd cry because she's hot and anxious and then that would break out more. (Lisa, HH-30)

- **Common health advice for hot weather (Nicholls and Strengers, 2015; Nicholls and Strengers, 2017) about appropriate ways to look after infants in extreme heat, such as adjusting clothing, hydration and the use of water, such as cold baths and washers**

  The rule that they go by is one more layer of clothing compared to what you're wearing. So I used to just follow that. On the really extreme nights where it was, you know, like 40 degrees still, she would just be in a nappy though. I just didn't want to risk it. (April, HH-35)

  The midwives come around every day for the first ten days after you come home from the hospital. And yeah, they did speak about keeping him cool and like, if he was really hot, put him in a cool bath. (Olinda, HH-34)

- **Warnings about other infant health issues such as Sudden Infant Death Syndrome (SIDS)**

  Overheating is a concern, when he's sleeping. So that's a risk factor for SIDS. It's been really stressful… just trying to keep him safe. (Michelle, HH-30)

Although only one parent said that a maternal child health practitioner had recommended using an air conditioning for the health of her baby, parents who had air conditioning usually used it if the weather was hot or humid (See Section C.1.2). Air conditioning helped with children's and parents' comfort, reduced parents' worry about infants' health, and allowed children and parents to sleep properly in hot weather. The parents in Cairns turned the air conditioning on in the morning, left it on all day, and often referred to air conditioning as a 'necessity':

> *This air con needs to be on all the time, for the kids to get comfortable… [the air conditioning] is pretty much on all the time.* (Adam, Cairns, HH-14)

> *In Cairns it's a necessity to have an 'air con'. There's houses here in Cairns that do not have air cons and I have no idea how they cope. But every house I've lived in I've made sure that there is air cons either in bedrooms or throughout the house. Because to me it's one of my basic living [necessities].* (Rebecca, Cairns, HH-15)

Parents in Dubbo spoke of the challenges and exhaustion experienced during extreme heat periods and used air conditioning through much of the summer and most intensively during periods of extreme heat, described by participants as weeks over 40°C:

> *In January it gets above 40 degrees and that's normal, [it] lasts generally about a week to two weeks during summer. This year was particularly harsh. 46[°C] was probably the highest, so that was pretty bad.* (Nadine, Dubbo, HH-23)

> *[We have] one really, really, really hot 40-45 degrees month and the rest, like December you might be sitting around in about 34[°C].* (Lily, Dubbo, HH-33)

Implication: Common understandings of infant vulnerability, poor quality housing and the challenges of parenting in hot weather contribute to parents' reliance on air conditioning.

Implication: Households in regions with prolonged extreme heat and/or humidity may not be adequately considered in energy policy making.

C.2.2 Concern about high electricity bills contributes to potentially unhealthy self-rationing of air conditioning and fans, particularly in older households

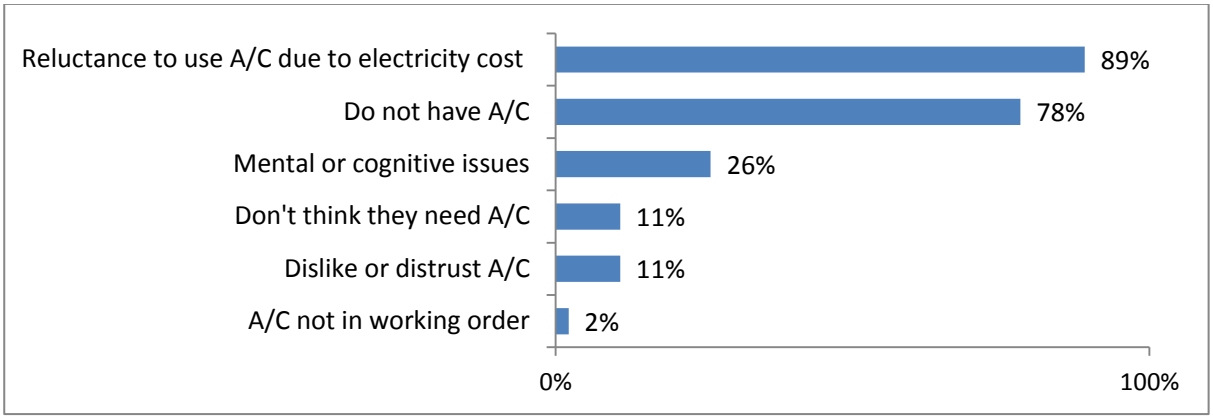
Restricting air conditioning usage is a widespread problem

Electricity cost was a major concern in many households. This concern affected whether, or how much, air conditioning was used in hot homes. Key informants indicated that self-rationing of air conditioning in heat vulnerable households was a widespread problem[5]. Most (88%) of 52 key informant survey respondents were 'aware of at risk clients that do not use air conditioners during heatwaves'. Most (89%) of these 41 respondents identified 'reluctance to use air conditioning due to electricity cost' as a main reason clients do not use air conditioning during heatwaves (see Figure 3), and 66% indicated that it was 'very common' for 'electricity costs to contribute to client reluctance to use air conditioning' (see Figure 4).

> '*Aged clients are vulnerable to heatwaves… many aged clients on minimum incomes attempt to economize on electricity consumption i.e. [not] running fans or air conditioning because of financial costs).* (KI-S8)

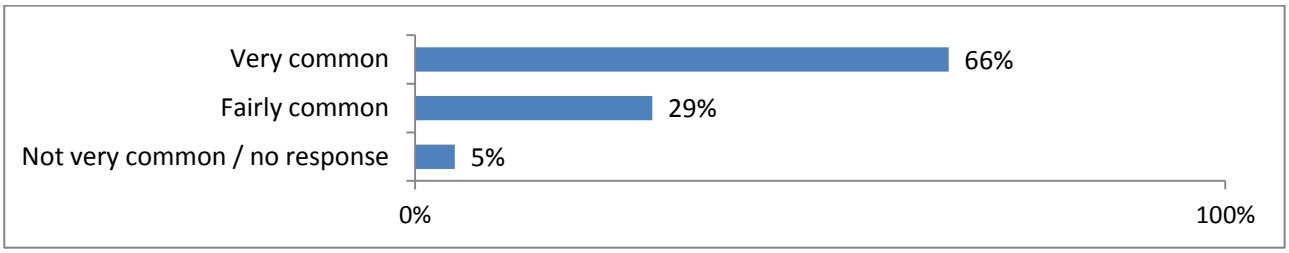
[5] Key informant survey respondents were not asked to distinguish between household/ client types

Figure 3. Main reasons* key informant survey respondents' clients do not use air conditioning during heatwaves (n=46)



*Respondents could select multiple responses

Figure 4. How common is it for electricity costs to contribute to client reluctance to use air conditioning? (n=41)



Eleven of the 16 older household participants who had air conditioning said they severely restricted or managed their use carefully due to electricity running costs. Older residents predominantly used fans and only used air conditioning as a last resort or for short periods.

> *I said (to my husband) what's the good of getting [an air conditioner] for the bedroom, because it's too much electricity, you can't pay for it? … Yes, it's easy to get, but you've got to think of [electricity cost] at the finish, haven't you?* (Debbie, aged 80, HH-25)

> *Just put [the air conditioner] on half an hour before we go to bed, that's all… it's the expense for us.* (Irvin, aged 73, HH-15)

Most older householders said they would like to start using air conditioning or use it more. Some did switch their air conditioner on for visitors, children or others they perceived as more vulnerable than themselves (consistent with Section C.1.3).

> *If we have visitors, however, we will use [the air conditioning] because we know they don't cope with the heat generally speaking as well… we might put it on for a couple of hours or 3 hours just to cool this room down. Sometimes, if they're staying with us as my son and family were in the bedrooms up there, we'll have [the air conditioner] on.* (David, aged 68, HH-5)

> *[I] put the air con on 'cause guests are here… and then when the lady comes in to vacuum… I have to have it on for her because she'd die otherwise.* (Simone, aged 70, HH-36)

Although the parents of infants interviewed for this study tended not to restrict their air conditioning use, key informants who worked with young families were concerned about infant health in very vulnerable/disadvantaged households who avoided using air conditioning due to electricity cost.

> *I see parents struggling with the heat. I guess some either, a) don't have air-conditioning or, b) don't want to put it on because they can't afford to pay the bill.* (KI-I11)

Restricting fan use in heat vulnerable households is also a problem

Smaller numbers of key informant survey respondents were also concerned about households who restricted use of fans due to concerns about electricity costs. About half (47%) were aware of clients who did not use fans during heatwaves and 70% of these 23 respondents (one-third of total survey respondents) considered electricity cost a main reason for client reluctance to use fans. Six of these 15 respondents reported reluctance to use fans due to electricity cost as 'very common', three as 'fairly common', and a further six as 'not very common'.

In interviews with key informants, aged care workers described their older clients' reluctance to use fans:

> *They'll have the blinds all drawn to keep the heat out and… doors kept shut, but then they won't have the fan on… and they're sweltering.* (KI-I19)

> *So [they will] be, 'Okay, it's got to be plugged in, therefore it costs too much money'.* (KI-I7)

Key informants working with CALD communities mentioned similar challenges in some client households:

> *They're not able to afford fans…and [there is] just this worry about that just running anything would increase their electricity bills… the worry that electricity costs …were going to go up.* (KI-I14)

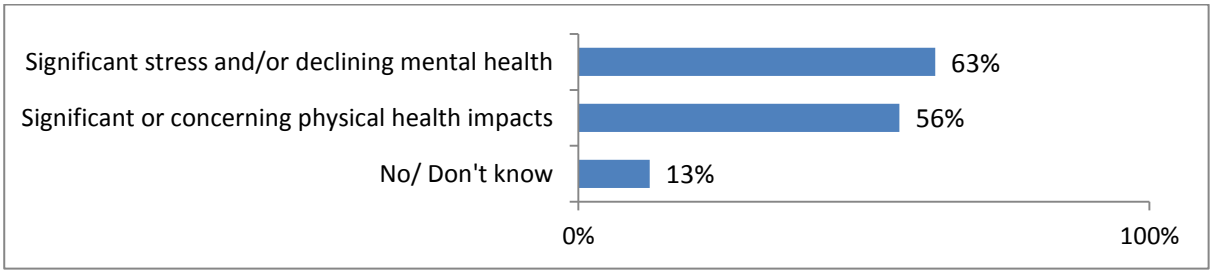
Key informants observe more health impacts from self-rationing use of air conditioning and fans than self-reported by householders

Household participants rarely identified impacts on their own health as a result of limiting air conditioning and fan use to save money – they usually considered that they were doing just enough to maintain their health, but not necessarily comfort.

> *We only turn it on when it is really hot. Sometimes when we have dinner we don't turn it on. [Because of the high medical costs looking after my mother]… I don't want to turn it on too much... it would be good for my mum [to turn it on more].* (Yo, carer, HH-6)

However, a high proportion of key informant survey respondents reported that they were aware of households in which self-rationing was having health impacts[6]. Over half (56%) were aware of households experiencing adverse physical health impacts, and 63% were aware of households experiencing stress and/ or declining mental health, as a result of restricting use of fans or air conditioning (see Figure 5).

Figure 5. Proportion of key informant survey respondents reporting health impacts on clients as a result of self-restriction of fans or air conditioning due to electricity cost concerns (n=48)



*Some respondents selected both stress and/or mental health impacts, and physical health impacts.

Implication: Unhealthy self-rationing of air conditioning and fan use is likely to be exacerbated by rising electricity costs

[6] Households that key informants were concerned about may be more vulnerable or restrictive with cooling than some of household participants in the Heatwaves, Homes & Health study. Similarly key informants may observe health impacts that households would not self-identify/attribute to their hot weather practices.

C.2.3 Households rarely rely on air conditioning alone to stay cool

New parents and older households engaged in a range low or no energy practices to stay cool during periods of extreme heat, in addition to using air conditioning and fans.

Parents engaged their children in water play (e.g. paddling pools, sprinklers and hoses), used cool showers or baths, and prepared and drank frozen liquids to help keep children cool. They also emphasised the importance of hydration and reducing clothing during periods of very hot weather. All parents used some of these low- and no energy practices to cool their infants in hot weather, particularly as they also provided opportunities for play and entertainment. Two parents living in public housing without air conditioning described their typical practices to keep their infants cool:

> *I put ice cubes in the freezer. I always have cold water in the fridge. But we have fans in every single room. I try and keep the blinds closed. If it's too hot of a night time, I'll get a wet tea towel or a face washer and put it behind the fan… lots of showering… We go down and sit in [playgroup in] the air cannot only does it calm me down, but [Ben] he… is more relaxed. He's not so irritable… As well as the pool… that's a cost factor, but at the same token, he is getting cool.* (Naomi, HH-10)

> *I have to leave the flat and go outside, down on the park... around evening. But when it's really hot like sun outside, I can't go outside… I have to leave her [her 18 month old child] undressed… I put her in the bathroom, so [she] can play with water… sometimes if it's hot I have to go there to spend time [an air conditioned community centre] and the swimming pool*. (Melinda, HH-9)

Understanding and access to low- and no energy practices rarely reduced air conditioning use in households with children, as air conditioning (if available) was typically turned on at the same time as utilising low or no energy cooling practices.

It was mostly in older households where low energy cooling practices helped reduce air conditioning use and the effects of extreme heat[7]. Older household participants increased their fluid intake and commonly used wet clothes or washes to stay cool. They also removed some of their clothing, and actively used ventilation or shading of the home. Some older participants also mentioned eating lighter and colder food during hot weather. While helpful, these strategies are not always sufficient to maintain health for older or chronically unwell people living in poor quality housing in extreme heat, as discussed in Sections C.1.4 and C.1.1.

Implication: Low-/no energy practices can be under- or over-utilised in households and can both alleviate or contribute to financial or health risks

C.2.4 Ceiling fans reduce discomfort in hot weather and reliance on air conditioning

Ceiling fans were prevalent in Cairns – all household participants had between three and nine ceiling fans (Table 6). In Dubbo, six homes had one or more ceiling fans. In Melbourne only one household had a ceiling fan and it was located in the bedroom.

All households with ceiling fans used them regularly and reported their effectiveness in keeping them cool. Using ceiling fans reduced air-conditioning reliance in most households, particularly older households. Cairns households with climate-sensitive home design reported that ceiling fans enabled them to avoid debilitating discomfort for large parts of the day or year without using air conditioning. Some households also had ceiling fans outdoors (e.g. in pergola spaces) and emphasised the key role of these spaces for keeping cool in hot (and humid) weather.

> *The rest of the house is just [ceiling] fans. It's three bedrooms so we just have the fans and as you can see we've got fans out all round here outside. If we sit out here with the fan on [speed setting] 'three', you're all right [without air conditioning], there's no problem… It's quite surprising*. (Irvin, Cairns, HH-15)

[7] 5 households (all in Cairns) had pools which were also used to cool off

> *Me, I might have it [air conditioning] on once a year. I have the ceiling fan on.* (Luke, Cairns, HH-22)

In Dubbo, ceiling fans helped older householders sleep in hot weather (without air conditioning). Parents often used their ceiling fans to improve the effectiveness of air conditioning.

> *I sleep upside down in bed so I'm under the fan.* (Kate, age 70, Dubbo, HH-28)

> *If it's been a particularly hot week because we have the air con on and the fans on… fan provides relief when it's humid… in the bedrooms… for air circulation at night.* (Susie, parent, Dubbo, HH-31)

Some key informants noted the lack of ceiling fans in homes as a contributor to their clients' heat vulnerability, and suggested that housing needs '*higher ceilings for [ceiling] fan use*' (KI-S23). Households without ceiling fans were less positive about the usefulness of portable fans which '*push hot air constantly around*' (Naomi, HH-10).

Key informants mentioned safety risks associated with using portable fans in households with small children or adults with challenging behaviours, and were concerned that portable fans were insufficient to maintain health in some heat vulnerable households living in poor quality housing.

> *Even a fan, it just blows hot air in the summer when we get the extreme heat when you're in Griffith and other parts of Western New South Wales.* (KI-I10)

> *There's a safety issue with [fans] as well. So you have to be careful then that if they've got fans and they're in a high enough place… cords aren't dangling… depending on how old the child.* (KI-I11)

In contrast, an older Melbourne couple living in an older, well shaded ground floor apartment were just using '*two little fans*' (Ingrid, aged 72, HH-1). Although Ingrid cited electricity cost ('*it's frightfully expensive*') as a reason not to get air conditioning the couple did not feel at risk without an air conditioner: '*in reality this place doesn't need air conditioning… we come in here, the temperature is very seldom above 25[°C]*'.

Implication: Most households could benefit from having ceiling fans to reduce hot weather discomfort and/or reliance on air conditioning.

C.2.5 Caring for pets in hot homes can increase air conditioning reliance

Half of 16 household participants with pets said they left the air conditioning on exclusively for their pets, mostly for dogs. These households ran the air conditioning when nobody was at home, or in extra rooms, out of concern for their pets' heat vulnerability and their perception that it was unsafe for them to be left alone in heat. Julie explained the longer periods when she leaves the air conditioning on for her two dogs:

> *When I've gone out to the boys to play football… we might leave here at 1 o'clock in the afternoon and get home 8, 9 o'clock at night and I'd leave the air-conditioning for [the dogs].* (HH-14)

Michelle talked about the dual benefits of keeping the dogs cool as well as keeping the house cool whilst her and her family leave the house:

> *When we go out, because the dogs are inside dogs… we leave it on for them and… to keep the house cool [for us].* (HH-26)

Mike and Lucy described how they look after their long-haired dog during heatwaves:

> *We have a big like fluffy husky looking thing.* (Mike, HH-32) *Yeah we leave [the air conditioning] on during the heatwave when we're out… I'd definitely leave that on for her.* (Lucy, HH-32)

Implication: Common understandings of pet vulnerability, which contribute to some households' reliance on air conditioning, are not currently considered in energy policy making

C.3 Financial and health considerations for energy policy

C.3.1 Households are struggling to pay high electricity bills associated with air conditioning use

Air conditioning use was contributing to high electricity bills – particularly in households with infants and/ or health issues affected by extreme heat, and in areas with sustained periods of hot weather. Fourteen of the 36 households interviewed were financially stressed and nine of these were either behind on their bills or on energy hardship programs. Some households accessed emergency relief grants, applied for advance Centrelink payments, or borrowed money from relatives to pay electricity bills.

> *It's about the suddenly getting that bill and having no knowledge that it was going to be that big and no way of paying that off… this bill killed me … I had to apply for the[emergency] relief because I was like, 'There's just no way I can come up with that sort of money'.* (Julie, HH-14)

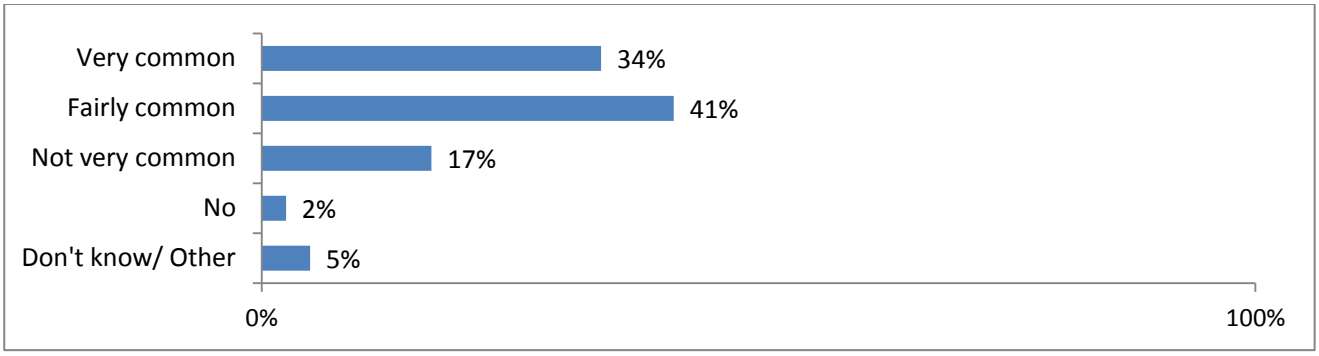
> *We're both students… at the end of last year we had to go get the vouchers for our bill… Mike's now working two jobs… we borrowed money off Mum for a while to help pay rent and bills and stuff. And used some of [Jordan]'s money (5 year old son's savings account).* (Lucy, HH-32)

Although householders use air conditioning for various reasons, three quarters of key informant survey respondents said it was either 'very common' (34%) or 'fairly common' (41%) for households to experience financial stress as a result of using air conditioning for health and wellbeing reasons (see Figure 6).

> *Mostly [heatwaves] just adds to their general levels of stress - particularly financial.* (KI-S35)

> *You're probably going to get more people who are [in] family-type groupings who are using air-con and… over-using it in a way, in terms of their financial means … leading to financial stress.* (KI-I3)

Figure 6. Key informant survey: Are you aware of clients experiencing financial stress, such as difficulty in paying electricity bills, as a result of air conditioner use for health reasons (n=41)



Implication: Tariff changes that result in higher bills for financially constrained households who rely on air conditioning will exacerbate existing financial stress

C.3.2 Financial stress associated with high electricity bills is impacting household wellbeing

Paying high electricity bills including high usage from air conditioning was often prioritised over other expenses such as groceries, childcare, health insurance, and social or entertainment activities for children or older people (such as going to the cinema). Ongoing concerns about how to juggle electricity bills and other costs, deal with energy retailers, and avoid disconnection, negatively impacted wellbeing in some households (see also Nadia Case Study, page 33).

> *I might have to like cancel kindy [kindergarten] payment of $80 to put $80 on Ergon [electricity bill]. And then put $40 towards kindy or swap it over.* (Adam, HH-12)

A lot [of our friends] have had to do [withdraw from private health cover because] the last [bill] increase was just the straw that broke the camel's back and it's a shame because when you're older is when you're likely to get sick. (Jackie, HH-19)

Heat stress, mental stress, choosing between staying cool and other necessities, increases in social isolation. (KI-S15)

Several participants described being in a constant state of worry about electricity disconnection. This was exacerbated by communication with their energy retailer and an inability to access energy hardship programs. In some households electricity bills compounded other significant family and wellbeing stresses.

[Our electricity bill] was $3,690… [The retailer contacted us] not to offer hardship [assistance], but to let us know that [if] nothing was made in arrangements for payments, then we were going to have our electricity disconnected, which went on for months and months, they just kept sending threats out… It took us to bring it up and go… 'we are really struggling, and what can you offer us?'. (Rebecca, HH-13)

The stress of one day saying the power is getting cut off because you can't afford to pay. That's a huge factor in the back of my mind always. Even though we still pay every fortnight it's just getting that phone call saying. 'Come on guys, you owe $1,400. What's going on? I know you're paying $40 every fortnight but we're going to turn your power off', that's the scariest part. (Adam, HH-12)

Implication: Retailers may not be providing adequate information or support, including access to hardship programs, for those under significant financial stress as a result of their electricity bills.

Implication: Concession programs are not adequately addressing the impacts of increasing energy and other living costs on wellbeing.

C.3.3 Medical cooling concession arrangements are not sufficiently addressing the health and financial risks for those reliant on air conditioning

Current medical cooling concessions were described as too restrictive, insufficient, not adequately promoted, or too administratively complex. Not having access to a cooling concession when health issues required higher use of air conditioning compounded existing health and financial vulnerabilities. For example, a pensioner living in Cairns described the increase in air conditioning use for his terminally ill wife and his worry about the electricity cost:

When my wife was sick she was, she died Easter Sunday night, so she asked for the air-conditioner to be on... I'm not going to tell you how much it cost me but for the few weeks leading up to just before she died… it was horrendous. I couldn't afford it but I had to pay it because she needed to be a little bit more comfortable, you know?… She was diagnosed terminally ill. But there's nothing [available to help financially]. (Luke, Cairns, HH-22)

Key informants were concerned about eligibility requirements for cooling concessions, *'who's eligible, who gets it and, like, there's a lot of people who are quite vulnerable who don't get it?'* (KI-I3) and explained the complexity of accessing the concession and the challenges faced by those in need:

A lot of these people aren't in a good position to do a lot of paperwork or get on the internet or constantly monitor their bills to make sure they're getting the concession… there's no reason it should be so hard for people. And I know people who don't bother with the concession because they just got so sick of fighting with the retailers and submitting endless paperwork that would get lost or not processed or whatever. (KI-I5)

Nadia's Case Study (below) illustrates how households who are dependent on air conditioning for health and family wellbeing can miss out on any assistance with their cooling costs under current concession arrangements.

Implication: Current medical concession programs exclude, or are not visible or simple enough for many vulnerable households who need to access them.

Implication: The current levels of medical cooling concessions are not sufficient for those with chronic health conditions and high cooling needs which are life-threatening or significantly affect their quality of life.

Case Study: Nadia

Nadia is a sole parent living in public housing with multiple heat sensitive health conditions, including a serious heart disorder. Without air conditioning when it's hot, Nadia's heart can go into arrhythmia requiring specialised hospital care: '*Nothing can bring [my heart rate] down besides either electric shock or really strong medication that only hospitals have'.*

Nadia was socially isolated and had little family support. Frequent hospitalisations during hot weather caused financial stress because she had to pay for childcare while in hospital.

The process of getting air conditioning installed by the housing agency was a long and difficult: '*It took so long… it was such a process… [it took] a year.* Nadia now uses her air conditioning regularly and her health has improved. However, Nadia now struggles with high electricity bills which cause stress and limit expenditure on other essentials: '*[After my] $600 bill, I'm hardly left with anything… I've cut down on the shopping; taking [my children] places… I'm really stressed'.*

Although Nadia needs to keep the room temperature below 26°C to manage her heart condition, she thought she would need to cut her air conditioning use if electricity costs increased during hot periods under cost-reflective pricing: '*It would probably not be a very good outcome for me… [but]… I'd try and use [the air conditioning] less'.*

Nadia was unaware of the availability of, or eligibility requirements for, the medical cooling concession. She had recently used a Utility Relief Grant to help pay an electricity bill but had not been offered a hardship program by her retailer. She was worried about the remaining outstanding amount and how she would pay the electricity bills over the coming summer which would likely be even higher: *'I applied for that grant you can get every two years… my bill was getting so high… but there's still an outstanding amount so I've rung them... to organise a payment plan'.*

C.3.4 Peak pricing is likely to exacerbate unhealthy self-rationing of air conditioning and fans in some households

Older households and households with health conditions exacerbated by heat are already avoiding or self-rationing use of air conditioning in hot weather. Electricity tariffs that include higher costs for electricity at peak times are likely to encourage some of these households, and others, towards further restriction of air conditioning and health risks. It was common for households to state that they could not afford (health-wise) to use the air conditioning any less than they already were, but they also reported being unable to afford any more increases in their electricity bills.

Towards the end of household interviews, interviewers described a three-part Time-of-Use (ToU) tariff scenario[8] (see Appendix E.5). As in earlier research (Nicholls and Strengers, 2015) participants often found it difficult envisage what a ToU tariff would mean for their household financially. Even though the impact of peak pricing depends on each households' pattern of electricity consumption (their bill may go up or down on a peak tariff), the concept of peak prices created anxiety in financially stressed households and prompted ideas about further restriction of air conditioner and fan use:

> *That would be really terrible… wouldn't be able to use [the air conditioner], if it got dearer…I don't know what we'd do… That would be dreadful… without that [the air conditioner] I tell you what, [last summer], I think that we would have died.* (Debbie, aged 80, HH-25)

> *No, definitely not… I don't think I'd sleep, to be honest. My anxiety would go up. I would spiral downhill. I need to be cool. It's, it allows my body to relax and with my anxiety, like, as soon as it does get hot… my anxiety gets worse and worse and I don't want to end up in hospital because of it… I don't think I'd really change [my fan use]. Like, I, it's actually kind of scary thought… to not be able to use fans and cool down, that's horrible.* (Naomi, HH-12)

Key informants were also very concerned that peak pricing would encourage older people to self-ration air conditioning to an unhealthy extent:

> *People [over] 65, their common practice, their behaviour just is, 'No, we don't have these things [air conditioners]'… a frequent part of discussions [as part of our outreach services] is, 'Do you know how to use this [the air conditioner]? And how often do you use it? Do you actually use it for your health?' Because again, that fear of the financial impact at the end of summer will hold people back from using it*. (KI-I2)

Young mother Nadia (HH-10, see Case Study, page 33) also stated that she would try to use less air conditioning under a ToU tariff because, despite requiring less hospitalisation for her heat-induced hear condition after the installation of air conditioning, she was struggling to pay electricity bills and fearful of being disconnected and the impact that would have on her young children.

> *I'd try and use it [the air conditioner] less, and do more of the face washers and cold water, and all of that too.*

Implication: Peak pricing is likely to encourage demand responses which could be detrimental for health in some households, without significantly helping the electricity grid at peak times – because the households most likely to respond are already conservative with energy use.

[8] Except to the few households who already had a ToU tariff

C.3.5 Peak pricing is unlikely to substantially impact air conditioning use in households who consider it integral to daily life (regardless of the financial impact)

Most households who used air conditioning extensively were households with children and prioritised comfort and wellbeing over bill costs. As in past research, they thought their electricity use would be unaffected by cost-reflective pricing (Nicholls and Strengers, 2015). Some participants said hypothetically they may be interested in taking up cost-reflective pricing but then when asked if they were willing to cut back on air conditioning during a heatwave or extreme heat they said they were not.

> *It'd kill me [electricity price increase during hot periods], but I would do it [turn the air conditioner on] just because you can't live… up here. We need air con to function otherwise it's just, you become lethargic, dehydrated very easily up here, so keeping yourself cool and hydrated is the main need to survive [despite $3690 electricity debt].* (Rebecca, Cairns, HH-13)

> *We're going to use [air conditioning] regardless. It's just going to be, you know, in the back of your mind, like, oh, this is going to be costing us 'triple' the amount as it usually would.* (Michelle, Dubbo, HH-26)

Some participants needed more time, information and specific cost implications to think about cost-reflective pricing but usually talked about the financial outcome based on current routines (without shifting energy use).

> *I want to be able to do a comparison of how much we use in peak, and how much in off peak, or on shoulder.* (David, HH-5)

> *I think I'd have to look at the deal and see how much extra it would cost… if it worked out to be the same or cheaper in the long run, then yes, I would be interested in that. But if it would be more expensive in the long term, then I wouldn't.* (Olinda, HH-34)

Key informants also expressed concern about how clients may respond based on the design and understanding of cost-reflective pricing approaches:

> *We've got this concern about blanket cost-reflective pricing, how it would be understood by the clients we work with, how they would respond to it… One, is to comprehend it. Two, first you've got to understand it, but then you've got to operationalise it in your home to be able to go, 'Oh, so the toaster's been on for two minutes, what does that mean over a half an hour period and how do I stack up all the things for half an hour?' (KI-I3)*

Implication: Peak pricing is unlikely to encourage a substantial demand response from higher users of air conditioning and may exacerbate financial hardship for some of these households.

C.3.6 Household responses to peak demand issues and public messaging are undermined by distrust and confusion arising from recent public debates about energy issues in Australia

Household interview questions about peak pricing and public messaging often elicited doubts or misunderstandings about demand management approaches. Participants usually thought that government and the private sector could easily address the peak demand issue with more electricity supply and/or changes to energy policy including:

- **Expansion of household solar PV**. *If the government was serious about us using solar panels and saving electricity about that, they should make that easier for us. You know they had the high tariff… and now they're cutting that out.* (Nicole, HH-16)
- **Perceived impact of privatisation of electricity assets and services and power stations closing down.** *If you're supplying any other sort of goods and demand goes up for it you produce more. But with the power the way it is and now in Victoria where they just decided, they privatised*

the power in Victoria and then an overseas company decided that they didn't want to invest any more, didn't want to operate, so just closed it down. (Bruce, HH-19)

- **Insufficient planning and politicisation of energy issues**. *They blamed it on renewable energy, which was stupid, because that's not the reason that there was a blackout… It was because there was a malfunction… they're not actually thinking carefully about the energy requirements for the future, and where that energy should come from.* (Olinda, HH-34)
- **Targeting energy use by businesses**. *Maybe it's not a private [residential] issue though. Maybe it's a commercial thing and say 'commercial businesses, turn off your [power]… for an hour. That would constitute more power savings than 10 streets turning off their [power]… for an extra two hours.* (Mike,HH-32)
- **Addressing gas export policy**. *You do it first, then I'll do it… No, I don't believe in all that, because they're giving our gas and everything away for absolutely nothing. And they want us to pay all this big money for it, and they're giving it away for nothing.* (Phillip, HH-20)

Consistent with past research (Strengers and Nicholls, 2013), households were mostly unaware of how residential peak demand contributes to high electricity prices and they thought that the energy sector's problems shouldn't be pushed onto households via cost-reflective pricing or public messaging to reduce demand at critical times.

Some regional households were concerned that capital city-based bureaucrats and politicians were making decisions for regional areas without an understanding of the extreme heat conditions and their associated cooling requirements:

> *I'm always sceptical with that sort of shit... It's all well and good to jump up and down, but I never saw any actual data which suggests that [reliability is an issue] – we didn't experience anything out here… I wasn't aware of it.* (Mike, Dubbo, HH-32)
>
> *I'd say it's up to the individual's choice because people aren't going to have the things on unnecessarily… I think [public messaging] is a bad idea. It's only a waste of government money.* (Barry, HH-21)
>
> *Maybe they need to experience [hot weather in Dubbo] and they'll have a greater understanding of what people in really hot towns and hot places go through. It really zaps you because it's just so intense if you spend for a long period of time in that kind of temperature… before you encourage us not to have our air-conditioning on.* (Nadine, HH-23)

Some households saw the potential need for public messaging but expressed a range of concerns including that:

- **They would not respond.** *Well for me personally it'd be like hell, no, that ain't going to change… if I'm really hot I'm going to use my air con.* (Rebecca, HH-13)
- **The people they thought should respond (high consumers or young people) would not due to expectations of comfort.** *The people that would be inclined to use a lot of electricity, I don't actually think that… they'd take those messages on board really*. (Betty, HH 27)
- **Targeting certain types of households was unwarranted or unfair.** *Wouldn't groups feel a bit persecuted that you are targeting on different groups? I just think if you're all sensible and think of our neighbours there's no need to target different groups.* (Ingrid, HH-1)
- **Messaging should account for diversity in climates.** *Unless they've experienced it to be able to… say that to someone 'You really shouldn't use it. You should be careful about using your air con'; when you're living in this heat, and even if it is only a month, you need it, especially if you've got kids and babies*. (April, HH-35)

Implication: Households' trust and fairness concerns limit the effectiveness of public messaging and current demand management initiatives.

C.3.7 Some of the most vulnerable people may further restrict cooling in response to public messaging to reduce electricity use in extreme heat

Some householders and key informants were concerned that public messaging about electricity restrictions and the potential for planned or unplanned outages – alongside requests to reduce electricity consumption – could encourage heat vulnerable households to further restrict air conditioning or fan use. David said:

> *We were brought up that way that we save money whenever we can… the government is telling us to do something which will save energy and electricity and… save us money too, we tend to do it without thinking necessarily about our health and whether we should or shouldn't*. (David, HH-5)

Other household participants said that they would maintain their current cooling practices in response to public messaging, usually because they felt they couldn't manage with any less air conditioning. However household participants were concerned about the impact on others that they perceived to be more vulnerable than themselves, including a concern about causing additional stress and anxiety:

> *Already frugal elderly people would put their health at risk by reducing air conditioning and other important services. I think that the [public messages] could be a bit more targeted toward high energy users rather than just a blanket [message]… the aged, they wouldn't be high energy users anyway. So, by putting a blanket statement out… it might cause a bit of anxiety, a bit too much anxiety for [the aged]. And then they suffer as a result.* (Ester, HH-4)

> *I would hope that they'd be very subtle about how they do it [public messaging] to make sure that pensioners, who have got so much time on their own to think… [so] they're not frighten[ed] because they would worry about that*. (Veronica, HH-24)

Key informants' were also concerned that community-mindedness would contribute to unhealthy outcomes from some of the most heat vulnerable households and undermine their attempts to encourage householders who are particularly at risk in extreme heat to use their air conditioning.

> *I think having those messages go out to the general public… the elderly are going to take it on board. If they do reduce it any more than they already do, it's going to put them at a greater risk.* (KI-I17)

> *The only problem with those messages is that the people who need to have the electricity and to use it are the ones that won't use it. And the young ones who don't need it won't take any notice.* (KI 18)

> *'[We are asking people] have you got air conditioning if it gets really bad?'… And then on the other hand these people are listening to public messaging about being considerate about your energy use. It might be just a bit conflicting for people.* (KI-I16)

Implication: There are risks associated with public messaging that does not identify differing health needs for cooling.

C.3.8 Electronic billing and direct debit arrangements may further reduce household engagement with energy bills and communications

Over recent years, utilities have incentivised households to receive energy bills electronically and pay by regular direct debt arrangements (e.g. charges for paper bills, discounts for bills paid on time or by direct debit). As found in previous research (Nicholls et al., 2017b), householders were paying bills automatically or by a click of a button, often in response to emails opened on smart phones. As a result bill recipients usually spent less time looking at the bills or associated information and other household members were unlikely to see the bills at all. Previously paper bills remained visible in homes for a period of weeks prior to payment,

potentially stimulating discussion or observation of tariff details, or providing a visual reminder to attend to energy consumption.

> *Because they take [the payment] out, I think it's every 3 months or every 4 months, I can't remember. So they debit it and they email me… yesterday I got the email.* (Susie, HH-31)

> *I've only just gone over to direct debit. I don't say I like it much… I'm not used to it, I like to see my bill… I prefer to read it in my hand. I get so many things on internet that to sit in a room and just look at it… also you can read [a paper bill] and put it down and you can pick it up [again] and you know exactly where [it is] but with a computer… you've got to find it.* (Kate, HH-28)

For older households or those without easy access to a computer, the shift to electronic communications could further distance them from insights into electricity consumption, tariffs and costs.

> *The reason why I've gone online because they want to charge you extra if you have paper bill so I am online believe it or not. So for someone who doesn't… know how to use the ATM, or have a mobile phone… the format of the online bill is… a little rectangle with 'pay now' on [it]… If you want to look at your bills in detail you've got to… go somewhere else which is beyond me. So straight away I hit, 'pay now', and that's it so I don't check.* (Ingrid, HH-1)

> *I can't sit up and read at a screen. It's too hard. I just prefer paper. I like writing comments in the margin which isn't necessarily a good thing to do but you can't do that on a screen.* (Ester, HH-4)

As illustrated by these quotes, these technological shifts were undermining energy literacy and awareness in some households. This unintended outcome is important in the context of the further promotion of cost-reflective pricing in households.

Shifts towards electronic billing and direct debit may further exacerbate misunderstandings about what tariff applies to each household, whether there is a peak charge, how high the peak charge is, and when the peak charge applies. These misunderstandings could also exacerbate unhealthy self-rationing of air conditioning or fans and elicit inappropriate demand responses.

Implication: Technological shifts to electronic billing and direct debit payment may undermine energy literacy aims and potentially compromise outcomes for households and the energy sector.

C.3.9 Culturally and linguistically diverse (CALD) households have diverse responses to extreme heat and face extra challenges navigating electricity costs and tariff reform

Strategies and understandings about how to stay cool in hot weather can differ between cultural groups. Key informants described how some cultural groups (who were not represented in the household research) prefer being indoors using air conditioning in hot weather while others prefer family beach activities and avoid air conditioning even when it is available in their homes. People from some cultural backgrounds feel particularly unsafe with windows and doors open so may experience extra indoor heat and humidity – and this may be exacerbated when large families live in small houses. Some communities also visit air conditioned religious centres as a way of bringing communities together and keeping cool during extreme heat (Section C.1.6). However, some migrant women were reported to be isolated and suffering from extreme heat in poor quality homes.

A key informant working with new migrants (KI-I14) described high levels of stress in some migrant groups during periods of extreme heat due to:

- **Unfamiliar climate, housing and social conditions**

> *Mostly people can only afford [homes] quite far out of the city, places that are quite run down usually… they're not able to afford fans, air-conditioners and …[I work with] families who tell me that it's just absolutely scorching in their house and that… it's affecting their family.*

[There is] also [an impact] on mental health… its incredibly stressful for a family [when] in their country would be able to deal with this situation but here they're not able to.

The families that are quite isolated… their only option is to come in and ask their caseworker and they're at quite a loss by the time they get to that point. But I think other people when they have their community they band together and come up with solutions.

- **Financial stress**

I've seen people who will pay off an electricity bill before putting, using that money for children's excursions… or even food… people come in and say, 'I can't afford my rent because I just paid this electricity bill'.

They would use it [fans] more for the children but not for themselves.

CALD households and key informants described how having English as a second language affected these households' understandings of electricity use and tariffs, and contributed to extra challenges dealing with landlords and utility providers.

I don't think many… elderly people with no English whatsoever… know what's happening… [with smart meters and electricity tariffs]… So there has to be some scheme from their own language background to help them to have smart meters and explain how it works, then they will be really good… it has to be explained in their language. (KI-I9)

If I don't understand [my electricity bill] I have to go to Fitzroy library or …the secretary staff [at a parent group] so she can explain to me, what it means. (Melinda, HH-9)

They don't know that help exists with these companies and that you can just ring up and speak to a financial hardship team, and… not a lot of people are able to read English and I find [its] bit too much to actually cope with… you can't just do over the phone… you have to fill out this form… and it just seems to stress people out. (KI-I14)

Implication: CALD communities are likely to face additional challenges when navigating extreme heat, cost-reflective pricing and public messaging. These challenges are insufficiently understood.

D. Discussion and recommendations

Together, poor quality housing and high electricity costs compromise health and wellbeing in Australia. Australian homes typically have little protection from the ingress of outdoor heat. Households try to manage with extreme indoor heat, cool their home with air conditioning, or go somewhere else to stay cool.

The Heatwaves, Homes & Health study found that electricity costs for air conditioning exacerbate financial stress and potentially unhealthy self-rationing of electricity. The reported experiences from households and key informants participating in this study demonstrate that unhealthy self-rationing of air conditioning, or even fans, in hot weather is common in disadvantaged heat-vulnerable households. This problem is likely to become more prevalent if electricity prices rise. Likewise, the health, social and economic impacts of rising electricity prices are likely to become more pronounced in the event of more severe heatwaves as predicted under current climate change scenarios (CSIRO, 2015; IPCC, 2014).

Mitigating the impact of future heatwaves on household health is a complex social problem which calls for cross-sectoral policy attention. The Heatwaves, Homes & Health study focused on the role of electricity policy and demand management in heatwave vulnerability.

As such our recommendations focus on four key areas targeted specifically at heat vulnerable households:

1. Developing consistent and nuanced messaging regarding hot weather peak demand and health inequities.
2. Improving outcomes from electricity policy and programs, particularly cost-reflective and alternatives to tariff-based demand management.
3. Improving housing stock, available retrofits and appliances to stay cool in extreme heat.
4. Delivering integrated health and housing service-based approaches.

We encourage the electricity sector to reach out to relevant sectors and jurisdictions to collaborate on these recommendations which require housing, urban planning, community development and health sector contributions. Engagement with households, communities and other sectors is also necessary to build trust, identify widely acceptable approaches, and build support for, and productive responses to, demand management initiatives.

Key informant participants in this study put forward a range of ways to reduce the risks associated with electricity costs and potential price rises in heat vulnerable households. Many of their suggestions are incorporated into the study recommendations but a full summary is provided in Appendix E.6, including useful suggestions beyond the scope of the study.

D.1 Messaging about hot weather and electricity

1. **Consistently embed messaging about health inequities in public communications about hot weather peak demand and electricity conservation.**
   - ❖ The messaging should identify:
     - the critical importance of electricity for heat vulnerable households; and
     - that younger (e.g. under 65 years), healthy households can help by reducing electricity use.
   - ❖ Recent messaging examples in which households were encouraged to *'safely reduce their electricity'* or *'where it's safe to do so'* are too vague to discourage unhealthy self-rationing by frugal and community-minded elderly households. Collaboration with health authorities is needed to identify suitable messaging and approaches which balance immediate risks to individual health against longer-term risks of financial stress and electricity insecurity associated with air conditioning reliance.

2. **Promote climate-appropriate low-/no energy ways to stay cool, and minimise messaging that positions air conditioning as a necessity regardless of age and health.**
   - ❖ In isolation, messages such as *'turn up your aircon to 26 degrees'* can normalise and entrench air conditioning reliance. It is important that households maintain and expand the use of low- and no energy ways to stay cool without air conditioning so that healthy people can assist in reducing peak demand and all households have strategies to support their health in the event of planned and unplanned electricity outages in hot weather.

3. **Raise public awareness regarding the role of peak demand and household air conditioning in contributing to electricity price rises.**
   - ❖ Greater understanding of the implications of rapid uptake of home air conditioning is needed to improve demand management outcomes and overcome assumptions that provision of more peak supply can be easily delivered without increasing household energy bills.

D.2 Cost-reflective pricing and alternatives to tariff-based demand management in extreme heat

4. **Expand understandings of vulnerability in energy policy and explicitly include heat vulnerability as a key consideration in hot weather demand management strategies.**

5. **Develop a strategy to minimise adverse health and financial outcomes on heat vulnerable households as a result of cost-reflective pricing.**

   - ❖ The Power of Choice review (AEMC, 2012) suggested identifying and protecting vulnerable consumers but current concession schemes are insufficient to address the risks associated with cost-reflective tariffs as identified by this research. Approaches to consider include:

     - Identifying and registering heat vulnerable households who may have different or additional needs.[9]
     - Minimising enrolment of heat vulnerable households to tariffs with strong peak price signals, e.g. through screening for age and health suitability, and monitoring energy retailer marketing practices.
     - Allowing heat vulnerable households to easily opt-out of cost-reflective tariffs and requiring retailers to actively inform them when they would be better off on a flat-rate.
     - Conducting further research with CALD households to better understand vulnerability to heat and tariff reforms in particular communities, and how to mitigate them.
     - Working with the health and social services sector to support parents to care for infant health in hot weather in energy efficient ways.
     - Exploring household concerns about pet health in heat to address associated electricity use.

6. **Ensure medical cooling concessions are able to assist people with a range of heat health needs – both in terms of eligibility and accessibility.**

   - ❖ A threshold age for medical cooling concession eligibility such as 75 or 80 years old could reduce complexity for those who may be least able to engage with lengthy application processes. It would also send a productive health message to older people about prioritising their own health in hot weather despite recent increases in electricity bills. Consultation with the health and social services sector is needed to develop a revised framework for eligibility for medical cooling concessions and build effectiveness of referral pathways.

[9] In the UK, energy, water and telecommunications businesses maintain 'Priority Services Registers' which include a wider range of household vulnerabilities than reliance on electricity for life support equipment. These registers assist in prioritising support to the most vulnerable, including in the event of electricity outages.

7. **Undertake research into the impacts of electronic billing and direct debit on household engagement and tariff understandings.**
    - ❖ More research is needed to understand how reduced household engagement affects financial and electricity usage outcomes. This research should identify what can be done to address this issue in the current energy market, which requires and advocates for greater engagement and awareness of different tariff options and often assumes that 'energy literacy' will improve.

8. **Prioritise demand initiatives that are less likely to have adverse health and financial impacts on heat vulnerable households.**
    - ❖ These could include:
        - Initiatives to engage households in collective efforts such as non-financial 'peak alerts' when peak demand events are predicted (Nicholls and Strengers, 2015; Strengers and Nicholls, 2013), free incentives to visit publicly or privately cooled spaces during heatwaves, and/or community-based rewards for demand reductions, e.g. solar for schools;
        - Direct load control; and
        - Programs that support replacement of inefficient air conditioners.

9. **Collaborate with state and local governments to engage communities and develop local demand and supply solutions.**
    - ❖ Areas of disadvantage experiencing heat vulnerability and network constraints could be targeted for local solutions such as cool public spaces (above) or deployment of new technology solutions[10].

10. **Increase access to cool public places and conduct research into the needs and delivery of heat refuges.**
    - ❖ The opportunities and challenges of increasing access to indoor public places (e.g. libraries which experience a surge in demand on hot days), and setting up heat refuges (including resourcing, location, venues, transport and risk management), are not well understood. Regional areas may have different needs and constraints.
    - ❖ The provision of shaded outdoor areas with access to drinking water (Lopes et al., 2016) and water for play and body cooling (such as splash pads) are being embraced internationally (e.g. Toronto[11]). The electricity sector could collaborate (e.g with local councils, housing agencies, health agencies) to support provision of cool public spaces in key areas of network constraint and heat vulnerability/ disadvantage.

D.3 Housing stock, appliances and retrofits

11. **Improve housing quality and energy efficiency for heat vulnerable households, including strategies for public and private rental housing.**
    - ❖ There is a clear need for cross-sectoral collaboration between the energy, housing and appliance sectors to address households' exposure to indoor heat indoors through housing design, housing and appliance regulations and standards, retrofit programs, incentives and other schemes, and in ways which account for local climate conditions (e.g. BSL, 2016; Gabriel et al., 2010; Pitt & Sherry, 2014; Thrive Research, 2017). Economical home ventilation is one priority, including:
        - Windows and security doors which can be opened to reduce indoor temperatures overnight; and/or

[10] See NAGA and EAGA, 2017. Future energy planning. Northern Alliance for Greenhouse Action and Eastern Alliance for Greenhouse Action, Melbourne.

[11] https://www1.toronto.ca/wps/portal/contentonly?vgnextoid=d6934ccde7717410VgnVCM10000071d60f89RCRD&vgnextchannel=5c98dada600f0410VgnVCM10000071d60f89RCRD

- Mechanisms to encourage installation and use of ceiling fans (where ceiling height allows) and ensuring ceilings in new homes are sufficient to accommodate ceiling fans[12].

❖ Another option is to develop targeted programs to increase access to solar PV or other forms of micro-generation for heat vulnerable households, including those who live in public and private rental properties.

12. Integrate heat vulnerability assessments into existing programs and services.

❖ Public housing maintenance inspections and energy efficiency retrofit programs are opportunities to identify where tailored energy efficiency solutions, community support and/or air conditioning (below) are needed for heat vulnerable households.

13. Improve access to home air conditioning for households in extreme circumstances e.g. elderly and frail residents, and those with chronic conditions exacerbated by extreme heat.

❖ Some key informants wanted air conditioning installed in all public housing, or at least on the upper levels of high-rise buildings. Community campaigns on this issue are ongoing[13] and the NSW government has been reviewing its policy not to provide air conditioning in public housing[14]. Our research supports the provision of air conditioning for households with specific health needs or circumstances. However, the provision of air conditioning to households in extreme circumstances needs to be balanced with:

- the potential financial impacts for households of increased reliance on air conditioning;
- loss of capacity to use low- and no energy practices to stay cool (which in turn would increase vulnerability in the event of electricity outage); and
- the broader need to manage peak demand and carbon emissions.

This recommendation should be considered in conjunction with our other recommendations for reducing heat exposure, stress and financial vulnerability in heat vulnerable households.

D.4 Integrating energy into health service-based approaches

14. Increase capacity of health and community organisations to deliver hot weather reminders and welfare checks for heat vulnerable households.

❖ These services exist but can be fragmented or under-funded (see Appendix E.6).

15. Develop resources which raise awareness of healthy and energy efficient ways to stay cool.

❖ Current resources for heat vulnerable households mostly focus on heat health. More resources should assist households in navigating both health and energy cost concerns and be tailored to different heat vulnerable household circumstances, e.g. specific resources for parents of infants, older people, pet owners and CALD communities. Existing resources such as the Red Cross 'Coping with hot weather fact sheet'[15] could be adapted.

16. Upskill service providers in energy efficiency and heat health.

❖ Health and community service providers, particularly in-home service providers, have access and relationships to assist heat vulnerable households. However they may be underskilled in the complex issues of energy vulnerability, energy efficiency and energy tariffs, and unable or insufficiently resourced to provide integrated and tailored advice.

[12] Some public health advice has discouraged fan use in extreme heat but recent evidence suggests these concerns are unsubstantiated (Gupta et al, 2012; Jay et al, 2015)
[13] http://www.theage.com.au/victoria/airconditioning-plea-for-public-housing-tenants-20140208-328ul.html
[14] http://www.abc.net.au/news/2016-01-19/inappropriate-to-speculate-on-aircon-review-timing/7097308
[15] https://www.redcross.org.au/files/20091113Coping_with_hot_weather_fact_sheet.pdf

E. Appendices

E.1 Key informant online survey

. Thank you for participating in the Heatwaves, Homes & Health project. The project seeks to understand how vulnerable households are coping with heatwaves – including any health, wellbeing or financial impacts related to home cooling. The findings will inform policy and programs to better support households during heatwaves.

The temperature at which heat becomes a risk to health and wellbeing depends on many factors e.g. age, health or some disabilities, housing etc. Therefore references in this survey to heatwaves refers to any period of very hot, or hot and humid weather which may create risks to the health and wellbeing of certain people.

This survey is designed for people working in health and social service organisations to share their experience, insights and concerns on the research topic. The questions have been formulated to be relevant to a range of service, advocacy and policy organisations. The references to 'clients', mean the people your organisation interacts with directly, or indirectly via partners. For some questions you may not have relevant client experiences to draw from and are therefore able to skip the question.

The survey questions relate to households in Australia who:

- may be at risk of negative health and wellbeing impacts during hot weather, and;
- who pay their own electricity bills.

For the reasons above, the survey questions do not relate to those who: do not have access to housing or primarily live outdoors; do not pay for their housing and energy bills; or have housing with energy costs included in rent, e.g. aged care homes or student housing.

The survey takes approximately 10-15 minutes to complete. You have until 20 January 2017 to complete the survey. You may save partial completions of the survey and move back and forward within the survey to amend responses.

The research is led by Dr Larissa Nicholls, Dr Yolande Strengers and Dr Karyn Bosomworth from RMIT University and is funded by Electricity Consumers Australia. The project is approved by the RMIT Human Research Ethics Committee. You may respond anonymously. If you provide your contact details you will not be identified in public documents and journal publications resulting from this research and your responses will not be linked to your organisation.

If you would like more information you can access it below:

○ I would like more information

.

What will happen to the information I provide?

- All data will be kept confidential and not used for any purpose outside of the research. The only people that will access to your data will be members of the research team and a professional transcriber (for the voice recording).
- Any information that you provide can be disclosed only if: it is protect you or others from harm; if specifically allowed by law; or you provide the researchers with written permission.
- The data from the study will be aggregated and findings used in research outputs such as reports, presentations, and research articles. In any publication and/or presentation, non-identifying codes (fake names) will be used so you cannot be identified, except with your express permission. You can request access to your data at any time. You may request access to a summary of project findings.
- Research outputs may be publicly accessible in an online library.
- Your research data will be kept securely at RMIT for 5 years after publication, before being destroyed.
- You can request access to your data at any time. You are free to withdraw from the project at any stage by notifying a member of the research team. Any unprocessed data withdrawn and destroyed, providing it can be reliably identified.

Security of the website

- Participants completing the survey online should be aware that the World Wide Web is an insecure public network that gives rise to the potential risk that a user's transactions are being viewed, intercepted or modified by third parties or that data which the user downloads may contain computer viruses or other defects.

Security of the data

- This project uses an external site to create, collect and analyse data collected in a survey format. The site we are using is Qualtrics. If you agree to participate in this survey, the responses you provide to the

survey will be stored on a host server that is used by Qualtrics. At the end of the survey period, personal information (participant contact details) will be deleted from the site and our records and will not be stored as data. Once we have completed our data collection and analysis, we will import the data we collect to the

RMIT server where it will be stored securely for five (5) years. The data on the Qualtrics host server will then be deleted and expunged.

Possible benefits or risks of taking part

- Benefits: There may be no clear benefit to you from being part of the project but you may appreciate contributing to knowledge which can help provide better services to households.
- Risks: There are no perceived risks outside your normal day-to-day work activities and the interview will not cover any questions of a sensitive nature.

If you want any further information concerning this project you can contact any member of the research team.

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Complaints: If you have any concerns about your participation in this project, which you do not wish to discuss with the researchers, then you can contact the Research Ethics Co-ordinator, Research Integrity Governance and Systems, RMIT University, GPO Box 2476, MELBOURNE VIC 3001. Tel: (03) 9925 2251 or email human.ethics@rmit.edu.au

Block 2

Q1.
Which of the following types of work or services does your organisation provide?

Check all that apply.

- [ ] In-home health, care or support
- [ ] In-home financial or energy advice
- [ ] Other in-home services (please describe)
- [ ] Health, care or support services by phone or face-to-face in office, medical practice or community facility
- [ ] Financial or energy advice service by phone or face-to-face in office or community facility
- [ ] Hospital based health service
- [ ] Advocacy for vulnerable or disadvantaged households
- [ ] Online or other information for vulnerable or disadvantaged households
- [ ] Policy or research
- [ ] Other

Q2.
What role do you perform in your organisation?

Q3.
Other than age and medical conditions, what do you see as the key contributors to heat vulnerability in your

clients and why?

Q4.
What health and wellbeing impacts are your clients experiencing from heatwaves, if any?

Q5.
Are you aware of at-risk clients that DO NOT use air conditioners during heatwaves?
This includes either central or individual room air conditioners including refrigerative, evaporative, split/reverse cycle/inverter units, portable air conditioners, or window air conditioners.

- ○ Yes
- ○ No

Q6.
What are the main reasons clients DO NOT use air conditioning during heatwaves?

- ☐ Do not have an air conditioner
- ☐ Reluctance to use air conditioning due to electricity cost
- ☐ Don't think they need air conditioning during heatwaves
- ☐ Dislike or distrust or air conditioning
- ☐ Mental or cognitive issues
- ☐ Other (please specify)

Q7. Within your client base, how common is it for electricity costs to contribute to client reluctance to use air conditioning?

- ○ Not very common
- ○ Fairly common
- ○ Very common
- ○ Don't know
- ○ Other, please comment

Q8.
Do you have clients at risk during heatwaves using strategies other than air conditioning that you believe ***adequately alleviate risks*** to their health?

- ○ Yes
- ○ No

- Don't know

Q9. What are the strategies (other than air conditioning) used by clients which ***adequately alleviate risks*** to their health during heatwaves?

Q10.
Do you have clients using strategies other than air conditioning that you believe ***DO NOT adequately alleviate risks*** to their health during heatwaves?

- Yes
- No
- Don't know

Q11.
What are the most common strategies used by clients which ***DO NOT adequately alleviate risks*** to their health during heatwaves?

- Fans
- Visiting friends or relatives
- Going to other public places (e.g. shopping centre, community centres, library)
- Consuming cool drinks or frozen items
- Cooling the body with water or cold items (e.g. cool showers, baths, wet fabrics, ice packs).
- Sit or drive in the car with the air conditioning on
- Managing home temperature via shading or ventilation
- Moving to coolest part of the home
- Other (please specify)

Block 1

Q12.
Are you aware of clients that DO NOT use fans during heatwaves? This includes ceiling fans or portable fans (box, standing, desk or table).

- Yes
- No

Q13.
What are the main reasons clients DO NOT use fans during heatwaves?

- They use air conditioning instead of fans
- Reluctance to run fans due to electricity cost
- Don't think fans are helpful
- Dislike or distrust of fans
- Can not afford to buy fans
- Mental or cognitive issues

- [ ] Other (please specify)

Q14. Within your client base, how common is it for electricity cost to contribute to a reluctance to use fans?

- [ ] Not very common
- [ ] Fairly common
- [ ] Very common
- [ ] Don't know
- [ ] Other, please comment

Q15.
Are you aware of clients experiencing financial stress, such as difficulty in paying electricity bills, as a result of air conditioner use for health reasons?

- [ ] No
- [ ] Not very common
- [ ] Fairly common
- [ ] Very common
- [ ] Don't know
- [ ] Other, please comment

Q16.
Are you aware of clients experiencing any of the following as a result of restricting fan or air conditioning use due to electricity cost concerns?

- [ ] Significant or concerning physical health impacts
- [ ] Significant stress and/or declining mental health
- [ ] Other, please comment

Q17. What services, programs or policies do you know of which are/were effective in supporting the health of vulnerable households during heatwaves? (Why?)

Q18. Are there any additional services, programs or policies you think are needed to support the health of vulnerable households during heatwaves?
You may also include in this box any other comments about heatwaves, home cooling, health and financial well being.

Q19. What postcode is your office in?

Q20. Please indicate which areas your clients are located in which have informed your answers to this survey.

State/s

Region/s

Towns or cities

Q21. This question is optional. What is the name of your organisation?

Q22.
Are you interested in any of the following research activities?:

- A face-to-face or phone interview to discuss the research issues in more detail
- Assisting RMIT to recruit households to interview in Melbourne, Dubbo or Cairns who may be at risk during heatwaves (households will receive a $50 supermarket gift voucher)
- Receive Heatwave, Homes & Health project outputs, such as articles and reports

Q23. So we can contact you about the activities you expressed interest in, please enter your contact details below. Please note that you will not be identified in public documents and journal publications resulting from this research and your responses will not be linked to your organisation.

Name

Email

Phone

E.2 Key informant interview topics/questions

Introductory questions

Can you tell me a bit about your organisation? What are its key functions and client groups it services or supports?

Can you describe your role in the organisation?

What sort of interactions do you have with clients as part of your role?

How long have you been in this role?

Have you been in other relevant roles you would like to mention?

What are the main health conditions or issues that are experienced by the clients you service or work with?

Impacts of heatwaves

How do you think your clients experience really hot days or heatwaves?

Prompt: Do you thinking existing health conditions affect the way your clients experience really hot days?

Do your clients experience health and wellbeing issues during heatwaves? What are they?

Other than age and health conditions, what do you think contributes to risks and impacts (from heatwaves)?

Can you tell me about a specific example you have seen experienced by a client – what it was and how it affected them. What was the extent of particular contributions?

Cooling practices

What do your clients do to stay cool or manage health risks from heatwaves (or really hot days)?

Prompts: Fan, air conditioning, public places, showers, wet towels.

What are the extent of these practices, and differentiation between different client groups?

How do you know about these activities?

Which cooling strategies do you think are most helpful and why?

Which are the most problematic and why?

What are the reasons clients may not be undertaking other more beneficial cooling strategies?

Prompts: Are there financial challenges of particular cooling practices(air conditioning or accessing public cool spaces?)

Do your clients struggle to pay their electricity bills?

How are your clients managing these challenges?

Prompts: Stricter budgeting, falling behind on bills, hardship programs, borrowing from high interest lenders, credit card debt.

Do you think they can afford cooling strategies like fans and air conditioning?

Do you think this is a problem?

Prompt: Sufficiency of fans

Are there subsequent issues from the financial implications of cooling? (e.g. wellbeing activities forgone, alcohol use or domestic violence).

Are there risks to your clients if home based air conditioning becomes the primary recommendation for coping during very hot weather?

Prompts: Can you tell me about these risks? Financial or health?

Do you consider home-based air conditioning essential to health for some/all of your clients in heatwaves? Which ones? Why?

Do you provide direct advice and/or assistance to your clients about how they can keep cool during heatwaves, or refer them to any existing resources?

If yes, what advice, assistance or resources do you provide them with or direct them to? Do you think these are adequate? Why or why not?

Blackouts

Do you recall any blackouts during hot weather? If yes, do you know anything about impacts to your clients?

Do you know how your clients cope, or might cope during an electricity outage? Prompts:

Are these practices problematic in any way?

Why do you think clients are undertaking these practices?

Do you expect that electricity will be reliable and affordable in the future?

Public messaging

Do you recall any public messaging in the past, for example on TV or print media about black out risks during peak energy periods (when people use the most power? E.g. hot afternoons and evenings)? This may include messaging about reducing electricity use during peak periods.

Prompts: For example, in the 2014 Heatwaves articles appeared in the AGE, ABC news about the risk of electricity outages and encouraging householders to limit their electricity use.

Do you know if this messaging had any impact on the cooling practices of your clients? Do you have any concerns about this?

What do you think about public messages on electricity reliability and use (generally – or during hot weather)?

Prompts: Should they be targeted? If so, to whom?

Cost reflective pricing

Are you aware of cost reflective electricity tariffs? Yes, continue, no provide an overview of cost reflective pricing

What do you see as the potential implications of cost reflective pricing for your clients? (Negative and positive)

How do you think any potential negative implications should be mitigated or managed? Whose job is it to do this?

Existing and future programs

Are there existing programs you believe are effective at supporting the health and financial wellbeing of clients during heatwaves?

Are their additional policy or programs you would like to see to support the health and financial wellbeing of clients during heatwaves?

Prompts: Housing, electricity pricing policy, health programs. Whose role is it to develop and implement these?

Is there anything else you would like to add about heatwaves, electricity policy or health and financial wellbeing?

E.3 Household participant recruitment flyer

Struggled in the heat recently?

RMIT University would like to hear from you

RMIT UNIVERSITY

Who:	Households: 65 + AND parents with infants
What:	Health, wellbeing and financial impacts of heatwaves at home
Where:	60-90 minute interview at your home: Melbourne, Dubbo & Cairns
When:	February - May 2017
As a thank you:	**$50 Coles/Myer voucher**
More information:	Call us on (03) 9925 4622 or visit: http://heatwaveshomeshealth.net/index.html
Contact us:	Halley McCann on (03) 99254622 or halley.mccann@rmit.edu.au or via the website

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E.4 Household participant demographic questionnaire

RMIT University

Interview No ..... Date: ..... /..... /.....

First Name .....

Gender (please tick box) □ Female □ Male

How old are you?.....In what country were you born?
.....

If English is not your first language, what is your first language? .....

If you were born overseas, how many years have you lived in Australia?.....

How long have you lived in this house? .....

Do you own or rent your home? .....

How many children live with you? .....What are their ages?: .....

Other than your children who else lives in your home?

Relationship to you:..... Age: .....

Relationship to you:..... Age: .....

Relationship to you:..... Age: .....

Do you have pets at home?: (number and type).....

What is the highest level of education you have completed? .....

What sort of work do/did you usually do? .....

What is your current work status?

□ Full-time □ Part-time □ Casual □ Homemaker □ Retired □ Not working

How many people in the home are currently working? .....

Are you happy to tell us your household income? Yes / No

If yes, please indicate your household income range (before tax/gross)

□ Less than $13,000 □ $13,000 - $20,800 □ $20,900 - $41,600
□ $41,700 - $67,600 □ $67,700 - $83,100 □ $83,200 to $104,000
□ $104,100 to $156,000 □ More than $156,000

E.5 Household interview topics and questions

Household and routines

Can you tell me a little about yourself and your household? Do you spend most days at home? What sort of commitments and activities outside the home do you have in a typical week?
Prompts: Do you have family or friends close by? Do you see them very often? Do have any health conditions?

Impacts of heatwaves and cooling practices

What do you think of as a heatwave / really hot day / oppressive heat?
Do you remember the last heatwave or really hot day you experienced?
What is your home like on these really hot days?
Do you remember how you felt?
What kind of impacts did it have on you (and your household)?
Thinking about this summer (or hot / wet season), has there been many days that you felt really affected by the heat? How days would you think?
What was it about these days that made them particular difficult to cope with?
Do you have any health issues that get worse during hot days or heatwaves? Does it require you to use electricity or particular appliances?
How did you / your household / your infant cope during heatwaves?
What do you normally do to stay cool during very hot days or heatwaves?
Do others check in on you on very hot days? (in person, via phone, mobile, text, social media, neighbours)

Air conditioning practices

What sort of weather conditions or other things trigger you to put the air conditioner on?
How often does this happen (over summer, wet season, daily / weekly routines)?
What sort of air conditioner / ing do you have?
What temperature do you normally set the air conditioner to?
Do you have it on all day, or only particular parts of the day?
How do you decide when to turn it on/ off?
When did you first start using air conditioning?
What prompted you to install it or start using it?
Has your use changed over time?
What has prompted these changes?
When you have visitors (family, friends or services) how have they found the temperature and or humidity in your home?
Do you put the air conditioning on more for visitors than yourself? Do you ever change the temperature of the air conditioning for particular visitors?
Has anyone advised you, family friends or otherwise, that you should have the air conditioning on for your health, or the health of your family? Who? What did they advise? Do you follow that advice? If not, why not?
Do you put the air conditioning on for pets? Why? [similar follow up as per above question]

Low- or no energy cooling practices

Do these things keep you cool and comfortable?
If not, can you tell me a bit more about that?
Are there other things would you like to do to keep cool? What sorts of things? Why would you like to do these things?
Why can't you?
What would help you?
Do you ever go elsewhere to escape the heat?
Where do you go? How do you get there?
Do you know of any places you could go or would like to go? Are there reasons you don't go to these places if it's very uncomfortable at home?
Are there things you have done to reduce heat getting in your home?
Or are there things you would like to do to that you haven't?
Why haven't you been able to make these changes to the home?

Impacts of cooling practices

Are there any impacts from what you do to keep cool?

Prompts: Do you sacrifice things you want to buy or do so you can afford the cost of air conditioning, travel to places with air conditioning, or do other things to keep cool?

Does running air conditioning make you behind on any bills or expenses? (If yes) What are you doing to manage this? borrowing money, increasing credit limit etc.

Does running air conditioning make you worried about money or finances?

(If yes) What do you think could be done to help?

Understanding of energy and energy use

Do you have gas, or just electricity in your home?

Do you know what your average monthly or quarter electricity costs are?

Do your bills vary over the seasons? If so how so?

Are you surprised by your bills? (If yes), why do you think this is?

Have you ever been behind on your electricity bills before? (If yes) How did you manage it this?

Who is responsible for reading, interpreting and paying electricity bills in the household?

Do you receive paper or electronic bills? If electronic, has receiving them electronically had any impact on who sees them, how much time you spend looking at or thinking about them.

(If direct debit, or Centrepay is used) how has this affected how much you think about electricity use?

How easy is it to understand your electricity bills? (If not easy), why is this?

Electricity pricing

Do you know if your electricity is priced at a flat-rate, which means you pay the same price whatever time of the day you are using it? Or does the price vary depending on what time of day you are using electricity?

Does this affect you energy use during very hot afternoons and evenings?

Have you heard of Time-of-Use, peak pricing, flexible, or cost reflective energy pricing? What do you understand about it?

Explain 3-part ToU electricity scenario if unfamiliar to households, including more expensive 'peak' cost between 3pm and 9pm during on weekdays.

Would you use the air conditioning differently ? If yes how so? Would this affect what you do to get or keep cool? If yes how?

(If yes) how does or might this affect your health (or the health of your family / other householders)?

Blackouts, shortages and public messaging

Have you experienced an electricity black out before? What did you do in response?

Have you ever experience a black out during very hot weather? How did you manage?

If you haven't, how do you think you would manage?

Do you have anyone you could call on to help you?

Do you remember ever seeing or hearing things on the news about a potential shortage of electricity when it is really hot? Or messages asking people to cut back on electricity use?

If so what did you think about these messages? Did you do anything differently? Why/why not?

How would cutting back on electricity use during heatwaves affect your health and wellbeing?

Heatwave programs

Have you accessed any information, networks, activities that support you during heatwaves?

If so what were they and how did they help?

Are there any other things you can think of that would help your health and financial wellbeing during heatwaves?

E.6 Key informants' suggestions to reduce household vulnerability to heat

Health and social services sector key informants put forward a range of strategies to help reduce the vulnerability of households to adverse health and financial outcomes as a result of extreme heat. Their suggestions are summarised in the boxes below each recommendation and many have been incorporated in the report recommendations. Many of the initiatives mentioned have been delivered but on a small scale or temporarily and/or are dependent on funding to restart, continue or expand to reach more heat vulnerable households. Given the findings of this study, these initiatives will be increasingly important as cost-reflective electricity tariffs become more widely available.

Improve housing quality and energy efficiency to reduce heat in homes

- Policies to raise energy efficiency standards in new private and public housing
- Programs and subsidies for improvements to private homes and rental properties including insulation, draught-sealing, blinds, glazing, solar hot water and solar PV (retrofit programs)
- Improved energy efficiency of existing and new public housing

*The former **HESS Scheme (Home Energy Saver Scheme)** in which clients could receive a subsidy from the HESS Scheme and apply for a **NILS (No Interest Loan)** for an item at a subsidized cost was very successful. This created social and financial inclusion for clients to be able to purchase an essential household whitegoods item with a good energy efficiency rating, which resulted in using less energy.* (KI-S16)

***Ongoing programs - not pilots**. The problem of access (financial) to energy efficiency appliances and quality, climate appropriate homes that perform well during heatwaves is not changing. The same pilots are being rolled out year after year. The fundamentals remain the same. The problem of decreasing home ownership is impacting the most financially vulnerable. I'd like to see some appropriate cross disciplinary metrics introduced so that these issues can be effectively monitored and targeted for health and wellbeing change campaigns.* (KI-S50)

Cool public places and transport services

- Accessible, no-cost, cool public spaces
- Transport for vulnerable residents who cannot safely reach cool public places
- The **Gippsland Southern Health Service Planned Activity Groups** incorporate activities to take heat vulnerable people to '*a cool centre in which they receive a meal, are hydrated, cared for, and they do not have the cost of cooling their homes*'. (KI-S34)

I also think we might have to start looking at other ways, encouraging people maybe having community events in parts where there is a decent canopy coverage so that people can come down, they don't have to be overly active but at least sit in the park and have music or something, there's something on that encourages activity in a community setting without having to rely upon electricity.(KI-I6)

Reminder and welfare checks in hot weather

- Identification and registration of vulnerable households
- Calls or visits to check on wellbeing and remind about hydration and other ways to protect health
- Services to check on vulnerable residents delivered by public housing organisations, local governments, the Red Cross, Meals on Wheels and other social services

***[Telecross REDi** is a] very successful for those who are registered unfortunately quite an expensive program to run and cannot support the number of clients that may require the service.* (KI-S36)

*Our **[Meals on Wheels]** volunteers when delivering the meal in middle of day can monitor the*

client and suggest to turn on the air conditioner or fan if they have not done so. (KI-S10) *Community supports checking in on the elderly during a heat wave - could be extended to check in on vulnerable families/mental health clients.* (KI-S21) *Specific emergency extreme weather plans for individuals deemed vulnerable due to physical or mental health conditions.* (KI-S38)
Raised awareness of heat health and energy efficient ways to stay cool • Raise the profile of heat health and energy efficiency in the media • Encourage people to check on potentially heat vulnerable neighbours • More information about actual running costs of fans and air conditioners • Provision of heat health and energy efficiency information via organisations like Centrelink • Delivery via home visits for vulnerable households
Up skill service providers • (Additional) training in heat and energy vulnerability for a wider range of in-home service providers, e.g. aged care and disability service staff • Raise service provider awareness of medical cooling concessions and energy rebates including health practitioners, home and community care workers, energy company staff
Greater access to home air conditioning • Access to air conditioning for heat vulnerable public housing tenants • Access to more energy efficient air conditioning and air conditioning that can be operated without confusion and excess energy use • Repairs and maintenance to improve air conditioning efficiency • Subsidies for home cooling equipment for vulnerable households
Financial relief and support for vulnerable households • Improve Medical Cooling Concessions and access to Utility Relief Grants • Mechanisms to reduce electricity prices • Enhance broader welfare support/ rental assistance • Access to affordable housing • Fund health and social service organisations' capabilities to assist heat vulnerable households

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