FINAL REPORT: Exploring the nexus of energy use, ageing, and health and well-being among older Australians

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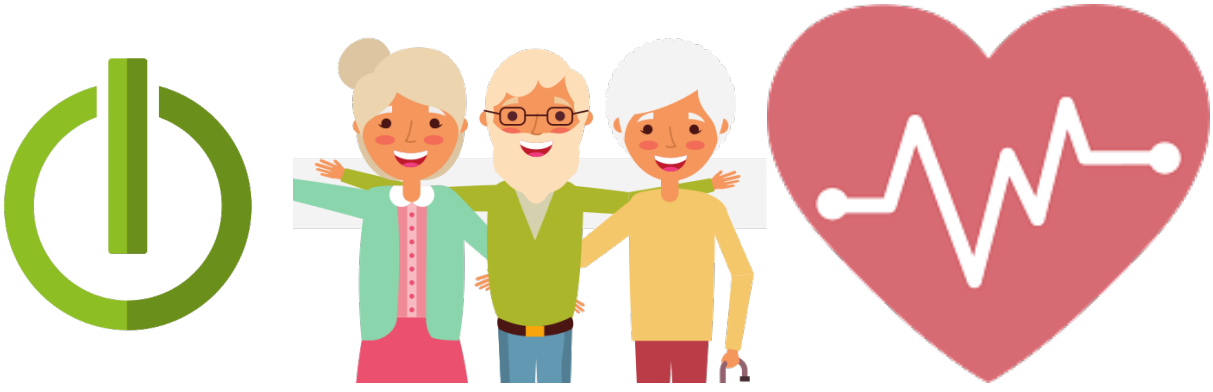

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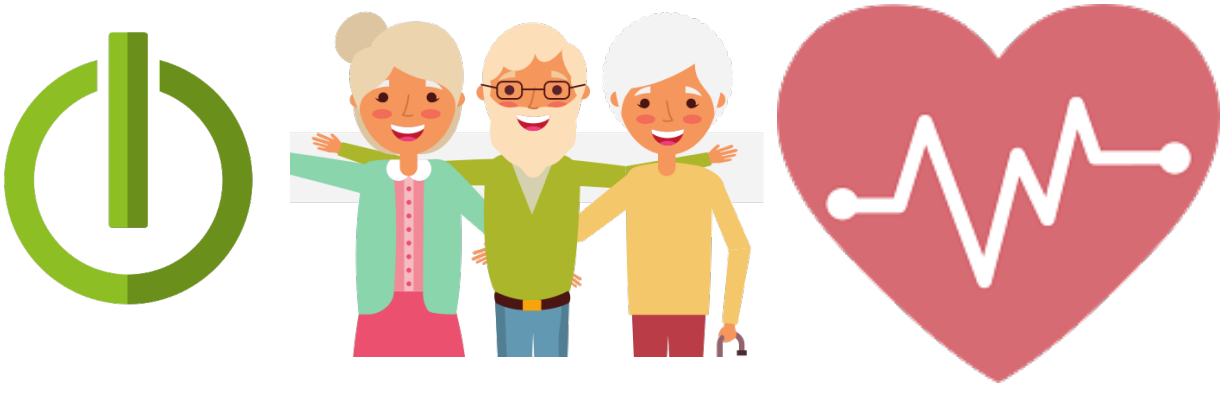

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EXECUTIVE SUMMARY

The overall aim of this research project was to provide in-depth understandings of the way that energy use and health and well-being are associated among older Australians, and the ways that they use energy in the home to manage and maintain their health and well-being. To address this aim, the project was guided by the three research questions:

RQ1. What are the statistical associations between health, well-being, domestic energy use, energy costs, place of residence, and household characteristics among older Australians?

RQ2. How are the domestic energy use practices of older Australians who live at home configured by their understandings and experiences of ageing, (ill) health and well-being?

RQ3. How do older Australians negotiate the key domestic energy use challenges to manage health and well-being in the home?

A mixed method research design was selected with quantitative and qualitative data collected in three stages. The first stage was a quantitative cohort survey that collected baseline data about energy practices, health and well-being from 1583 people aged 60+ years nationwide in March 2018. The second stage employed ethnographic methods of narrative interviews, a projective technique cue card activity, and a home video ethnography. Data were collected during 2018 with 39 people from a range of household types. The third stage was a follow up quantitative survey with the same cohort sampled at baseline that was conducted one year later in March 2019, and which achieved a sample of 851 people.

The main findings of the project can be summarised as follows:

- Cross-sectional analysis of the baseline survey data suggested associations between health and well-being status and the energy behaviours of participants, with location and ancestry as covariates found to influence these associations.

- Cross-sectional analysis of the baseline survey data also suggested associations between the energy behaviours and health and well-being outcomes of participants, with age, location and ancestry as covariates found to influence these associations.
- Analysis of the baseline and follow up survey data using cross-lagged panel modelling found a mixture of statistically significant uni-directional, and bi-directional associations between energy and health and well-being variables.
- The results of the cross-lagged panel model analysis identified a mixture of causal associations in one direction and of bi-directional causal associations.
- In some instances, health and well-being variables were causally association with energy use variables. In other instances, energy use variables were causally association with health and well-being variables. Importantly, a number of bi-directional relationships were also identified. This provides evidence of the complex and two-way relationship between energy use and health and well-being.
- Our ethnographic research foregrounded how people use a range of domestic appliances to promote health and well-being, yet this is weighed up against the cost of energy;
- We also learnt that people associate rising energy usage and costs with ill health rather than with ageing per se;
- We identified that older people with resources can actively plan how to maintain health and well-being and to minimize the energy costs associated with aging;
- Older people with few resources are forced to reduce energy use often with negative consequences for physical, mental and social well-being.

The policy and advocacy implications arising from these findings are that:

- Energy, health, and well-being are inexorably linked – therefore policy and programs should take a holistic perspective that acknowledges these associations.

- Policy and programme responses are required to help support older Australians in the management of their health, well-being and energy use which can become more complex as they age.
- Targeted support for lower-income older Australians is required as they often have to restrict their energy use, and this can lead to negative consequences for their physical, mental and social well-being.
- In the interests of social justice, governments should consider how to subsidise energy generation systems to low-income people older Australians in order to promote healthy ageing in place.
- Energy stakeholders should recognise that energy not only helps older Australians manage their health but can enable their well-being through performance of various social and leisure activities – therefore policy, programs and advocacy should support an energy well-being agenda.
- Further work is required to better map the co-benefits that emerge between domestic energy use, health and well-being.
- Energy stakeholders should seek to build and support the capabilities of older Australians to enable better energy, health and well-being outcomes.
- Strong criticisms of the Australian Energy Market emerged from the project participants and stakeholders need to consider whether the commercial market for energy in Australia is working in the interest of older energy consumers.
- Rising energy bills create major barriers for older Australians to manage their energy use, health and well-being and more robust price regulation and controls may be required.
- Energy should be considered as a basic human right, rather than simply as a free market commodity.

BACKGROUND

Energy researchers and stakeholders are beginning to acknowledge the links between energy use, health and well-being (Waitt et al., 2016). Indeed, researchers have argued that our understandings of energy efficiency should be re-defined to move beyond a concept singularly concerned with saving and cutting back on energy use, to one that acknowledges health, well-being and comfort. Butler et al., (2016 p.152) redefine energy efficiency as "using energy wisely and economically to sustain everyday life, live comfortably and support well-being." However, there remains a lack of research evidence regarding how energy use, health and well-being are associated. Accordingly, this project aims to provide in-depth understandings of the way that energy use and health and well-being are associated among older Australians, and the ways that they use energy in the home to manage and maintain their health and well-being. To address this aim, the project was guided by the three research questions:

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Energy consumption and efficiency is an important topic in Australia in a context of climate change, rising energy prices, fuel poverty, and energy security (Chester, 2010; Department of Climate Change and Energy Efficiency, 2012; Simshauser et al., 2011; Yergin, 2006). Household energy use is linked with climate change effects such as changes in atmospheric

conditions, topography, damage to water systems, and damage to plants and wildlife (Akhmat et al., 2014). Promoting household energy efficiency is considered as a key intervention for tackling climate change. The United Nations Environment Programme has stated that improvements in energy efficiency could contribute up to 1/5th of the cuts countries are required to make to meet the Intergovernmental Panel on Climate Change (IPCC)'s carbon budget. Improving energy efficiency could prevent up to 24 gigatonnes of carbon dioxide emissions between 2015 and 2030 (United Nations Environment Programme, 2014).

Rising energy prices are also a social concern in Australia (Chester, 2014), especially for lower income consumers (Butler et al., 2016; Cooper et al., 2016). Australia is estimated to have among the highest household electricity prices in the OECD (OECD Library, 2017). Simshauser et al. (2011) predict that over the next 15 years' electricity prices will increase between 96% to 133% in NSW. Around 33% of low-income households may face fuel poverty by the year 2026. Energy research with lower income consumers has identified that these hardships can lead to worrying economic, social and health outcomes (Chester, 2014; Waitt et al., 2016). High energy prices can create billing anxiety with consumers constantly worried about receiving a high energy bill, and thrifty practices of energy use that can be potentially harmful to low income consumers (Waitt et al., 2016). High energy prices also create particular challenges for ageing citizens who expect to use more energy as their health becomes less robust (Chester, 2013; Ritchie et al., 1981). Furthermore, low income households in Australia are often already doing much of the work of energy efficiency (Organo, Head and Waitt, 2012).

This has led to increasing interest on the relationships between energy use, health and well-being among older households (Ortiz, 2017). Access to energy for cooking, heating and

cooling, and productive activities is essential for human health (WHO, 2005). Using energy for these activities helps ensure that people can stay warm or cool, be fed, remain hydrated, and can maintain their health and well-being. Therefore, the energy-health-well-being nexus is an important one (WHO, 2005). However, much of the existing work in this field focuses on how energy production, such as fossil fuel extraction and use, can harm human health (Armstrong and Tait, 2014). Currently, there is a lack of research and advocacy regarding the associations between energy use by householders and the management and maintenance of their health and well-being.

In this project, we take a holistic and inclusive perspective regarding definitions of health and well-being. Health is conceptualised for this project as the ability to adapt and manage:

- physical health i.e. the maintenance of physiological homeostasis through changing circumstances
- mental health i.e. a sense of coherence and ability to cope, recover from psychological stress, and prevent post-traumatic stress disorders
- and social health i.e. capacity to fulfil obligations, manage life with a degree of independence, and the ability to participate in social activities including work (Huber et al. 2011).

Well-being is conceptualised in this project as a multidimensional concept referring to the manifestation of an individual's social, economic, psychological, spiritual, and medical desires, objectives and needs (Gordon and Oades, 2017). For this project, we adopt a multidimensional definition of well-being that includes: physical vitality, mental alacrity, social satisfaction, a sense of accomplishment, and personal fulfilment (Naci and Ioannidis, 2015).

The associations between energy use and health and well-being as people age, have strong relevance for energy and health policymakers and stakeholders in Australia. The energy-ageing-health-well-being nexus is particularly important given the ageing Australian population; social policies to encourage ageing at home; and home-based health care. In 1964, the median age of the population in Australia was 28.5 years and people aged 65 and over represented 8% of the population (948,100 people) (ABS, 2014). By 2014 the median age had increased to 37.3 years and the number of people aged 65 and over had more than tripled to 3.4 million or 15% of the total population (ABS, 2015). The ageing of the Australian population is due to a combination of factors including increasing life expectancy due to health and lifestyle improvements and falling birth rates due to various socio-demographic changes (AIHW, 2017).

An ageing population has significant implications for energy policy, programs and advocacy in Australia. Researchers have identified that concerns over wasting energy, rising fuel costs, and fuel poverty can cause older people to put their health at risk (Hitchings and Day, 2011). This is an important issue of concern, as cold exposure among older people in winter is linked with increased winter mortality rates (Smolander, 2001), and heat stress in summer is linked with increased mortality among older people (Strengers and Maller, 2011). Recent research in Australia has identified that older people often use so little energy or perform practices of thrift due to anxiety about high energy bills, that it can come at a risk to their health and well-being (Waitt et al., 2016). This can include going to bed early in the winter to keep warm under the blankets, or not switching on lights during the night and having a fall in the bathroom (Waitt et al., 2016). These insights suggest some older Australians are committed to being thrifty, and are focused on saving on their energy costs, but that this brings potential health risks.

Alongside an ageing Australian society and increased life expectancy is a rise in chronic diseases and chronic disease management. The delivery of health care in the home is one outcome of these trends (Lathan et al. 1999), including the increased use of medical devices (WHO, 2008). Energy plays an important role in managing health. Electricity is often essential for the provision of forms of health care and use of devices in the home such as mobility devices, dialysis machines, home ventilators and oxygen therapy machines, and blood glucose and blood pressure monitors. Previous research has found that managing energy costs while using health care devices at home is a major concern for older Australians (Cooper et al., 2016). This research found that older Australians may have to use heating all the time to care for the sick and the dying, or have the lights turned on all the time due to deteriorating eyesight. These insights identify that managing health for older Australians has major implications for their domestic energy consumption. However, there is little research in Australia that specifically examines how older energy consumers manage their energy consumption while caring for their own health and well-being or that of others in their household.

It is important for policy and programs in Australia to be informed by a strong understanding of the energy-health-well-being nexus for people as they age. The economic burden on the government for institutionalised aged care is lessened by policies which encourage ageing in place (Judd et al., 2010). Older people are also thought to be able to enjoy greater independence and well-being by staying in their own homes though there is little consideration of the range of environments that they occupy. If older Australians are able to use energy appropriately to help manage and support their health and well-being, this would also support the ageing in place agenda. However, there are major challenges here. For example, in relation to thermal comfort levels in the home, studies have shown that older

people are not well-placed to make judgments about the impact of temperature upon their health (Roelofsen, 2015; Van Hoof et al., 2010) and especially about how to protect themselves from temperature extremes (Dalip et al., 2015). Klenk et al., (2010) have illustrated the increased risks of excessive heat to the older population and Geddes et al., (2011) have similarly reported the risks of cold exposure to this group. One of the factors that increases this risk is low socio-economic status (Stafoggia et al., 2006).

One in eight people who receive the age pension lives below the poverty line, and this increases significantly when housing status is taken into consideration. Those who rent and are aged 65 years and over experience poverty at a higher rate (43%) than the general population of older people (12%) (Davidson et al., 2018). Thus, the deregulation of the energy market and increases in energy costs have hit this sector of the population the hardest. Strategies used by low income households to manage energy costs include avoiding the use of heating and cooling appliances, rarely having visitors to the home to avoid use of heating/cooling or cooking appliances, only using certain rooms, and having shorter showers (Chester, 2013). These strategies to reduce energy costs may also lead to reduced expenditure on essential food and clothing, experiencing physical discomfort, reduced physical and mental well-being, loneliness and social isolation, strained household relationships, and distress (Chester, 2013).

In Australia promoting domestic energy efficiency, and protecting vulnerable households are important Commonwealth and State government priorities leading to a raft of policy and programme measures in recent years (Council of Australian Governments, 2015; Office of Environment and Heritage (OEH), 2013; Department of Resources, Energy and Tourism, 2012). While there is a wealth of research on energy consumption practices (e.g. Karatasou et

al., 2014; Lopes et al., 2012; Shove and Walker, 2014) – there is less research on the energy use practices and challenges and complexities faced regarding energy consumption among ageing citizens in Australia. A survey in Brisbane identified that aged households consistently used less than the average daily household energy of other households (Romanach et al., 2017) despite the fact that in other OECD countries older households are predicted to use more energy as they age (Tonn and Eisenberg, 2007; Brounen et al., 2012). Studies in Japan and the US have similarly found that energy usage increased with ageing (Yamasaki and Tominaga, 1997; Tonn and Eisenberg, 2007).

Hitchings and Day (2011) and Day and Hitchings (2011) in their work in the UK have argued that ageing is not just physiological and biological but also discursive, and so how we understand the practices of older households in relation to maintaining thermal comfort deserves further consideration. While research in other locations such as the USA and Scandinavia has identified that family norms, lifestyles, and patterns of interaction among family members; as well as external social, cultural, and structural factors can influence household energy use practices (Kleinschafer and Morrison, 2014; Gladhart and Roosa, 1982; Thøgersen and Grønhøj, 2010), there is less research that specifically looks at ageing households and the relationships between energy use and health and well-being. Furthermore, there is very little published research on this from Australia.

Climate change, fuel poverty, and everyday home life among ageing households are complex issues for the Government, energy providers, and consumers to navigate. This project helps tackle these issues by helping to understand energy consumption patterns and practices and their relationship with health and well-being, in ageing households in Australia. A better understanding of the way that the cost of energy is negotiated in relation to the use of

appliances that can help to maintain health and well-being provides agencies, governments and policy makers with essential insights that can inform appropriate policies and initiatives to support energy use and healthy ageing, especially in vulnerable households. To address the aims and answer the research questions for this project, a mixed and multi-method research design was employed featuring three stages of research.

RESEARCH METHODS

Method for Stage 1: Baseline Quantitative Cohort Survey

Stage 1 of the project involved a nationwide baseline quantitative cohort survey with 1583 participants aged 60+ years that collected data about their energy use, health, and well-being in March 2018. The survey study used a longitudinal cohort study design with a baseline survey described here, and then a follow-up survey at stage 3 of the project with the same cohort of participants one year later in March 2019. The survey was administered online using the Qualtrics survey software platform and was distributed through the use of a leading national consumer survey panel provider – the Online Research Unit. To achieve a representative sample that reflects the Australian populated aged 60+ years, the sample recruitment followed a quota sampling approach. All participants gave written informed consent to participate, and ethical approval for all stages of the project was obtained from the Macquarie University Human Research Ethics Committee.

The survey questionnaire was developed following an extensive review of the extant literature on domestic energy use, health and well-being and the use of existing rigorous and well tested survey scale items, and a process of cognitive pre-testing (n=10). The cognitive pre-testing process focused on checking the acceptability, appropriateness and comprehension of survey questionnaire content among the participant group (Kinnear and

Taylor, 1996; Fink and Kosecoff, 1998). The pre-testing process involved a research assistant administering draft versions of the survey to a sample of 10 participants face to face in a room, while another member of the research team observed the process. Participants were encouraged to think aloud while answering the draft survey questionnaire and identify any issues with answering certain questions. Following their completion of the survey, the observer then conducted a short narrative discussion with the participant to ask them how they found answering the survey, any specific issues or problems they identified, or to discuss issues that the observer noted during the process. During the pre-testing process, amendments were made to the questionnaire survey based on feedback by participants and observations made by the research team.

The survey questionnaire contained items measuring participants attitudes towards energy use (DeWaters, 2009), level of thermal comfort (Healy and Clinch, 2002) and satisfaction with thermal comfort (Huizenga et al., 2006) in their homes, frequency of use of energy appliances (Cooper et al., 2016); energy conservation behaviours (von Borgstede et al., 2013; Gadenne et al., 2011), $ value and kWh on their most recent energy bill, issues with damp, mould and condensation in their homes (Boomsma et al., 2017), the short-form (36) health survey (Ware and Sherbourne, 1992), the satisfaction with life-scale (Diener et al., 1985), the flourishing scale (Diener et al., 2009); perceived stress (Cohen et al., 1983), anxiety (Spitzer et al., 2006), positive and negative affect (Diener et al., 2009), capabilities (Lorgelly et al., 2015), and a range of demographic measures including age, sex, pre-existing health conditions, ownership of energy using health devices (e.g. mobility scooters, blood pressure monitors), household composition, religion, ancestry, employment, education level, income, and postcode.

Method for Stage 2: Ethnography

For the ethnography conducted for stage 2 of the project a purposive snowball sampling approach was used to recruit 39 individuals from 31 households. Participants were recruited in the first instance through contacts known to the researchers. Selection criteria were that participants must be over sixty years old and had lived in the Illawarra area for at least 12 months. Then with the generous help of participants, further households were recruited through snowballing. The research was staggered due to this recruiting strategy. Households were differentiated by composition: nineteen were married, ten were single males and ten were single females. All participants were retired though many worked in a voluntary capacity with charities and church groups. Four participants were from a Dutch background, two were of Italian background, three were of Scottish background, two were from the UK, one was from Asia, one from New Zealand and one from a German background, and the remainder were of Anglo-Australian descent. Ages ranged from sixty to ninety-seven years of age, thirty participants owned their own dwelling (either a free-standing home, retirement village apartment or unit) while nine lived in rental properties (both units and free-standing houses). Participant characteristics are shown in table 1 below.

Table 1: Stage 2 Ethnography Participant Sample Characteristics

	Pseudonym	Sex	Age	Health issues	Medical equipment	Demographics
1	Rebecca	F	YOB: 1926 Ancestry: Anglo 92	Reduced mobility (legs), skin conditions	Electric bed	Widow, own unit in retirement village. Lives alone, 2 daughters who live in Canberra
2,3	Chantelle Josh	F M	YOB: 1944 Ancestry; Dutch 75	Diabetes, heart condition, previous lung cancer, asthma		Married couple, own unit in retirement village
4,5	Laura Bobby	F M	YOB: 1951, 1946 Ancestry: German 67, 72	Joint pains	Solar heated spa	Married couple, own freestanding house, 2 daughters
6	Morgan	M	YOB: 1948 Ancestry: Anglo Australian 70	Skin conditions, early sleep apnoea		Married, two children, own home, original condition
7	Danielle	F	YOB: 1946 Ancestry: Dutch 72	Husband has peripheral neuropathy		Own unit in retirement block, retired maths teachers
8,9	Milly Albert	M F	YOB:1950 Ancestry: Italian 68	Good health		Married, own home recently renovated, three children
10	Michelle	F	YOB: 1958 Ancestry: Anglo Australian 60	Emphysema, kidney problems		Divorced, lives along, social housing, 5 children
11	Felix	M	YOB: 1952 Ancestry: Anglo Australian 66	Hip replacements		Single, lives alone, no children, social housing
12, 13	Constance Benjamin	F M	YOB: 1953 Ancestry: Anglo Australian 67	Lupus		Married, older son living at home, own home
14	Demi	F	YOB: 1947 Ancestry: NZ 70	Bursitis, arthritis, joint pains, IBS, asthma		Widow, 3 children, rents freestanding house

15	Kye	F	YOB: 1943 Ancestry: Anglo Australian 75	Breathing problems, diabetes, weight, ulcerated legs, eczema	CPAP Life pendant	Divorced, lives alone, three older children, social housing
16	Genevieve	F	YOB: 1929 Ancestry: Anglo Australian 89	COPD, hip problems		Widow, lives with daughter, owns duplex
17	Max	M	YOB: 1940 Ancestry: Anglo Australian 78	Breathing problems		Divorced, lives alone, little contact with 2 sons, social housing
18	Billy	M	YOB: 1944 Ancestry: Anglo-Australian 74	Diabetes		Married lives with wife, owner occupied house, two children.
19, 20	Nettie Malcolm	M F	YOB: 1935 Ancestry: Scottish 83	Parkinson's early stages, diabetes, heart problems, incontinent, mobility impairment, COAD	Stair lift Electric armchair Electric mobility scooter	Married, two children, own freestanding home
21	Scott	M	YOB: 1943 Ancestry: Scottish 76	Sleep apnoea, hip replacement	CPAP Solar heated pool	Married lives with wife, owner occupied house, 2 children
22	Carl	M	YOB: 1921 Ancestry: UK 97	Hip replacement, Blood Condition, Loss of Hearing, poor circulation		Widower, owner occupied house, three children.
23	Georgie	F	YOB 1946 Ancestry: Anglo 72	Good health		Single, three-children, owner occupied flat, cares for her mother who is 94.
24	Zack	M	YOB: 1929 Ancestry: Scottish 89	Loss of Hearing, Hypertension, Replacement Heart Valve		Widower, but has a gf living next door. Resides in a retirement village in an owner-occupied villa.
25, 26	Caitlyn James	M	YOB: 1947 Ancestry: Anglo-Australian 71	COPD, blood pressure		Recently retired fireman. Married, own free-standing home, 3 children
27	Lori	F	YOB: 1938	Legally blind, heart murmur	Portable AC	Widow, one older son lives at home, 2 daughters little contact

			Ancestry: Anglo Australian 81			
28	Gisel	F	YOB: 1939 Ancestry: Anglo 79	Good health, arthritis, vegan		Single, no children, rents free standing house
29	Alfred	M	YOB: 1932 Ancestry: Anglo Australian 86	Diabetes type 2, mild asthma, arthritis, cholesterol, back problems	Life pendant	Widower, 2 daughters, own unit in retirement village, retired electrician
30	Kay	F	YOB: 1935 Ancestry: Anglo Australian 83	Hot flushes, arthritis, susceptible to lung infections		Married, own unit in complex, 3 children, 5 grandchildren
31	Tristan	M	YOB:1936 Ancestry: Dutch 82	Diabetes, blood pressure, kidney stones, cataracts, hearing aids	Blood sugar monitor Blood pressure monitor Hearing aid charger	Single, no children, rents unit
32, 33	Anna Joseph	F M	YOB:1946 Ancestry: Anglo Australian 78	Joseph- asthma		Married, own freestanding home, 2 children
34	Daisy	F	YOB: 1947 Ancestry: UK 72	Reasonable health, high blood pressure, husband bronchiectasis	CPAP	Married, own freestanding home 2 children
35	Fern	F	YOB: 1941 Ancestry: Sri Lankan 77	Good health, Some asthma	Solar heated pool	Widow, own freestanding home
36	Maria	F	YOB: 1935 Ancestry: Anglo Australian 83	Good health		Widow, 2 daughters, own unit in retirement village.
37	Patrick	M	YOB: 1938 Ancestry: UK 80	Knee replacements		Single, no children, lady friend, unit in complex
38,39	Samantha John	M F	YOB: 1942 1945 76, 73 Anglo Australian	Blood pressure Hearing loss	Blood pressure monitor	Married, own unit in complex, 3 children, religious minister

Stage 2 of the project adopted a short-term ethnographic approach (Pink and Morgan, 2013). As Pink and Morgan (2013, p 359) identify short-term ethnography provides "a route to understanding alternative ways of knowing about and with people and the environments of which they are a part" rather than through surveys or semi-structured interviews alone. As such, there were two phases to the ethnography. The first phase was a narrative interview where participants were asked to talk about their household energy practices. The themes that were investigated included the background of the participants, their families and homes; how energy was consumed in the home (for example how they heated or cooled the home); how they used energy to maintain their health; how they understood the relationship between ageing, health and energy use; and whether energy efficiency was important to them in the context of their everyday lives. These discussions included open-ended questions that encouraged the participants to provide narratives and examples of their regular practices.

The second phase involved the researchers re-visiting the participants in their homes. Participants were asked to complete a Cue card activity – a form of projective technique to encourage participants to discuss and reflect on topics to which they hold deeply embedded beliefs, or which may be understood in the subconscious (Kitzinger, 1994). This method involves using cards with words that are central to the project themes (in this case, a range of domestic energy appliances) and asking the participant to arrange them on a board. This method is often used in market research but there has been less use in the social sciences (Rowley, 2012). The participants were asked to arrange the cards on the board towards either side. On one side health (for example conditions such as breathing problems, diabetes, heart conditions, blood pressure etc) and on the other side well-being (being able to eat well, bathe, socialise etc).

The aim of this activity was not to determine an overarching prioritisation of the importance of domestic appliances, but rather to prompt participants to discuss how domestic appliances were important (or not) for both health and well-being in the context of ageing. This method reduced the power imbalance between researcher and researched; it provided participants with a prop which worked to stimulate open discussion; and invited deeper reflection on the taken-for-granted role of domestic appliances in maintaining health and well-being. At the conclusion of the cue card activity, participants were invited to take part in a short (five to ten minute) video recording where they could demonstrate how an appliance was important to them in the domestic context. This method provided rich insights into everyday household energy practices and shed light on how participants resolved dilemmas around how they used energy to care for self and others.

This method was appropriate as it provided a way to explore how participants managed their health and well-being through energy use. Managing indoor thermal comfort; food preparation, storage and consumption; and routines for cleaning, clothes washing, and bathing were some of the key ways that participants managed their health. The videos provided insights into the eventful happenstance of everyday life that is often missing in talk-based approaches (Belk and Kozinets, 2005; Laurier et al., 2008; Lorimer, 2010; Simpson, 2011; Bates et al., 2015; Jayasinghe, 2015). For example, as participants demonstrated their reliance on medical appliances they became breathless, unsteady on their feet and needed to sit down during the short videos where they reflected on the importance of the appliance for their health and well-being.

The interviews, cue card activity and ethnographic home videos were audio-recorded and transcribed with the consent of participants. Participants were informed of their choice to

remain anonymous and were offered the chance to review transcripts. Following data collection, analysis was guided by an interpretive methodological approach in which the researchers identified and interpreted emergent themes based on the narratives of project participants. Data was organised using open, axial and selective coding of categories and concepts through inductive and deductive thinking (Strauss and Corbin, 1990). The analysis followed an iterative process of meeting, discussion, reflection, and further discussion and reflection among the researchers over a period of several weeks.

Method for Stage 3: Follow-up Quantitative Cohort Survey

The follow-up survey was conducted in March 2019 using the same questionnaire survey instrument hosted on the Qualtrics survey software platform and was sent out by the Online Research Unit consumer panel provider to the same cohort of 1583 people who participated in the baseline survey. Due to expected sample attrition, the follow-up sample that was achieved was 851 participants – who completed both the baseline and follow-up surveys.

FINDINGS

Findings for Stage 1: Baseline Quantitative Cohort Survey

Data was downloaded from Qualtrics and transferred into the SPSS 25.0 statistical software package. Following a process of data cleaning, descriptive analysis including of the participant sample characteristics was carried out.

Table 2: Baseline Cohort Survey Sample Characteristics

Age	Categories	Ranged from 60 to 94 years old, Mean = 69 years old
Gender	Female	772
	Male	811
Location	NSW	424 (26.8%)
	ACT	16 (1.0%)
	VIC	408 (25.8%)
	QLD	377 (23.8%)
	SA	157 (9.9%)
	WA	152 (9.6%)
	TAS	33 (1.9%)
	Not reported	16 (1.2%)
Income	$0 – $17,317 p.a	307 (17.3%)
	$17,318 - $20,749	218 (12.3%)
	$20,750 - $26,104	307 (17.3%)
	$26,105 - $33,176	191 (10.7%)
	$33,177 - $41,340	152 (8.6%)
	$41,341 - $49,816	128 (7.2%)
	$49,817 or above	271 (15.3%)
	No reported	9 (0.5%)
Education	< High School	73 (4.6%)
	High School	553 (35%)
	TAFE/FE College	525 (33%)
	Degree	423 (27%)

	No reported	9 (0.5%)
Ancestry	Australia	1113 (63.8%)
	UK	224 (12.6%)
	Other	302 (18.4%)

Table 2 shows a breakdown of the sample characteristics for the baseline cohort survey. Of the 1583 participants ages ranged from 60 to 94 years old, with a mean of 69 years old. There were slightly more males (n= 811; 51%) than females (n = 772; 49%). In terms of geographic location participants resided as follows: New South Wales (n = 424; 26.8%), Australian Capital Territory (16; 1%), Victoria, (n = 408; 25.8%), Queensland (n = 377; 23.8%), South Australia (n = 157; 9.9%), Western Australia (n = 152; 9.6%), and Tasmania (n = 33; 2%) in Tasmania. Most participants were retired (1081; 68.3%), lived in a house (1165; 73.6%), and were married (924; 58.3%) or partnered (102; 6.4%). Education levels varied across the following categories: < high school (n =73; 4.6%), high school (n = 553; 35%), TAFE/College (n = 525; 33%), and degree (n = 423; 27%). Of the sample of participants, 1113 identified their ancestry as Australian, 224 identified their ancestry as UK, and 302 identified as other ancestry (e.g. Lebanese, Chinese, Vietnamese). Please also note that survey participants were able to select up to two ancestry responses.

Given there is a lack of empirical research on the associations between energy use, health and well-being the analysis took an exploratory approach. Heretofore, there is little evidence on which direction(s) such relationships flow – that is whether health and well-being status predict energy use outcomes; or whether energy use predicts health and well-being outcomes. Based on our prior research on domestic energy consumption, our expectation was that these relationships between energy use, health and well-being operate in both directions – that is that energy use will predict health and well-being outcomes; and health and well-being status will predict energy use outcomes.

Cross-sectional associations between health & well-being; and energy use

General linear modelling, a form of multivariate analysis was then performed to investigate associations between health and well-being variables; and energy use outcomes while controlling for demographic variables as covariates. The general linear model is a flexible generalisation of ordinary linear regression that allows for response variables that have error distribution models other than a normal distribution, and to test for effects on more than one dependent variable (Sullivan, 2009). In our analysis associations between variables were deemed as significant using *p* values. Statistical significance was deemed by any effects at the $p < 0.05$ level, that is any p value lower than 0.05 indicates a statistically significant effect. As indicated in Table 3, and Figure 1 several statistically significant associations between health and well-being variables, and energy use outcomes were identified.

Figure 1: Baseline Survey Data General Linear Model Analysis showing associations between health & well-being, and energy variables

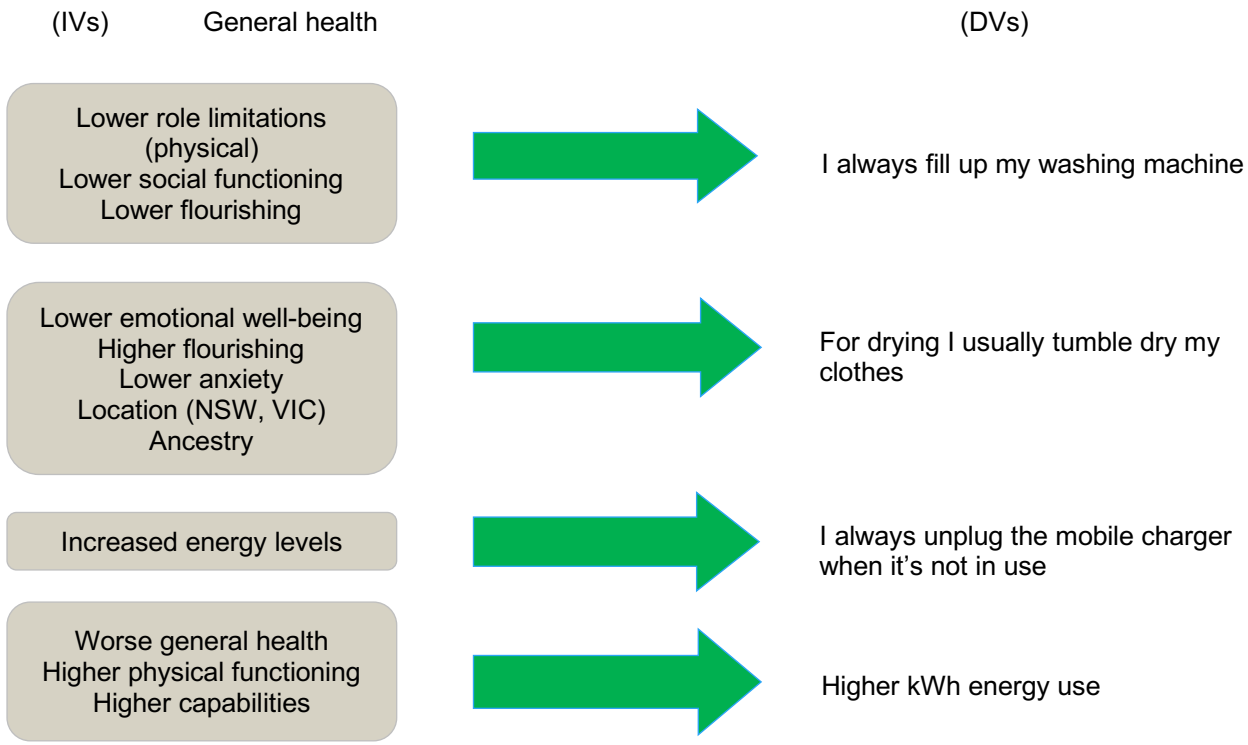


Table 3: Cross-sectional associations between health & well-being, and energy use variables

DV	IV	B	P value	Sig	t	Type III SS	df	MS	F	Partial eta2
I always fill up my washing machine	General health	.000	.996	NS	3.901	.000	1	.000	.000	.000
	Role physical	.027	.031	Sig	-.370	6.018	1	6.018	5.064	.133
	Social functioning	-.043	.047	Sig	-.475	5.074	1	5.074	4.270	.115
	Flourishing	-.108	.038	Sig	-.565	5.551	1	5.551	4.671	.124
For drying, I usually tumble dry my clothes	General health	.026	.107	NS	1.658	2.642	1	2.642	2.750	.077
	Emotional well-being	-.058	.016	Sig	-2.543	6.211	1	6.211	6.465	.164
	Flourishing	.130	.007	Sig	2.902	8.093	1	8.093	8.424	.203
	Anxiety	-.154	.048	Sig	-2.049	4.035	1	4.035	4.200	.113
	Location -NSW	-4.323	.003	Sig	-3.172	--	--	--	--	.234
	Location – VIC	-2.897	.032	Sig	-2.244	--	--	--	--	.132
	Ancestry – Australian	-2.070	.034	Sig	-2.207	--	--	--	--	.129
	Ancestry – European	-2.995	.032	Sig	-2.240	--	--	--	--	.132
	Ancestry – UK	-3.579	.011	Sig	-2.713	--	--	--	--	.182
I always unplug the mobile charger when it's not in use	General health	-.001	.941	NS	-.075	.007	1	.007	.006	.000
	Energy	.044	.007	Sig	2.858	10.723	1	10.723	8.167	.198
I reduce the temperature in my hot water system	General health	.030	.104	NS	1.674	3.525	1	3.525	2.804	.078
	Location – VIC	-3.159	.040	Sig	-2.139	--	--	--	--	.122
	Ancestry – Australian	-2.145	.054	Sig	-2.000	--	--	--	--	.108
How much electricity did you use in your last bill?	General health	-30.747	.031	Sig	-2.250	3819858.373	1	3819858.373	5.063	.133
	Physical functioning	29.283	.033	Sig	2.228	3744604.255	1	3744604.255	4.963	.131
	Capability	315.085	.044	Sig	2.091	3299723.569	1	3299723.569	4.373	.117

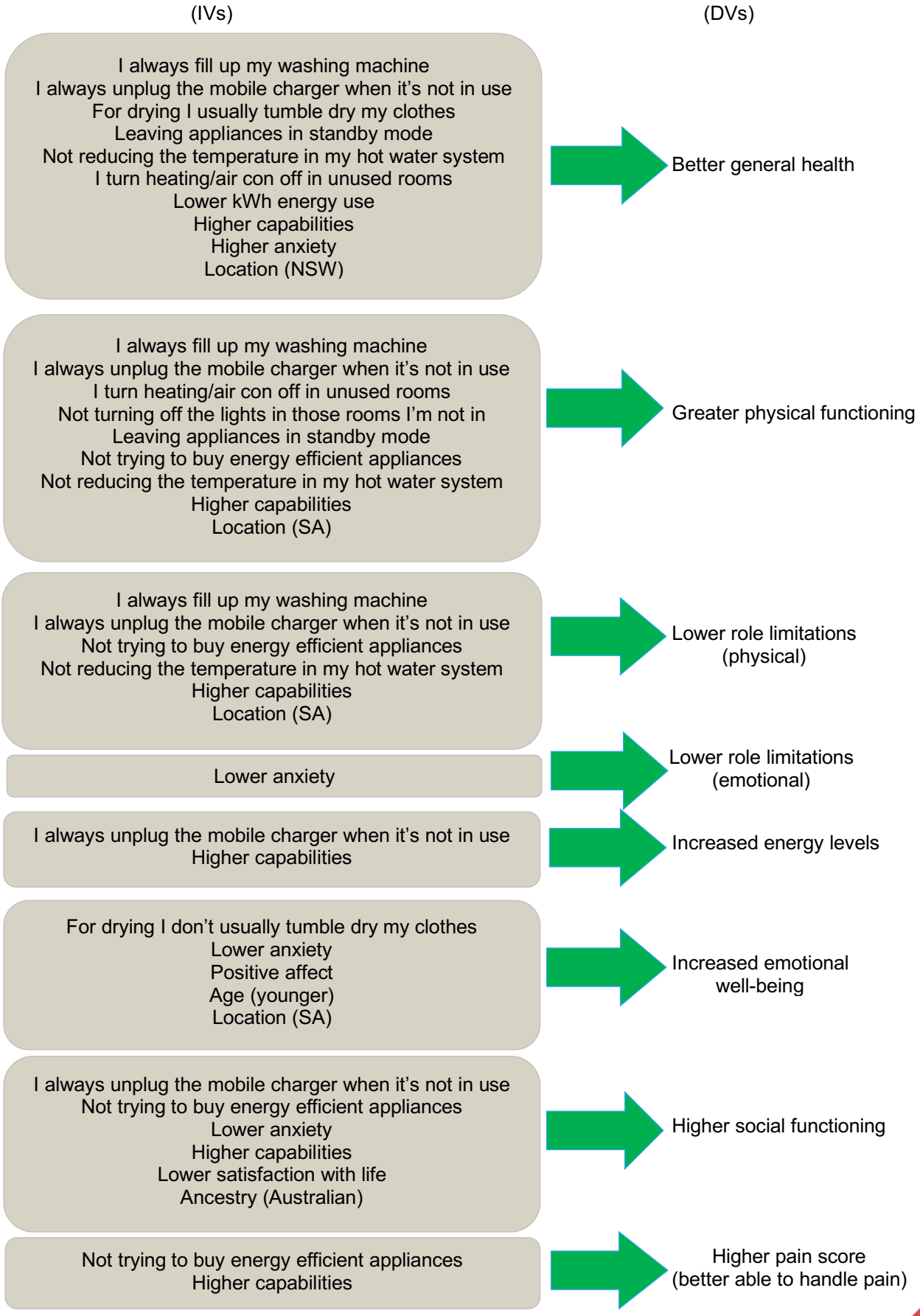
The analysis identified that I always fill up my washing machine was related to better physical functioning at home and work (i.e., role physical), less social engagement (i.e., social functioning), and lower level of flourishing. For drying, I usually tumble dry my clothes was related to lower emotional well-being but more flourishing and less anxiety. I always unplug the charger when it's not in use was related to increased energy levels. Kilowatts of energy used in your last bill was related to general health such that the more electricity used was related to worse health, but physical functioning and capabilities improved as the amount of electricity used increased. The following dependent variables: I always turn off the lights in those rooms I'm not in; I never leave electrical appliances in standby mode; I try to buy energy efficient household appliances; I keep heating and air con low to save energy; I turn the heating/ air con off in unused rooms and what was the amount of your most recent electricity bill (in dollars) were not significantly related to any of the health and well-being predictors.

Cross-sectional associations between energy use; and health & well-being

General linear modelling was then performed to investigate associations between energy use variables, and health and well-being outcomes, again controlling for demographic variables as covariates. As indicated in Table 4, and Figure 2 several statistically significant associations between energy use variables, and health and well-being outcomes were identified. Specifically, data analysis identified general health was related to always filling up the washing machine, always unplugging the phone charger and turning the heating off in unused rooms but it was also associated with regularly using the clothes dryer and leaving appliances in standby mode. Better health was associated with less energy used (i.e.,

kilowatts) and more capabilities. Interestingly, better general health was associated with more anxiety.

Figure 2: Baseline Survey Data General Linear Model Analysis showing associations between energy, and health & well-being variables



Physical functioning was related to always filling up washing machine, always unplugging the phone charger and turning off the heating in unused rooms but physical functioning was also related to being less likely to turn off the lights in unused rooms, leaving appliances in standby mode and not buying energy efficient appliances or reducing the temperature of hot water system. Higher levels of physical functioning were also related to more capabilities. Lower level of role limitations physical (e.g. better agility, & movement) at home and work was related to always filling up washing machine and always unplugging the charger but they were less likely to turn off the lights in unused rooms, to buy energy efficient appliances and to reduce the temperature in hot water system.

Furthermore, lower levels of role limitations (physical) at home and work was related to more capabilities. Role limitations emotional (or better emotional functioning at home and work) was related to less anxiety. Higher levels of physical energy were related to always unplugging phone charger when not in use and more capabilities. Increased emotional well-being was associated with using the clothes dryer less frequently to dry clothes. It was also related to more positive emotions, less anxiety and to being younger in age. Engaging in social activities (social functioning) was associated with always unplugging the phone charger and not buying energy efficient appliances. It was also related to more positive emotions, less anxiety and to being younger in age. Engaging in social activities (social functioning) was associated with always unplugging the phone charger and not buying energy efficient appliances. Increased social functioning was also related to less anxiety and more capabilities but lower satisfaction with life. As higher scores on the SF-36 equate to better functioning – being able to better handle pain (i.e., higher pain score) is related to more capabilities and being less likely to buy energy efficient appliances.

Table 4: Cross-sectional associations between health & well-being, and energy use variables

DV	IV	B	P value	Sig	t	Type III SS	df	MS	F	Partial eta2
General Health	I always fill up my washing machine	7.679	.006	Sig	2.943	1446.170	1	1446.170	8.661	.224
	For drying I usually tumble dry my clothes	4.153	.040	Sig	2.142	766.340	1	766.340	4.590	.133
	I never leave appliances in standby mode	-6.962	.010	Sig	-2.735	1249.191	1	1249.191	7.482	.200
	I always unplug my phone charger	5.050	.019	Sig	2.474	1021.872	1	1021.872	6.120	.169
	I turn heating/ air con off in unused rooms	7.860	.024	Sig	2.377	943.549	1	943.549	5.651	.159
	Bill amount (kilowatts)	-.008	.042	Sig	-2.127	755.038	1	755.038	4.522	.131
	Anxiety	2.053	.007	Sig	2.888	1392.479	1	1392.479	8.340	.218
	Capability	7.698	.001	Sig	3.632	2202.095	1	2202.095	13.189	.305
	Location -NSW	49.699	.015	Sig	2.585	--	--	--	--	.182
Physical functioning	I always fill up my washing machine	9.930	.001	Sig	3.556	2418.188	1	2418.188	12.648	.297
	I always turn off the lights in those rooms I'm not in	-10.409	.005	Sig	-3.067	1798.650	1	1798.650	9.408	.239
	I never leave appliances in standby mode	-6.898	.017	Sig	-2.533	1226.426	1	1226.426	6.415	.176
	I always unplug my phone charger	5.835	.012	Sig	2.671	1364.205	1	1364.205	7.136	.192
	I try to buy energy efficient appliances	-14.312	.000	Sig	-4.225	3413.168	1	3413.168	17.853	.373
	I reduce the temp in my hot water system	-7.666	.006	Sig	-2.979	1696.100	1	1696.100	8.871	.228
	I turn heating/ air con off in unused rooms	11.220	.003	Sig	3.171	1922.894	1	1922.894	10.058	.251
	Capability	6.243	.010	Sig	2.752	1448.394	1	1448.394	7.576	.202
	Location – SA	-74.774	.000	Sig	-3.919	--	--	--	--	.339

DV	IV	B	P value	Sig	t	Type III SS	df	MS	F	Partial eta2
Role limitations physical	I always fill up my washing machine	13.758	.005	Sig	3.019	4642.375	1	4642.375	9.111	.233
	I always turn off the lights in those rooms I'm not in	-12.388	.033	Sig	-2.236	2547.613	1	2547.613	5.000	.143
	I always unplug my phone charger	9.584	.012	Sig	2.688	3680.990	1	3680.990	7.225	.194
	I try to buy energy efficient appliances	-19.514	.001	Sig	-3.529	6345.374	1	6345.374	12.454	.293
	I reduce the temp in my hot water system	-8.823	.044	Sig	-2.100	2246.817	1	2246.817	4.410	.128
	Capability	11.410	.004	Sig	3.082	4838.768	1	4838.768	9.497	.240
	Location – SA	-75.257	.022	Sig	-2.416	--	--	--	--	.163
	Anxiety	-3.216	.009	Sig	-2.798	3418.324	1	3418.324	7.830	.207
	Location – SA	-74.536	.015	Sig	-2.585	--	--	--	--	.182
	I always unplug my phone charger	5.780	.010	Sig	2.743	1338.954	1	1338.954	7.526	.201
	Capability	4.634	.043	Sig	2.118	798.056	1	798.056	4.486	.130
	For drying I usually tumble dry my clothes	-3.015	.004	Sig	-3.155	403.976	1	403.976	9.955	.249
	Anxiety	-1.513	.000	Sig	-4.318	756.747	1	756.747	18.648	.383
	Positive and negative affect	1.120	.004	Sig	3.120	395.091	1	395.091	9.736	.245
	Age	-.374	.049	Sig	-2.054	171.285	1	171.285	4.221	.123
	Location – SA	-17.858	.051	Sig	-2.032	--	--	--	--	.121
	I always unplug my phone charger	4.096	.017	Sig	2.522	672.175	1	672.175	6.359	.175
	I try to buy energy efficient appliances	-7.511	.006	Sig	-2.982	940.009	1	940.009	8.893	.229
	SWLS	-1.174	.029	Sig	-2.296	557.312	1	557.312	5.272	.149
	Anxiety	-1.830	.003	Sig	-3.236	1106.716	1	1106.716	10.470	.259
	Capability	4.611	.010	Sig	2.734	790.190	1	790.190	7.475	.199
	Ancestry – Australian	-23.087	.039	Sig	-2.163	--	--	--	--	.135
	I try to buy energy efficient appliances	-9.832	.020	Sig	-2.459	1610.872	1	1610.872	6.046	.168
	Capability	7.344	.010	Sig	2.743	2004.546	1	2004.546	7.524	.201

Therefore, the cross-sectional analysis of the baseline survey data identified associations between energy use and health and well-being outcomes; and between health and well-being status and energy use outcomes. That is, as expected we found that the relationships between energy use, health and well-being appear to operate in both directions of influence. These finding can be justified, as prior research has shown how the development of health and well-being issues among householders makes demands on their energy use – for example people who have cancer may require the heating on more often or at a higher temperature, someone with kidney disease may need to use a home dialysis machine, or a person with depression may need to use entertainment or leisure devices more often to help manage their emotional health - leading to higher $ value energy bills and kWh energy use (Liddle, 2011).

People who enjoy good health and well-being may on the other hand, feel enabled to use energy in particular ways that may be efficient – for example by always filling up the washing machine, hanging up their laundry rather than using a clothes dryer, unplugging phone chargers, and switching off appliances at the wall rather than leaving them on standby. Conversely, research has also shown that how people use energy can have an effect on their health and well-being – for example people who do not keep their homes well heated or cooled may develop health problems such as catching a cold in winter or suffering heat stress in summer (Brown and Walker, 2008; Gasparini et al., 2015; Hansen et al., 2011). Furthermore, people who are not able to use as much energy at home as they may desire due to the high cost of energy may experience stress and anxiety about being unable to care for themselves and others in the home or about be anxious about receiving a high energy bill (Waitt et al., 2016).

Accordingly, the baseline cohort survey data analysis identified important associations between energy use, health and well-being that suggest they are inexorably linked. Causal associations between the variables in the study are investigated in the Stage 3: Follow-up cohort survey analysis section later in this report.

Findings for Stage 2: Ethnography

We present a discussion of the findings from the stage 2 ethnography in the following section. To protect the identities of project participants, pseudonyms are used. The findings from the research indicate that many older households have access to multiple appliances, yet the use of appliances is minimal. Table 5 gives an overview of the appliances owned and used (or not) by ethnography participants. In our analysis of the findings, we first discuss how households maintain thermal comfort and their beliefs around energy use at home. We found that household energy practices were diverse and varied with age and health conditions. We found that there were essential and non-essential medical devices which supported both physical health and mental well-being. For many of the households in this project, technology had become an important part of managing physical health and well-being. Our findings illustrate that new tasks and technologies can be learnt by older householders and that they can reap significant tangible and personal benefits that impact physical health, mental well-being and social connectedness.

Table 5: Participants, appliances and patterns of use

Name	HWS	Fridge	Stovetop	Oven	RC AC	Ceiling fan	Clothes dryer	Dishwasher	Washing machine	Electric blanket	Heater	Iron	Kettle	Microwave	Medical equipment	Computer/ iPad/laptop	Vacuum	TV	Hobby
Rebecca	Y	Y	D	R	OCC	N	NEV	R	W	N	N	OCC	D	D	Electric bed	W	F	D	craft
Chantelle Josh	Y	Y	D	F	REG	D	N	N	W	D	D	OCC	D	REG		D	OCC	D	Electric train set
Laura Bobby	Y Solar	Y	D	OCC	REG	REG	R	D	W	N	N	R	D	D	Solar heated spa	D	W	D	Gardening
Morgan	Y	Y	REG	REG	N	N	N	N	W	N	R	OCC	D	D		D	W	D	Family Genealogy
Danielle	Y	Y	D	W	REG	N	R	W	W	N	OCC	N	D	D		D	W	D	Craft, church activities
Milly Albert	Y Solar	Y	D	W	R	N	R	D	W	N	D	N	D	D		D	W	D	Organic gardening
Michelle	Y	Y	D	W	N	D	N	N	W	N	D	N	D	D		N	W	D	Gardening
Felix	Y	Y	D	W	N	D	N	N	W	N	D	N	D	D		N	W	D	Art
Constance Benjamin	Y Solar	Y	D	W	OCC	D	OCC	W	D	D	D	W	D	D		D	W	D (4)	Electric trains
Demi	Y	Y	D	W	N	N	N	N	W	N	D	NEV	D	D		D	W	D	Yoga
Kye	Y	Y	D	W	N	D	N	N	D	N	D	NEV	D	D	CPAP Life pendant	N	W	D	Craft
Genevieve	Y	Y	D	W	OCC	N	OCC	N	W	N	OCC	R	D	D		D	REG	D	Church activities
Max	Y	Y	OCC	F	N	D	N	N	W	N	D	NEV	D	D		N	W	D	gardening
Billy	Y	Y (2)	D	W	N	D	N	N	W	N	D	NEV	D	D		D	W	D	Power tools
Nettie Malcolm	Y	Y	D	W	NEV	N	N	N	REG	N	D	N	D	REG	Elect chair, stair lift, Mobility scooter	D	F	D	Power tools
Scott	Y Solar pool	Y (2)	REG	R	OCC	REG	OCC	REG	W	N	REG	N	D	D	CPAP	D	W	D	Social groups, dogs
Georgie	Y*	Y	R	NEV	N	N	N	N	W	N	OCC	N	D	D		D	W	D	Study
Caitlyn James	Y Solar	Y	D	W	OCC	OCC	OCC	W	W	N	OCC	W	D	D	Pool	D	W	D	Caravanning
Lori	Y	Y	D	NEV	N	R	REG	R	D	N	D	REG	D	D	Portable AC	R	R	D	Pets
Gisel	Y Solar	Y	D	W	N	OCC	N	N	W	N	D	NEV	D	N		D	W	D	Yoga

Alfred	Y	Y	OCC	NEV	REG	OCC	Y-NEV	N	W	N	N	OCC	D	D	Life pendant	D	F	D	Driving
Kay	Y	Y	D	REG	REG	OCC	OCC	NEV	W	N	OCC	REG	D	NEV	AC	D	REG	D	Golf, netball
Tristan	Y	Y	OCC	NEV	N	N	N	N	REG	N	NEV	REG	D	D	Hearing aids	N	R	D	Jazz music
Anna Joseph	Y	Y	D	W	D	D	OCC	W	W	N	D	NEV	D	D		D	W	D (5)	Golf, cycling
Daisy	Y Solar hws	Y	D	W	W	D	REG	W	W	D	W	W	D	D	CPAP	D	F	D	BBC dramas
Fern	Y solar	Y	D	F	W	D	W	W	F	D	N	F	D	D	blood pressure monitor pool	W	F	D	Tapestry
Maria	Y	Y	D	W	W	REG	N	N	W	N	N	OCC	D	D		D	F	D	Cooking
Patrick	Y	Y	R	OCC	R	REG	R	N	W	N	NEV	NEV	D	D	Hearing aids	N	F	D	Flute, church
Zack	Y	Y	D	W	R	REG	W	N	W	NEV	W	N	D	D	Life pendant	N	W	D	Power tools, golf
Carl	Y	Y	D	REG	D	N	OCC	N	W	D	D	NEV	N	D	Electric blanket Hearing aids Life pendant	N	?	D	Cooking, music
Samantha John	Y	Y	D	REG	REG	N	N	N	W	N	N	N	D	D	Blood press monitor	D	W	D	Church activities

KEY:

Y= own appliance N= do not own appliance *=usually switched off	D=daily use W=weekly use F=fortnightly REG=regular (once/month) OCC=occasional(once/3 months) R=rarely (twice/year) NEV=never

Everyday thermal comfort practices

The households in this study (n=31) demonstrated that conserving energy was a common practice in relation to maintaining levels of thermal comfort. Older householders generally utilised passive heating and cooling strategies before employing electrical appliances to heat and cool the home. Notably, they managed thermal comfort by adjusting clothing (wearing more in winter and less in summer), using blankets in common areas rather than space heaters, wearing socks and slippers, using heat bags, hot water bottles and electric blankets for sleeping rather than heating bedrooms. If appliances were used it was generally for a short period only as explained by Georgie:

> It's really quite cold in here in the winter. In the morning ... I get up really early. I'm up by 5:00 in the morning, and it's cold. And I just for the last couple of weeks, when it's been very cold, I've been putting that heater on first thing in the morning. But I turn it off quite early, and I have a blanket over, around myself. And I have a hot water bottle on, for my feet.
> (Georgie, female, single, aged 72).

This supports prior Australian research that found lower income consumers are reasonably energy efficient (Chester, 2013). Older households generally agreed that their past experiences heavily influenced their attitude towards energy use. It was a part of a general attitude that emphasised frugality and conservation of resources and infused most of their everyday practices. For example, Danielle illustrates how being older she considers the cost of energy more than she would have previously when she was in paid employment:

> I'm 72 so we grew up after the war. I grew up overseas after the war. Where you didn't waste anything. So, when I was working you might've gone, "Oh it's Tuesday night. I've got to do the washing. I've only got half a load bad luck. I've got to do the washing. I need these clothes." Now I'll go, "It's only half a load. There's no point. I've got enough clothes. Wait till I've got a full load."
>
> (Danielle, female, married, aged 72).

This reluctance to use electricity in a profligate manner was positioned as something of a moral good where householders did not utilise appliances for convenience sake. It was a common sense understanding that seemed to be related to the lived experiences of the practices of a previous generation. While household organisation is important, it is not the overriding priority for those aged over 60 years, they are prepared to allow more time for completion of household tasks rather than turn to energy intensive appliances unlike many younger households (Aro, 2017). This common-sense approach that was not framed entirely in economic terms but was related to physical functioning. As illustrated by Genevieve, those who were physically able to, would usually dry their laundry naturally, either outdoors or indoors. This reiterates the findings of the survey that found increased physical functioning and better health was associated with lower levels of energy use.

> I don't know, really. I think ... I don't waste electricity. I'm not stingy about it, but I don't waste things. I turn lights off, and I don't have things running all the time. And, I have ... Like, the dryer. We wouldn't just put our clothes through the dryer.
>
> (Genevieve, female, single, aged 89).

Alongside beliefs about conserving resources, there was also a generalised concern about lessening impacts on the environment. For example, Georgie resisted installing reverse cycle air conditioning in her unit (despite pressure from neighbours and Strata) because of her wish to reduce energy costs and to reduce her impact in terms of greenhouse gas emissions.

> It (reverse cycle air conditioning) would be expensive to run, and because I believe we shouldn't be using more energy than we need…It's more about conserving energy…Not using more energy than I need to use. I haven't always known about that (climate change), but as I've heard it, you know, over the last 15 years or so, I've thought that that's really important, that we don't ruin the planet, we do as best we can to use as little plastic as we can, and just be as responsible as we can with power. (Georgie, female, single, aged 72).

This attitude extended to how households considered the costs associated with heating and cooling the house. For those with relatively good health, space heating or cooling was generally considered unnecessary. They choose strategies that focused on the body-clothing, blankets, electric blankets, hot water bottles, hot drinks or less clothing, fans, swimming- which minimised energy use. Most commonly, they used material barriers like shutters, blinds and curtains to prevent heat transfer and usually only heated or cooled small areas as illustrated by Fern.

> So upstairs in the summer time I keep the shutters down. That's a nice cool room. Summer time, not hot at all. Beautiful.
> (Fern, female, widow, aged 77).

For most, keeping cool in the summer time was more achievable than keeping warm in the winter because they utilised natural ventilation or fans in the summer, as explained by Patrick.

> This unit is a particularly good one because I've got openable windows on all four sides, so I can get natural ventilation. And being within half a kilometre of the sea, I get the benefit of the sea breeze, so that's good. As for air conditioning, I rarely use it unless I have visitors. I do like to, I've got a ceiling fan here and I've installed ceiling fans in two bedrooms, that is quite sufficient. In fact, I enjoy the feel of the moving air even though it's not as cool as what would come out of an air conditioner.
> (Patrick, male, single, aged 82).

Households that owned a reverse cycle air conditioner did not usually utilise it except on the very coldest days in winter or hottest days in summer.

Thermal comfort and sociality

Ageing at home provided householders with options for how they used energy to care for themselves and others. Some participants reported that they adjusted the temperature of the home when expecting friends or family, something previously documented by Hitchings and Day (2011). While not using space heating was a strategy to keep energy costs low, often this practice was malleable. For example, heating the home as an act of hospitality can be read into the following examples, where family or visitors were expected. Zack explains:

[A]t times I have put it (reverse cycle air conditioning) on. I put it on yesterday afternoon because I knew the daughter was coming. But at times I just got a couple of throw rugs and just sit here and watch the television with that on.

(Zack, male, widower, aged 89).

Like Hitchings and Day (2011), participants such as Carl commented that they had put the heating/cooling on before the research visit to make the home comfortable.

Sometimes we'll heat it up or cool it down before people come and if we had- before you came this morning we banged it (air conditioner) on just to make sure it was reasonably warm when you came in.

(Carl, male, widower, aged 97).

However, some participants such as Danielle reported that visitors were expected to adopt the normal household practices of using blankets rather than space heating.

My daughter was here last night. She complained about being cold. I gave her a blanket. I offered to put the heater on, I gave her a blanket instead.

(Danielle, female, married, aged 72).

An alternative interpretation is that this practice could be considered a strategy to mask the thermal conditions that were normally experienced as a part of fuel poverty. Some participants such as Georgie narrated their inability to entertain at home because of the temperature extremes, and the social shame they felt accompanied a home that was not well-

heated or well-lit. Thus, higher levels of energy use may be associated with higher levels of emotional well-being, something that was suggested by the survey results.

> [I]t's horrible to be sick, with a mental illness or a physical illness, and be in a cold, cold place, I think. Because the place is not welcoming. You don't like to ... Just like I, I don't want to invite friends here, because it's not a cozy, welcoming place.... Well, I guess the thing is, I can sit here with a blanket and a hot water bottle. I couldn't expect guests to do that, and I wouldn't do it in front of guests. And so, if I want to spend time with people, we go out.
>
> (Georgie, female, single, aged 72).

From this example, we can see that it is not just measures of temperature that constitute a healthy home, but it is important to acknowledge how social understandings of energy use impact both health and well-being through how domestic appliances allow people to make their homes comforting and welcoming. Thus, how people use energy as a part of the discourse of successful self-care and ageing, involves negotiating the costs of energy to provide a welcoming home, while still trying to maintain good health.

Negotiating health and safety with energy costs

At 40% of household energy use, heating and cooling are together the largest energy users in the average Australian home (DEWHA, 2008). Seventy-five percent (n=23) of the households in this study did *not* own a reverse cycle air conditioner but 77% owned a heater and 70% owned a fan. Reverse cycle air conditioners are the cheapest form of electrical heating and cooling yet for many the purchase costs and the concerns over running costs prevented their installation. For this group, the choice to run larger domestic appliances e.g.

dishwashers, washing machines and clothes dryers was always dependant on energy efficiency and physical capacity. For example, running a full load was the standard for dishwashers and washing machines. Clothes dryers were seldom used, with participants opting to line dry (externally and internally) as demonstrated by Carl.

> I've stopped using the outside line because I felt awkward. I'd have to put my stick down and lift things up, then I'd go wobbly. I fell a couple of times, so...I have a dryer for emergencies, but I try not to use it because of the electricity costs.... It dries in the kitchen anyway.
> (Carl, male, widower, aged 97).

When asked to reflect on the way that energy was important for health, most householders reflected on their understandings of biological ageing as explained by Samantha, and also Max. Here they often ruminated on their deteriorating balance, their increased tendency to slip and fall, or their decreased muscle strength. They displayed that they actively planned how to negotiate everyday tasks in ways that minimised risk.

> As you age, you realize that you are becoming more frail, more fragile. Falls are not good so you take care.
> (Samantha, female, married, aged 73).

> When you're young, you are 10 foot tall and bulletproof. As you get older, you're more aware of what could be a possible hazard and maybe an injury. Like I said, it's about considering things before you do them these days. Where is the element of danger here?

(Max, male, single, aged 78).

Other simple strategies to ensure safety were incorporated into household practices to facilitate better ageing. For example, as discussed by Billy, lighting became important for reducing potential falls and was generally understood as affordable .

> If you have it [the home] lit up especially on the outside, there's less chance of you falling over and doing damage that way, and what we have got, what we had put in when we first got it, we got two way switches, so if you're going from one end to the other, you can always have your lights on and make sure you don't trip over and fall that way, yeah.
> (Billy, male, married, aged 74).

So, while all participants employed a precautionary approach to physical safety within the home, they also were mindful of preventative approaches which could help manage their health conditions. Significantly, within the project, 25% of households had installed Solar PV reflecting the growing trends (of around 20% nationally) within Australia to take advantage of the climate and to reduce energy costs (Australian Government Department of the Environment and Energy, 2018). Older Australians are increasingly considering their future energy needs and how they will manage their health in the light of increasing energy costs.

For example, three households used solar heated pools and spas to alleviate the pains associated with ageing and or accidents and as a source of gentle exercise. After an accident five years ago where he had broken his hip, Bobby installed a spa in the back garden (see Figure 3) and used it around three times weekly to relieve muscle pain. His wife Laura also

found relief in using the spa once a week and both relished the fact that it did not impact their energy bill.

> Massages you. Any sore backs, you hop in, and you put the pressure points on it, and the hot water on it, and it's relieving it.
> (Bobby, male, married, aged 72).

Figure 3: Bobby's solar spa used for muscle pain relief

Source: Authors, 2018.

Other households such as Benjamin's used solar to power heating and cooling or to run larger appliances during the day to reduce both the physical discomforts and the costs of use.

> Well, with the solar, we like to spread things out, not put everything on at once so that the solar takes care of most of the power usage. We put the dishwasher- or the washing machine on first. When that's finished then we put the dishwasher on. When

that's finished, and then the kettle or something, just put things in order, so spread them out over the day, not do everything at once.

(Benjamin, male, married, aged 67).

For some households with more limited resources (n=10), options were very limited and limiting. Without solar power and with older, less efficient appliances there were more pressing concerns over the cost of use which sometimes resulted in living totally without heating or cooling. For example, Tristan, single, 82, reported that he had used his electric space heater twice in a nine-year period. Similarly, Patrick, single, 82, lived without heating and did not utilise hot water for showering. Both of these single men cited health reasons for these practices, they believed that an over-reliance on appliances was detrimental to their health as well as acknowledging the increasing costs of energy.

This supports previous studies in Europe which argue that single elderly households demand substantially less heating (approximately 23%) than married seniors (Brounen et al., 2011). It also speaks to the literature which advocates that there needs to be greater knowledge of the influence of social and contextual factors, in particular with regard to the thermal comfort of housing (Maller and Strengers, 2011; Shove, 2003). Understanding these strategies may be important for reducing reliance on heating and cooling appliances and expanding the range of acceptable indoor temperatures that can reduce energy demand overall (Murtaghab, Gaterslebena and Uzzell 2014; Strengers, 2010). That said, these energy saving strategies would not easily be incorporated into health discourses which advocate for a more moderate temperature range for the elderly to avoid exacerbating any health conditions. It is not clear what the short- or long-term impacts of living without heating or hot water are on physical

and mental health, but clearly some parts of the elderly community are experiencing living conditions that few others do.

Increased energy demand associated with health conditions

There is evidence that ageing households tend to spend more time at home and have a sedentary lifestyle that is associated with higher energy use (Liddle, 2011) though clearly this is influenced by demographic and cultural factors (Ota, Kakinaka and Kotani, 2018). In this study, those with health conditions, rather than simply those of an older age, tended to rely more on electrical appliances to maintain an appropriate level of thermal comfort. For example, Malcolm has early onset Parkinson's disease and feels the winter cold as does his wife Nettie, who has kidney problems. He utilises a heater in the lounge room where he spends much of his time watching television, and he leaves this on all day and night on a low temperature setting.

> I have a mate that comes up this morning, every week. And walks in, and people walk in and they say, "Ah, we've come over here to get warm, the house is warm." And we popped in at some friend's the other day, and aw gee, the place was cold. I said to Nettie, "About time we got moving" and they told me how much energy they saved, and I said, "If it's like that, the way that is, like that is, there's no way I'm saving energy" …you know it's going to cost, you know it's gonna cost. To be warm and comfortable in your own home is more important than that, as far as I'm concerned. (Malcolm, male, married, aged 83).

Similarly, Lori, who has had a stroke, has a heart murmur and is legally blind, has the heater on all day and night during the winter. Because of her sight problems, she avoids going out

and depends on her son to do household shopping, to assist with food preparation and clothes washing and drying. She suffers more from the summer heat and so is heavily reliant on a portable air conditioning unit to maintain her thermal comfort over the summer period. A previous episode where she had been hospitalised for heat stroke convinced her that air conditioning was essential to maintain her health. Lori could not afford to pay for installation of a split system air conditioner and so uses a portable air conditioner (see Figure 4) purchased for her by her son.

Figure 4: Lori's portable air conditioning unit

Source: Authors, 2018

> That's (air conditioning) of paramount importance to me. After that episode where I went ... You know, it was extremely unpleasant. I wasn't master of my own destiny and it was quite frightening. And as I said, sitting in the cool air it was lovely thank

you. So naturally, I learned something from that, and that was to keep cool and just to keep stock of yourself, so you don't get to that stage again.

(Lori, female, widow, aged 81).

Clearly, participants had a good understanding of how to manage their health conditions through the use of heating and cooling appliances.

Using energy for essential medical devices

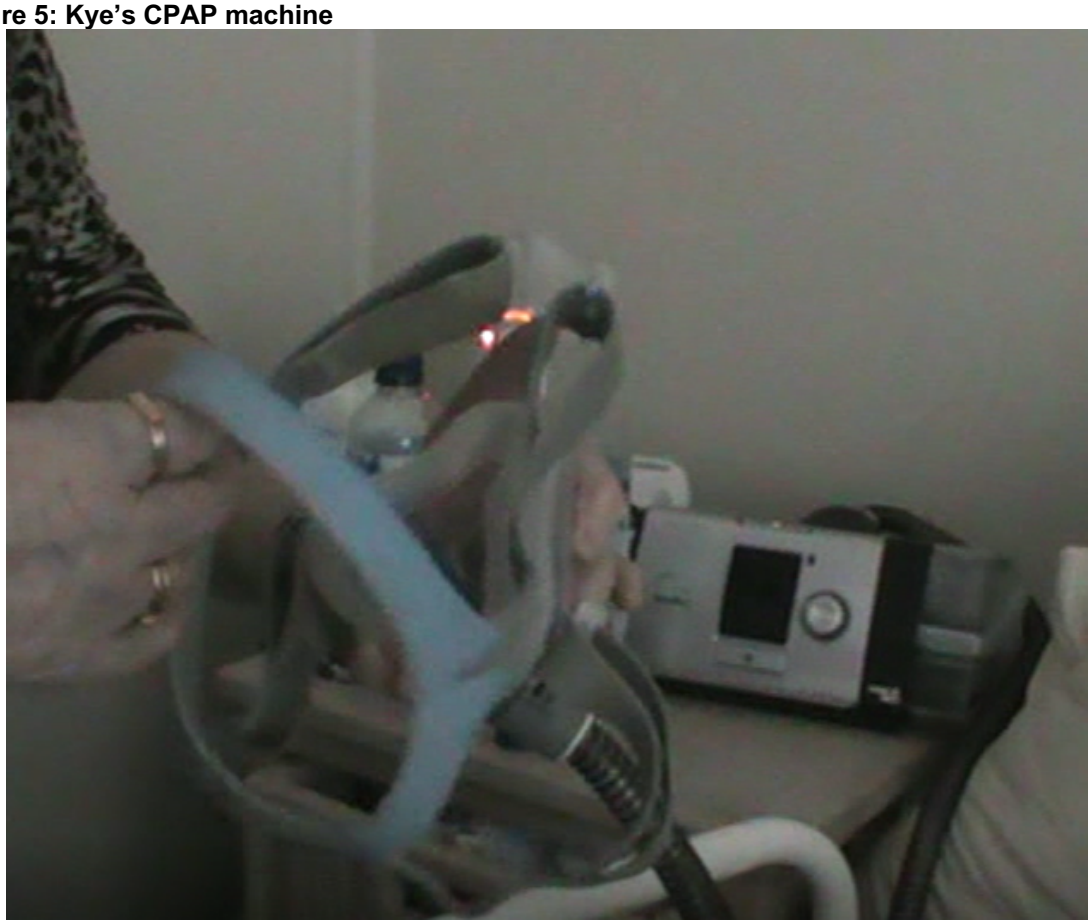
Around 20% of the householders in this study used specific medical devices for their health. This included CPAP machines to address sleep apnoea (see Figure 5), life pendants (a variety but generally those that connected the householder with emergency medical support services and were activated manually or by falls) and monitors (for example blood pressure, blood sugar) so that people could maintain a level of good health. All of the householders who used this equipment agreed that it was essential for maintaining their health and therefore energy costs did not come into consideration, as explained by Daisy below.

I thought it was low power use, that CPAP. That's what I assumed. But I don't ... Really, I mean, that has to come first, the fact that he (husband) needs to breathe.

(Daisy, female, married, aged 72).

While these devices may not account for a large proportion of the household energy costs, it is significant that participants in this study were not aware that they were entitled to any energy rebates for CPAP machines (entitlements of $157 per year for each piece of qualifying essential medical equipment and medically required heating or cooling through the Australian Government Department of Human Services, Essential Medical Equipment Payment).

Figure 5: Kye's CPAP machine



Source: Authors 2018.

Three participants who lived alone also relied on a life pendant or bracelet which connected them to immediate medical help (see Figure 6). This remained plugged in and turned on at all times and pendants or bracelets required batteries which they recharged. Participants did not query the amount of electricity needed to power these devices, and while it is comparatively low in the overall household energy budget, it is significant in the light of the number of elderly people in Australia who live below the poverty line and who may do without other daily necessities in order to pay their energy bills.

Figure 6: Kye's life pendant

Source: Authors, 2018.

Using energy for non-essential medical devices

There was a range of non-essential medical devices used by our households to improve their quality of life. These were generally associated with maintaining a certain level of independence, physical mobility and comfort. For example, 92-year-old Rebecca lived alone and though her health was generally good, she had a decreased level of physical mobility. A hospital grade adjustable bed made her life more comfortable because she could adjust the height for climbing on and off the bed, and also adjust the angle of the bed to facilitate sitting up to read or watch television (see Figure 7). While this was not an essential health item, it made her life easier by reducing the physical strains and exertions associated with becoming comfortable in bed.

Figure 7: Rebecca's remote-controlled bed

Source: Authors, 2018

Similarly, Malcolm had surrounded himself with a range of appliances that helped him to maintain his mobility and independence. His condition of early onset Parkinson meant that his physical mobility was impacted though he remained mentally alert and engaged. He had previously suffered from depression and so maintaining physical mobility had a positive effect on his mental health. For example, he used his electric armchair to raise and lower himself in order to access his walking frame (see Figure 8).

Figure 8: Malcolm's remote-controlled electric armchair

Source: Authors, 2018.

After accessing his walking frame, Malcolm was able to walk to his front veranda and to use the electric stair lift which he had installed three years earlier (see Figure 9). This took him to the lower level of his home where he had another walking frame so that he could independently make his way to his workshop which had an array of power tools. Malcolm spent a significant portion of each day in his workshop working on various projects and could move between upstairs and downstairs several times per day without assistance.

Figure 9: Malcolm's external stair lift

Source: Authors, 2018.

Ninety-seven-year-old Carl was dependant on his electric blanket to sleep at night. His poor circulation meant that without it he was unable to maintain a comfortable temperature and sleep through the night. Five other participants reported using an electric blanket instead of heating the bedroom, though they turned it off 10-15 minutes after getting into bed. While an electric blanket does not qualify as medical equipment it was important for elderly householders to maintain a certain level of physical comfort for relatively little energy expenditure. Thus, for many of the householders keeping warm and comfortable in an economical way often involved the use of small domestic appliances. Kettles were used many times in a day to provide hot drinks which were not only about keeping warm, but also contributed to householders' sense of well-being as explained by Daisy.

> That's definitely for health and well-being, because I definitely need a kettle for my stress management with my cup of tea. Well, it's very British. If there was ever a family issue we'd say, “Oh, come on in and have a cup of tea. I'll put the kettle on." If you take the kettle away I'll start stressing.
>
> (Daisy, female, married, aged 72).

What we see with these practices utilizing non-essential medical devices is that although they are framed as aiding physical health, they are not easily separable from the improvements to mental well-being that accompany their use. So, while electric armchairs, electric beds and stair lifts may enable greater physical mobility, or spas and pools provide muscular relief, it is the related affordances and affects that act on bodies which cements these practices into everyday household routines. While most of the participants in this study were unable to clearly articulate the way that energy was related to health and well-being, it is clear that the appliances and the energy that powered them were central to participants understandings of what constituted a fulfilling life and how they were able to manage their lives independently.

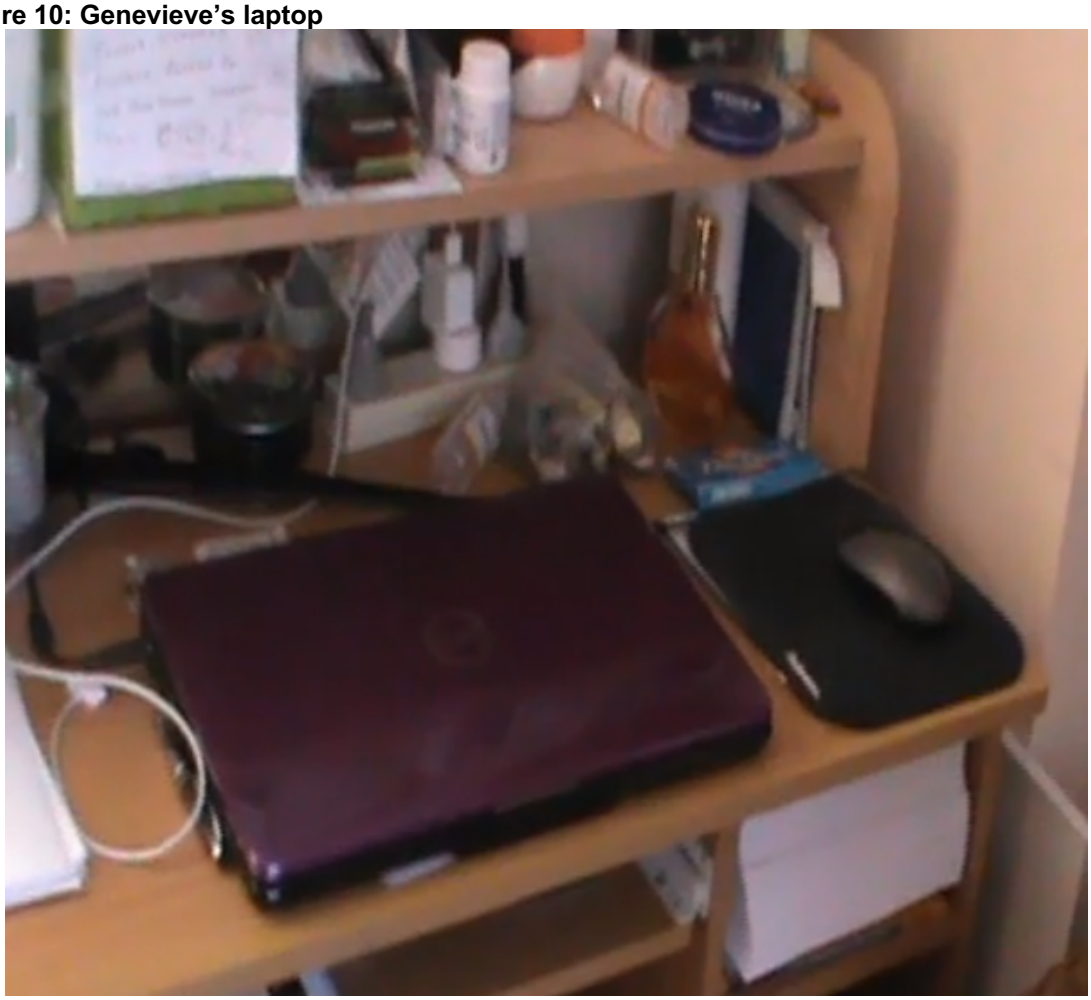
Using energy to facilitate social life

All participants in this study owned a television and used it daily. It was an important part of maintaining connections with society - it allowed them to keep up with current news, watch programs for entertainment and relaxation, provided a talking point when meeting friends and family and provided ‘company’ for those with few opportunities for face-to-face interaction. Patterns of use varied enormously, with some watching all day long, and some having specific times to watch particular programs, while some householders had mastered a range of technologies (program recording, DVDs) and recorded favourite programs to watch at convenient times. Even households with busy schedules (those that worked voluntarily, had

family commitments, participated in community welfare activities, played sport) regularly made time for television viewing. Often it was a form of sociality, where people chose to watch programs together. For example, 89-year-old Patricia lived with her daughter and they would negotiate which programs to watch providing an opportunity to discuss shared interests.

For the majority of householders in this study, voluntary and community activities were extremely important. The Australian Human Rights Commission (2018) estimates that Australians aged 65 years and over contributed almost $39 billion each year in unpaid caring and voluntary work. Thus, computers, laptops, iPads and digital phones were a part of household routines for 85% of the project participants and these were commonly used to organise, and schedule events related to community work, church activities, voluntary occupations or family commitments. Most householders reported that they used technology to send and receive emails, to connect with family and friends on Facebook, to google information, to share photographs and information, to conduct banking and to play puzzles and games. Genevieve had set up a home office (see Figure 10) that was important for how she organised her duties and schedules around community work.

Figure 10: Genevieve's laptop



Source, Authors, 2018.

Genevieve discussed how the use of a computer and using emails and other forms of communication helped facilitate her social life and her role within the community.

> There is a little bit of communication between them regularly every time we have a meeting and, you know, little things, so it's continual. So, I'm doing emails and little reports and little things like that on it. I'm 89 now. When I was 85, I finished working in an office where I was doing that kind of thing all the time. So, when I turned 85, I thought, "Well, I've done enough." So, I don't do that (go into the office) anymore. I do stuff at home and I do stuff at the Community Centre. I have to authorise pays and payments, things like that, so I have to go into the computer and do things.

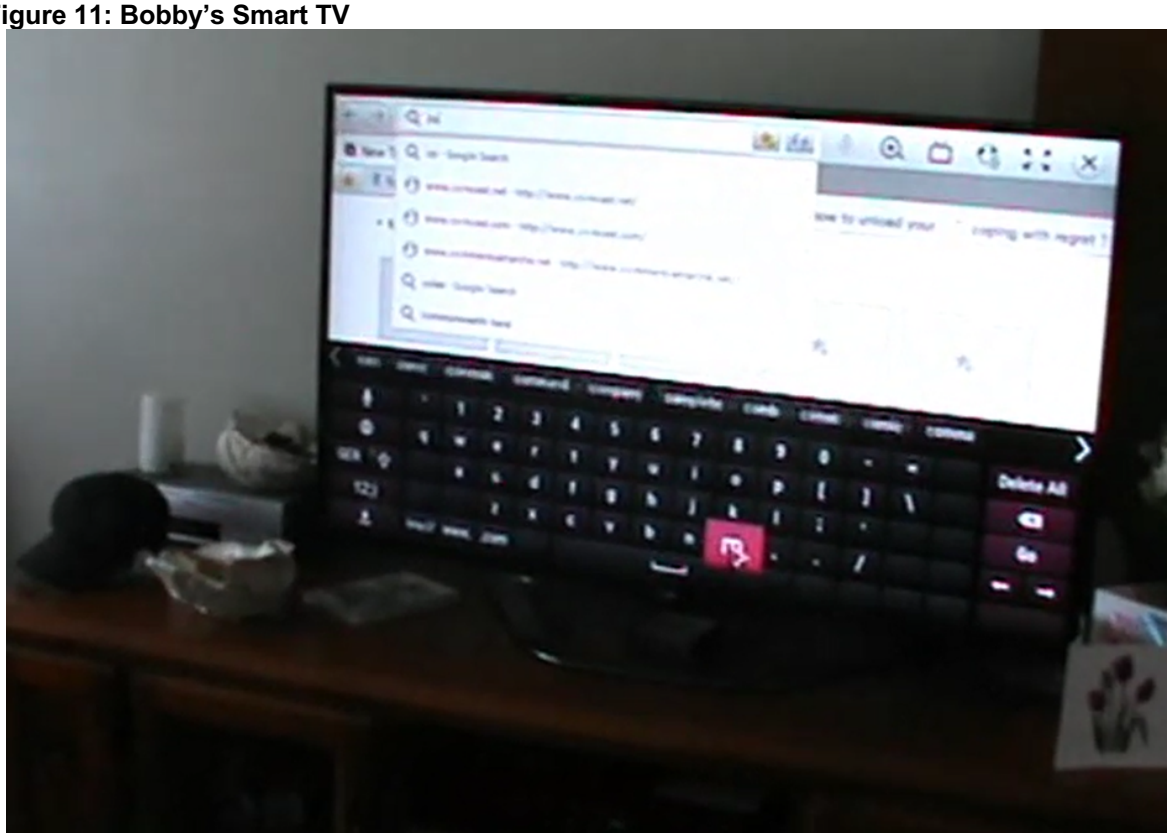
(Genevieve, female, single, aged 89).

Maria, a widow, also provides insights into how the computer is instrumental in supporting mental health and well-being. By developing the skills needed to utilise the computer, Heather felt that she was 'keeping up' with the times, she was aware that this technology was embedded in how people would manage their lives into the future. It served to position her as part of the digital shift rather than as an 'old woman' who was constantly 'left behind'.

> It's keeping up to the technology of today as well which you have a little bit of an insight as to what's going on because that's the life ahead. It is important because everybody leaves you behind… as you're an old woman you're always getting left behind. You have that feeling quite often.
> (Maria, female, widow, aged 83).

Similarly, Bobby demonstrated how he used his smart TV to do his banking, to monitor his finances, to book holidays, to google information on demand, and to relive photographic memories of holidays he and his wife had taken in the past (see Figure 11).

Figure 11: Bobby's Smart TV



Source: Authors, 2018.

It was also common, for participants in this project to use energy to engage in personal hobbies and crafts. Participants such as Malcolm, and Billy enjoyed using power tools and this afforded a certain level of pleasure and satisfaction. Billy explains:

> Well there's something relaxing that you can enjoy about it. No stress involved, or ... You just wander along and do what you like…And I'm only giving them away to different people and I've got to make up some later now because it's coming into spring, it's mainly the flower boxes and a few different craft things you can make up, so yeah, just doing bits and pieces and I get satisfaction with that.
> (Billy, male, married, aged 74).

A couple of our participants: Benjamin (married, 67) and Josh (married, 75) shared an interest in model train sets (see Figure 12). Both men come from an engineering background

and had invested much time and energy into perfecting working models of towns, villages, signals, lighting and controlled track switching. Benjamin has a dedicated space in the garage, while Josh has a room inside of his home where he spent up to three hours every day. This practice again provided a level of satisfaction and pleasure that was not easily duplicated in other household activities or practices.

Figure 12: Josh's model train set

Source: Authors, 2018.

It was clear that many forms of technology were important for enhancing social connectedness at various levels, it provided a mode of communication with family and friends, a source of readily available information, a tool for organising financial life, a means of participating in unpaid labour spaces and a way to contribute to sporting, religious or charitable organisations. Alongside the functionality of these technologies and the skills they generated, were the affective forces of pride – the achievement of a level of competence that reinforced feelings of self-worth and which helped many to feel their lives were meaningful and valuable. Here we must consider that energy is not only critical for physiological and

biological health, but also for promoting positive states of mental health that though not tangible or easily quantifiable, are equally as significant for healthy ageing.

Preparing for increasing energy needs and costs

It is not surprising that householders tried to maintain their health and comfort, while reducing energy costs as they aged. There were a number of strategies that they employed to maintain independence, physical health as well as mental well-being. Many of these were more available to home owners than to renters. Participants were aware of the increasing costs of energy and especially those associated with ill health and end of life. Many had nursed parents and partners and narrated the shock they had encountered with elevated energy bills. Zack recounted his experience of several years ago:

> My wife was ill for the last few years of her life, and I had to keep the air conditioning all day long. As soon as I got up in the morning at 7:00 I'd switch on the air conditioning. She'd come through and sit here and we had a table there and I put the radio on for her and then I'd go and make the breakfast. And the air conditioning would stay on all day until we went to bed about 10 o'clock, 10:30 at night. And after she died, the rates of electricity charges started going up. The first bill I got after all this long number of hours, air conditioning on every day. The first quarterly bill after my wife's death was nearly 500 dollars.
>
> (Zack, male, widower, aged 89).

Similarly, Fern narrated how her energy bills rose to over $1000 per quarter at the height of her husband's illness. This was due to having the reverse cycle air conditioner, the television, the lights and the computer on twenty-four seven to make his life more comfortable. After his

death, Fern reported that her energy bills had dropped to $160 per quarter and this was also due to how she had installed and used her solar PV system. Fern would use the washing machine, dishwasher, clothes dryer during the day and would reduce her energy use during the evening. Thus, there was a realisation that with ageing and especially declining health, energy needs increase. Solar PV was seen as a way to offset these future needs.

Some households were able to manage a comfortable transition by installing energy efficient appliances and investing in alternative energy generation. Other households managed their comfort in alternative ways that were reflective of cultural and social difference. Those on low incomes were disadvantaged by the current deregulation of the energy market. Where connection charges are consistent across all consumers those with less efficient appliances effectively subsidise those who are able to purchase and run newer appliances. As well, understanding how to maximise the efficiency of appliances needs to be promoted in the interests of cost and energy saving. For, example householders often believed that an empty fridge or freezer was more efficient than one that was well-stocked.

Thus, our examples illustrate the way that ageing householders must weigh up the cost of energy against potential health impacts associated with using less energy. Using less energy impacts on the way that people heat or cool their homes, how they store and prepare food, their washing and bathing practices, as well as their capacity for social interaction via technologies. Physical and mental well-being are inter-dependant but also contingent in how different practices are associated with different affordances. So, while some may find pleasure in living without heating or cooling, or others may be content to wash or clean more or less often, and some may require arrangements that involve lighting or using technology it is clear that energy plays an important role individual health and well-being.

Findings for Stage 3: Follow-up quantitative cohort survey

As discussed earlier, there is a rationale for investigating whether the relationships between energy use, and health and well-being are bi-directional. Therefore, analysis of the cohort survey data combined from the baseline and follow-up survey was performed using cross-lagged panel models. Cross-lagged panels models provide a good approach to simultaneously examining the bidirectional relationships between variables over time. This is because they test stability paths (e.g. variance in the same variables across different time points), concurrent paths (e.g. variance between different variables across the same time point), and cross-lagged paths (e.g. variance between different variables across different time points).

Following a cross lagged panel method, for the purpose of this project data is collected about participants' health and well-being and energy use at one point in time (baseline quantitative cohort survey) and then recollected some time later again (follow-up quantitative cohort survey) to be analysed together. Cross lagged panel analysis with structural equation modelling (SEM) was used to investigate the causal direction of the relationships between energy use and health and well-being variables over time. Specifically, the approach to cross lagged panel analysis outlined by Newsom (2015) was employed, where both exogenous and endogenous covariance estimates are calculated to control for synchronous casual effects at either time point or any extraneous variables responsible for the association between the variables. The data was modelled using SPSS Amos 25.0 statistical software. Given that AMOS requires that there be no missing data, means and intercepts were estimated using maximum likelihood rather than unreasonably reduce the sample size by excluding cases with missing data.

The total number of participants who completed both the baseline and follow-up survey was 851. The follow-up survey data was downloaded from Qualtrics and transferred into the SPSS 25.0 statistical software package where it was matched, using an anonymised participant identification number, with the same participant's data from the baseline survey. This created a dataset that included the baseline and follow-up survey data from all 851 participants. Following a process of data cleaning, descriptive analysis including of the participant sample characteristics of the follow-up survey was carried out.

Table 6 shows a breakdown of the sample characteristics. The participants' ages ranged from 60 to 89 years old, with a mean of 71 years old. There were slightly more males (n= 411; 52%) than females (n = 379; 48%). In terms of geographic location participants resided as follows: ACT (n = 10; 1.3%), NSW (n = 225; 28.6%), Victoria (n = 215; 27.4%), Queensland (n = 189; 24%), South Australia (n = 76; 9.7%), Western Australia (n = 58; 9.7%), and Tasmania (n = 13; 1.7%). Most participants were retired (544; 69%), lived with other person (471; 59.8%) in a house (585; 74.2%), and were married/partnered (458; 58.1%). Education levels varied across the following categories: < high school (n =41; 5.2%), high school (n = 277; 35.2%), TAFE/College (n = 247; 31.3%), and degree (n = 223; 28.3%).

Table 6: Follow-up Cohort Survey Sample Characteristics

Age	Categories	Ranged from 60 to89 years old, Mean = 71 years old
Gender	Female	379
	Male	411
Location	ACT	10 (1.3%)
	NSW	225 (28.6%)
	VIC	215 (27.4%)
	QLD	189 (24%)
	SA	76 (9.7%)
	WA	58 (7.4%)
	TAS	13 (1.7%)
Income (p.a.)	$0 – $17,317	120 (15.2%)
	$17,318 - $20,749	112 (14.2%)
	$20,750 - $26,104	137 (17.4%)
	$26,105 - $33,176	109 (13.8%)
	$33,177 - $41,340	95 (12.1%)
	$41,341 - $49,816	58 (7.4%)
	$49,817 or above	157 (19.9%)
Education	< High School	41 (5.2%)
	High School	277 (35.2%)
	TAFE/FE College	247 (31.3%)
	Degree	223 (28.3%)
Ancestry	Australia	503 (59.1%)
	UK	212 (24.9%)
	Other	136 (16%)

Causal Relationships between frequency of use of energy appliances and health & well-being

Cross lagged panel analysis addresses the question of causal directionality (Newsom, 2015), that is, whether energy use influences health and well-being (or lack thereof), or whether health and well-being (or lack thereof) influences energy use. If the cross-lagged effect is significant in one direction but not the other, this indicates that the causal effect works in one direction but not the other. If the cross-lagged effect is significant in both directions, this indicates that the causal effect is bi-directional. In our analysis, relationships between variables were deemed as significant using *p* values. Statistical significance was deemed by any effects at the $p < 0.05$ level, that is any p value lower than 0.05 indicates a statistically significant effect given the length of time lag and the sample size for the study.

As indicated in Table 7, several statistically significant casual relationships between health and well-being variables, and energy use in the form of the frequency of use of energy appliances were identified. The results show a mixture of causal effects in one direction and bi-directional causal effects. In some instances, health and well-being variables were causally associated with energy use variables. In other instances, energy use variables were causally associated with health and well-being variables. Importantly, a number of bi-directional relationships were also identified. These findings provide further evidence of the complex and two-way relationship between energy use and health and well-being as suggested by Stage 1 and Stage 2 of this research.

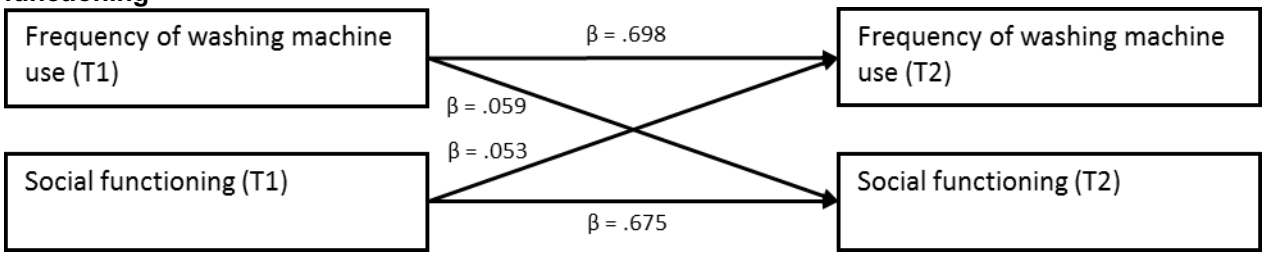
Table 7: Cross lagged panel analysis associations between frequency of use of energy appliances and health & well-being variables

Energy use variable	Health and well-being variable	Cross lagged effect	Direction of cross lagged effect	B	β	*p* value
Frequency of washing machine use	General health	Uni-directional	General health → Frequency of washing machine use	0.002	0.053	0.041
	Social functioning	Bi-directional	Frequency of washing machine use → Social functioning	2.187	0.059	0.032
			Social functioning → Frequency of washing machine use	0.002	0.053	0.041
	Positive feelings	Uni-directional	Positive feelings → Frequency of washing machine use	0.011	0.073	0.005
Frequency of clothes dryer use	Role limitations due to emotional problems	Uni-directional	Role limitations due to emotional problems → Frequency of clothes dryer use	0.002	0.065	<0.001
Frequency of dishwasher use	Role limitations due to emotional problems	Bi-directional	Frequency of dishwasher use → Role limitations due to emotional problems	1.483	0.074	0.018
			Role limitations due to emotional problems → Frequency of dishwasher use	0.002	0.030	0.026
	Social functioning	Uni-directional	Frequency of dishwasher use → Social functioning	1.189	0.080	0.003
	Positive feelings	Uni-directional	Frequency of dishwasher use → Positive feelings	0.210	0.074	0.001
Frequency of computer use	Emotional well-being	Uni-directional	Emotional well-being → Frequency of computer use	0.008	0.065	0.001
	Negative feelings	Uni-directional	Negative feelings → Frequency of computer use	-0.025	-0.048	0.015
Frequency of television use	General health	Uni-directional	Frequency of television use → General health	-1.809	-0.060	0.043
	Emotional well-being	Bi-directional	Frequency of television use → Emotional well-being	-1.875	-0.083	<0.001
			Emotional well-being → Frequency of television use	0.002	0.054	0.045
	Social functioning	Uni-directional	Frequency of television use → Social functioning	-2.058	-0.066	0.012
	Negative feelings	Uni-directional	Frequency of television use → Negative feelings	0.300	0.053	0.030
Frequency of separate freezer use	Physical functioning	Uni-directional	Physical functioning → Frequency of separate freezer use	-0.007	-0.060	0.005
Frequency of air con use in the summer	General health	Uni-directional	General health → Frequency of air con use in the summer	-0.004	-0.048	0.040

Energy use variable	Health and well-being variable	Cross lagged effect	Direction of cross lagged effect	B	β	*p* value
	Role limitations due to physical problems	Uni-directional	Frequency of air con use in the summer → Role limitations due to physical problems	-1.573	-0.064	0.025
	Energy	Uni-directional	Frequency of air con use in the summer → Energy	-0.827	-0.059	0.012
	Pain	Uni-directional	Frequency of air con use in the summer → Pain	-0.786	-0.049	0.037
Frequency of fan use in the summer	Physical functioning	Uni-directional	Physical functioning → Frequency of fan use in the summer	-0.004	-0.066	0.018
	Role limitations due to physical problems	Uni-directional	Frequency of fan use in the summer → Role limitations due to physical problems	-1.492	-0.063	0.029
	Role limitations due to emotional problems	Uni-directional	Frequency of fan use in the summer → Role limitations due to emotional problems	-1.632	-0.082	0.009
Frequency of reverse air con use in winter	Physical functioning	Bi-directional	Frequency of reverse air con use in winter → Physical functioning	-0.689	-0.044	0.022
			Physical functioning → Frequency of reverse air con use in winter	-0.003	-0.051	0.021
	Pain	Uni-directional	Frequency of reverse air con use in winter → Pain	-0.939	-0.064	0.007

The analysis showed that there were associations between the frequency with which participants used their washing machine and their general health, social functioning and experience of positive feelings. Specifically, higher levels of general health and greater experience of positive feelings was associated with greater frequency of use of the washing machine. This can be explained as being in good general health and good mental health can enable people to manage the labour of using the washing machine and doing the laundry. Interestingly, there was a bi-directional relationship between frequency of washing machine use and social functioning (see Figure 13). Increased frequency of washing machine use was associated with increased social functioning, that is, engaging in normal social activities with family, friends, neighbours and groups. In turn, increased social functioning was associated with increased use of the washing machine. This could be explained as doing the laundry and having clean fresh clothing to wear is something that people often do if they have busy social lives, get out and about, and wish to look presentable (Pink, 2005). The frequency of washing machine use was not significantly associated with other health and well-being variables tested including physical functioning, role limitations, energy, emotional well-being, pain, stress and negative feelings.

Figure 13: Bi-directional relationship between frequency of washing machine use & social functioning



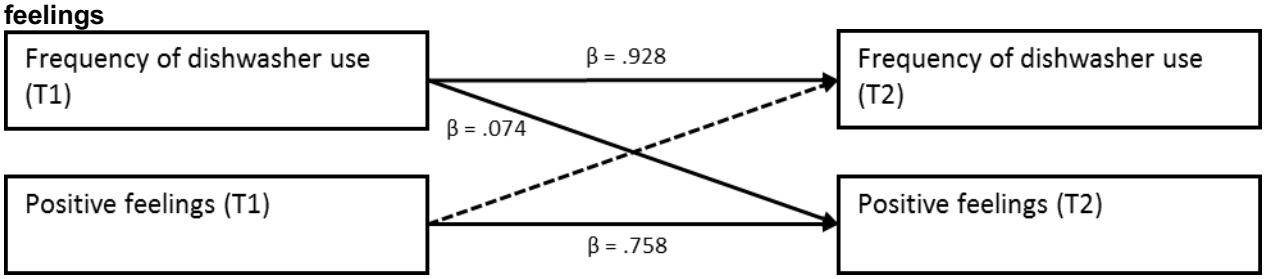
*Note: T1- Time 1; T2 – Time 2; solid arrow indicates significant relationship $p<.05$; dashed arrow indicates non-significant relationship.

Greater levels of role limitations owing to emotional problems was associated with greater frequency of clothes dryer use. That is, greater problems with work or other regular daily

activities as a result of any emotional problems (such as feeling depressed or anxious) was associated with greater frequency of use of the clothes dryer. This could be explained as when people experience emotional problems they may not feel like they can deal with the labour and hassle of hanging up laundry to dry, and instead use the clothes dryer to remove some of the physical and emotional burden on them (Gordon et al., 2019). The frequency of clothes dryer use was not significantly associated with other health and well-being variables tested including general health, physical functioning, role limitations due to physical problems, energy, emotional well-being, social functioning, pain, stress, and positive and negative feelings.

There were multiple associations between the frequency with which participants used their dishwasher and health and well-being variables. Greater frequency of dishwasher use was associated with higher levels of social functioning and experience of positive feelings (see Figure 14). Perhaps using the dishwasher offers people time to focus on other things like socialising and brings them positive feelings. There was also a bi-directional relationship between the frequency of dishwasher use and role limitations owing to emotional problems. Greater frequency of dishwasher use was associated with greater role limitations owing to emotional problems and vice versa. Similar to the case with use of the clothes dryer, people may use the dishwasher more frequently due to emotional stress and to offer some relief from this. The frequency of dishwasher use was not significantly associated with other health and well-being variables tested including general health, physical functioning, role limitations due to physical problems, energy, emotional well-being, pain, stress, and negative feelings.

Figure 14: Uni-directional relationship between frequency of dishwasher use & positive feelings



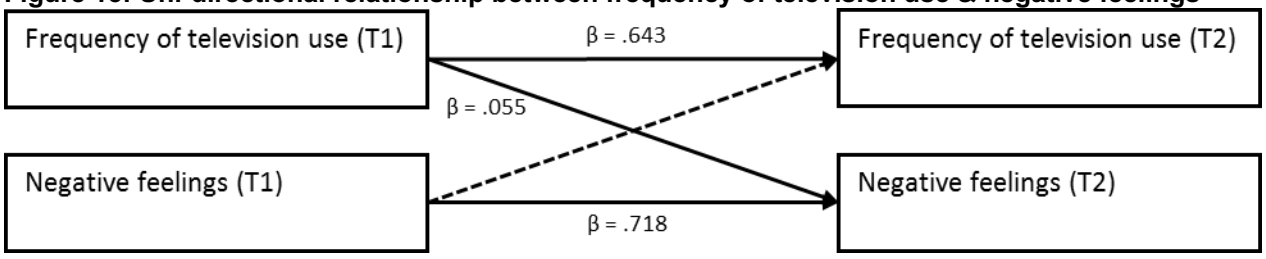
*Note: T1- Time 1; T2 – Time 2; solid arrow indicates significant relationship $p<.05$; dashed arrow indicates non-significant relationship.

Frequency of computer use was associated with two psychological aspects of health and well-being, specifically emotional well-being and the experience of negative feelings. Specifically, higher levels of emotional well-being but lower levels of negative feelings were associated with greater frequency of computer use. These findings support the insight from our ethnography which identified how participants used a computer to communicate, connect with friends and family, facilitate their community roles, play games, or even learn new skills such as cooking new recipes. The frequency of computer use was not significantly associated with other health and well-being variables tested including general health, physical functioning, role limitations, energy, social functioning, pain, stress or positive feelings. Frequency of laptop use was not significantly associated with any health and well-being variables tested.

The frequency with which participants used the television was associated with lower levels of both general health and social functioning and higher levels of negative feelings (see Figure 15). There was also a bi-directional relationship between the frequency of television use and emotional well-being. Greater frequency of television use was associated with lower levels of emotional well-being, but higher levels of emotional well-being was associated with greater frequency of television use. This may be because those older Australians relying mainly on the television for company and entertainment may have lower levels of emotional well-being,

whereas those with higher emotional well-being watch television as part of a socially active and engaged lifestyle. The frequency of television use was not significantly associated with other health and well-being variables tested including physical functioning, role limitations, energy, pain, stress and positive feelings.

Figure 15: Uni-directional relationship between frequency of television use & negative feelings



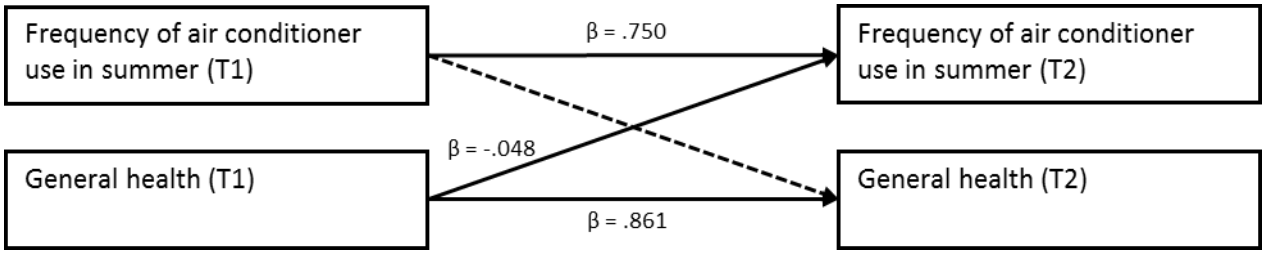
*Note: T1- Time 1; T2 – Time 2; solid arrow indicates significant relationship $p<.05$; dashed arrow indicates non-significant relationship.

The frequency of separate freezer use was associated physical functioning, or the ability to conduct activities such as lifting or carrying groceries or climbing stairs on a typical day. Specifically, higher levels of physical functioning were associated with less frequent use of a separate freezer. This could be because people with higher levels of physical functioning feel more able to cook fresh food regularly rather than storing frozen food. The frequency of separate freezer use was not significantly associated with other health and well-being variables tested including general health, role limitations, energy, emotional well-being, social functioning, pain, stress, and positive and negative feelings.

The analysis showed that there were associations between the frequency with which participants used their air conditioning during summer and their general health, role limitations due to physical problems, energy and pain levels. Specifically, higher levels of general health were associated with less frequent use of air conditioning during the summer (see Figure 16). Further, greater frequency of use of air conditioning during the summer was

associated with less role limitations due to physical problems and lower levels of pain, but also less energy. The frequency of air conditioning use during the summer was not significantly associated with other health and well-being variables tested including physical functioning, role limitations due to emotional problems, emotional well-being, social functioning, stress, and positive and negative feelings.

Figure 16: Uni-directional relationship between general health & frequency of air conditioning use in summer



Note. T1- Time 1; T2 – Time 2; solid arrow indicates significant relationship $p<.05$; dashed arrow indicates non-significant relationship.

Greater frequency of fan use during the summer was associated with less role limitations owing to physical and emotional problems. In contrast, higher levels of physical functioning were associated with less frequent fan use during the summer. The frequency of fan use during the summer was not significantly associated with other health and well-being variables tested including general health, energy, emotional well-being, social functioning, pain, stress, and positive and negative feelings.

The frequency of use of the reverse cycle air conditioner in winter was shown to have a bi-directional relationship with physical functioning. Interestingly, greater frequency of use of reverse cycle air conditioning in winter was associated with lower levels of physical functioning, but higher levels of physical functioning was associated with less frequent use the reverse cycle air conditioner in winter. This may be because as people become less physically able, or sick there is a greater requirement to have the heating on more often (see

Waitt et al., 2016). The frequency of reverse cycle air conditioner use in winter was not significantly associated with other health and well-being variables tested including general health, role limitations, energy, emotional well-being, social functioning, stress, and positive and negative feelings. The frequency of use of a heater in winter was not significantly associated with any health and well-being variables tested.

Causal relationships between energy conservation behaviours and health & well-being

Similar to the section examining causal relationships between the frequency of energy appliance use and health and well-being, several statistically significant relationships between health and well-being variables, and energy use in the form of the energy conservation behaviours were identified (see Table 8). In some instances, health and well-being variables causally preceded energy use variables. In other instances, energy use variables causally preceded health and well-being variables. These findings provide additional evidence of the complex and two-way relationship between energy use and health and well-being.

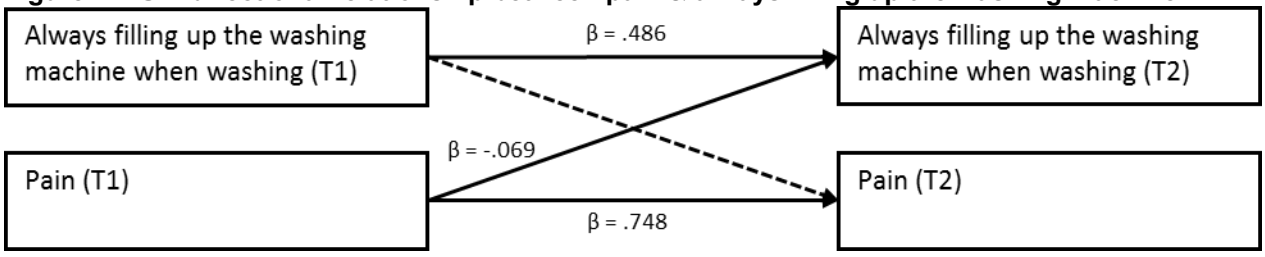
Table 8: Cross lagged panel analysis associations between energy conservation behaviours and health & well-being variables

Energy use variable	Health and well-being variable	Cross lagged effect	Direction of cross lagged effect	B	β	*p* value
I always fill up my washing machine when washing.	Pain	Uni-directional	Pain → Filling up washing machine	-0.003	-0.069	0.029
For drying, I don't usually tumble dry my clothes.	Pain	Uni-directional	Don't usually tumble dry my clothes → Pain	1.335	0.064	0.029
I always turn off the lights in those rooms I'm not in.	Physical functioning	Uni-directional	Always turn off the lights → Physical functioning	1.542	0.045	0.020
	Pain	Uni-directional	Pain → Always turn off the lights	-0.002	-0.069	0.030
I never leave electrical appliances at home in standby mode.	Role limitations due to emotional problems	Uni-directional	Role limitations due to emotional problems → Never leave electrical appliances on standby	-0.002	-0.063	0.025
	Energy	Uni-directional	Never leave electrical appliances on standby → Energy	0.994	0.052	0.027
	Emotional well-being	Uni-directional	Never leave electrical appliances on standby → Emotional well-being	0.755	0.050	0.041
	Stress	Uni-directional	Stress → Never leave electrical appliances on standby	0.029	0.075	0.008
I always unplug the mobile charger when it's not in use	Physical functioning	Uni-directional	Physical functioning → Always unplug mobile charger when not in use	-0.003	-0.057	0.047
	Role limitations due to emotional problems	Bi-directional	Role limitations due to emotional problems → Always unplug mobile charger when not in use	1.776	0.065	0.040
			Always unplug mobile charger when not in use → Role limitations due to emotional problems	-0.004	-0.097	<.001
	Emotional well-being	Uni-directional	Always unplug mobile charger when not in use → Emotional well-being	0.728	0.050	0.042
I try to buy energy efficient household appliances	Physical functioning	Uni-directional	Buy energy efficient household appliances → Physical functioning	1.418	0.038	0.046

Energy use variable	Health and well-being variable	Cross lagged effect	Direction of cross lagged effect	B	β	*p* value
I reduce the temperature in my hot water system	General health	Uni-directional	General health → I reduce the temperature in my hot water system	0.006	0.102	0.001
	Energy	Uni-directional	Energy → I reduce the temperature in my hot water system	0.004	0.068	0.034
	Stress	Uni-directional	Stress → I reduce the temperature in my hot water system	-0.027	-0.065	0.041
	Positive feelings	Uni-directional	Positive feelings→ I reduce the temperature in my hot water system	0.020	0.075	0.014

The analysis showed that there were associations between participants' pain and whether they always filled up their washing machine when washing. Specifically, higher levels of pain were associated with lower levels of always filling up the washing machine when washing (see Figure 17). Giving the physical labour required to fill the washing machine full of clothing and then dry it once washed, which would be challenging for someone with high pain levels, this finding is not surprising. The extent to which participants always filled up their washing machine when washing was not significantly associated with other health and well-being variables tested including general health, physical functioning, role limitations, energy, emotional well-being, social functioning, stress, and positive and negative feelings. Similarly, there was also an association between participants pain and whether they usually tumble dried their clothes. Specifically, higher levels of pain were associated with higher levels of tumble drying of clothes. This could be explained, as using the clothes dryer would require less physical labour for someone in pain than hanging up the laundry to dry. The extent to which participants did not usually tumble dry their clothes was not significantly associated with other health and well-being variables tested including general health, physical functioning, role limitations, energy, emotional well-being, social functioning, stress, and positive and negative feelings.

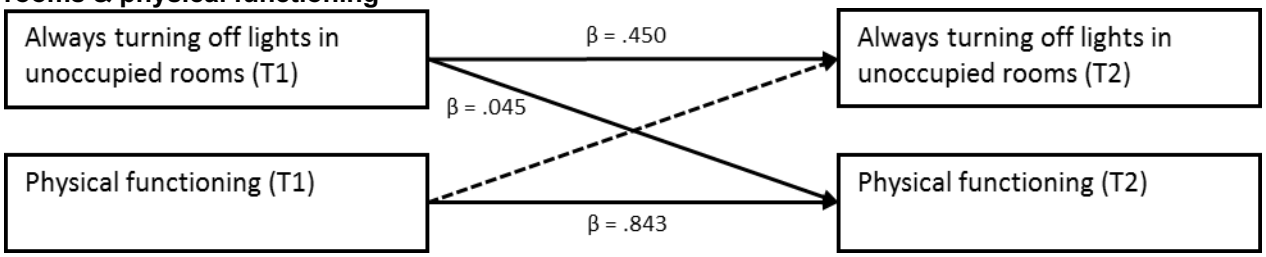
Figure 17: Uni-directional relationship between pain & always filling up the washing machine



Note. T1- Time 1; T2 – Time 2; solid arrow indicates significant relationship $p<.05$; dashed arrow indicates non-significant relationship.

The extent to which participants always turned off the lights in rooms they were not occupying was associated with physical functioning and pain. Specifically, higher levels of pain were associated with lower levels of turning off the lights in rooms that were not occupied. Interestingly, higher levels of turning off the lights in rooms that were not occupied was associated with higher levels of physical functioning (see Figure 18). This could be explained as those experiencing pain may feel less capable of doing the labour of going around the house and switching off the lights, whereas those with high levels of physical functioning feel able to do so. The extent to which participants always turned off lights in rooms that they were not occupying was not significantly associated with other health and well-being variables tested including general health, role limitations, energy, emotional well-being, social functioning, stress, and positive and negative feelings.

Figure 18: Uni-directional relationship between always turning off the lights in unoccupied rooms & physical functioning



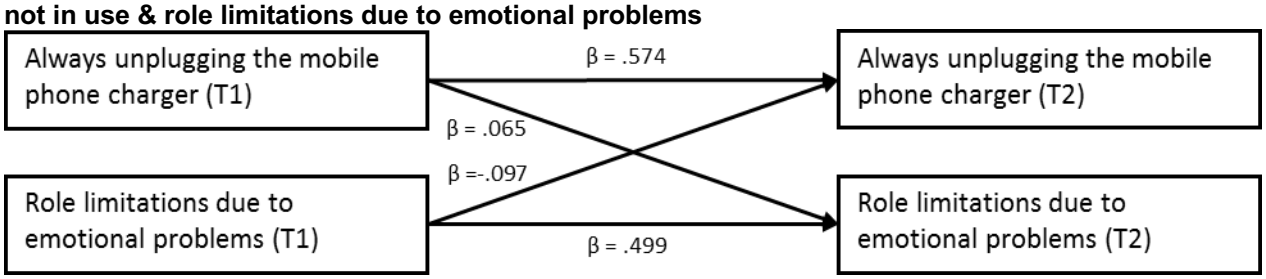
Note. T1- Time 1; T2 – Time 2; solid arrow indicates significant relationship $p<.05$; dashed arrow indicates non-significant relationship.

There were a number of significant associations between whether participants left electrical appliances at home in standby mode. Higher levels of role limitations owing to emotional problems, as well as higher levels of stress, was associated with lower levels of never leaving electrical appliances at home in standby mode. In contrast, higher levels of never leaving electrical appliances at home in standby mode was associated with higher levels of energy and emotional well-being. This suggests that if people are stressed out and experiencing poor emotional states they are less able to turn off appliances at the wall socket, whereas those

with high levels of physical energy and good emotional well-being are able to do so. The extent to which participants never left electrical appliances at home in standby mode was not significantly associated with other health and well-being variables tested including general health, physical functioning, role limitations due to physical problems, social functioning, pain, and positive and negative feelings.

Always unplugging the mobile charger when it's not in use was significantly associated with physical functioning and emotional well-being. Specifically, always unplugging the mobile charger when it's not in use had a positive association with emotional well-being. Further, higher levels of physical functioning were associated with lower levels of unplugging the mobile charger when it's not in use. This could be because people with high physical functioning are too busy doing other things to bother with unplugging their mobile phone charger, but this would require further research. A bi-directional relationship between always unplugging the mobile charger when it's not in use and role limitations due to emotional problems was also identified (see Figure 19). Always unplugging the mobile charger when it's not in use was associated with less role limitations due to emotional problems. In turn, greater role limitations owing to emotional problems was associated with always unplugging the mobile charger when it's not in use. The extent to which participants always unplugged the mobile charger when not in use was not significantly associated with other health and well-being variables tested including general health, role limitations due to physical problems, energy, emotional well-being, social functioning, pain, stress, and positive and negative feelings.

Figure 19: Bi-directional relationship between always unplugging the mobile charger when it's not in use & role limitations due to emotional problems

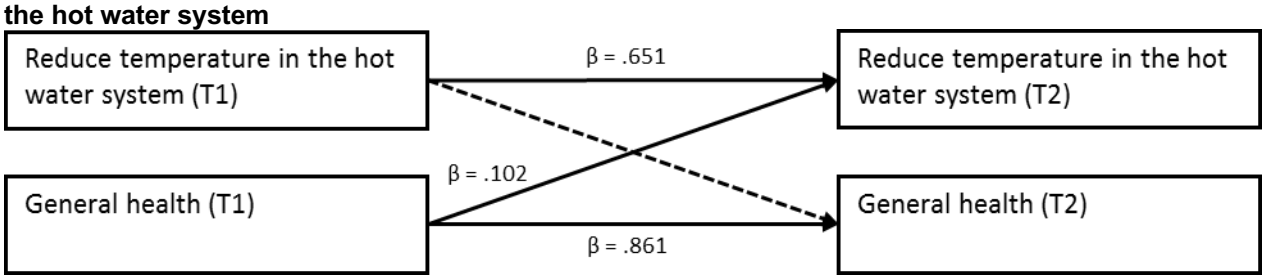


Note. T1- Time 1; T2 – Time 2; solid arrow indicates significant relationship $p<.05$; dashed arrow indicates non-significant relationship.

Higher levels of trying to buy energy efficient household appliances was associated with higher levels of physical functioning, perhaps because going out to the shops to buy appliances requires a certain level of physical capability for older people. The extent to which participants tried to buy energy efficient household appliances was not significantly associated with other health and well-being variables tested including general health, role limitations, energy, emotional well-being, social functioning, pain, stress, and positive and negative feelings.

Lastly, there were a number of significant associations between whether participants reduced the temperature in their hot water system and health and well-being variables. Specifically, higher levels of general health (see Figure 20), energy and positive feelings were associated with increased likelihood that participants reduced the temperature in their hot water system. In contrast, higher levels of stress were associated with a lower likelihood that participants reduced the temperature in their hot water system. These associations make sense as it requires physical and emotional effort to think of and then perform the action of reducing the temperature of a hot-water system. The extent to which participants reduced the temperature in their hot water system was not significantly associated with other health and well-being variables tested including physical functioning, role limitations, emotional well-being, social functioning, pain, and negative feelings.

Figure 20: Uni-directional relationship between general health & reducing the temperature in the hot water system



Note. T1- Time 1; T2 – Time 2; solid arrow indicates significant relationship $p<.05$; dashed arrow indicates non-significant relationship.

Keeping the heating / air conditioning low to save energy and turning the heating / air conditioning off in unused rooms was not associated with any health and well-being variables tested.

There are some limitations with our cross-lagged panel analysis that should be acknowledged. Firstly, it should be noted that because observed variables of energy use and health and well-being were used in the cross lagged panel analysis, measurement bias was not accounted for in the SEM. There is no reasonable method of accounting for such bias using observed variables (Newsom, 2015). Further, self-reported measures of energy use and health and well-being were employed. Given the ground-breaking nature of this study, it is important that further studies of the relationship between energy use and health and well-being are conducted, particularly studies that use latent variables with multiple indicators and triangulate self-report data with other sources.

DISCUSSION

The findings from our research demonstrate that there needs to be greater recognition of the challenges of managing energy use, health and well-being for Australians with ageing at home. The aim of this project was to understand the associations between energy use, health

and well-being, and to explore and understand how older householders utilise energy to maintain health and well-being.

In terms of our aim to better understand the associations between energy use, health and well-being our survey research found statistically significant uni-directional, and bi-directional causal associations between energy and health and well-being variables. In some instances, we found that health and well-being variables were causally association with energy use variables. In other instances, we identified that energy use variables were causally association with health and well-being variables. Importantly, a number of bi-directional relationships were also identified meaning that some energy and health and well-being variables are casually associated with each other in both directions of influence. These findings provide evidence that energy use and health and well-being are inexorably linked. This also demonstrates the complex and two-way relationship between energy use and health and well-being.

In terms of our aim to explore and understand how older householders utilise energy to maintain health and well-being our ethnographic research identified a complex range of practices carried out by our participants to negotiate their energy use, health and well-being that rely on a range of elements including knowledge, bodily and mental functioning, finances, materials, space and places, social support, and agency. We found that people used a range of domestic appliances to facilitate or manage their health and well-being, but yet this was often weighed up against the cost of energy. Our participants associated rising energy usage and costs with ill health rather than with ageing per se.

Among our participants, we found that older people with resources can actively plan how to maintain health and well-being and to minimise the energy costs associated with ageing. However, as we illustrated in this report, doing so relies on a range of creative, imaginative, resourceful and resilient practices. The capacity to continue to perform such practices as Australians age cannot be taken for granted, and indeed many participants spoke of how they were managing to get by just now but acknowledged that as they became older and their health and well-being may start to falter, that they may struggle. What is of even greater concern is that we found that some of our participants had few resources to draw upon in managing their energy use and health and well-being. This led to people being forced to reduce energy use often with negative consequences for physical, mental and social well-being.

Our participants also drew attention to how energy use and everyday practices of health and well-being are inexorably linked through energy using health management devices. We found a range of medical devices were in common use to maintain physical health, though several of our participants in this study were not aware of available rebates to offset their costs. The use and costs of these devices was seen as unavoidable to retain quality of life and thus increased energy costs were incorporated into household budgets. In the light of this finding we suggest that greater attention be given to making householders aware of any potential rebates and the requirements for accessing them. Online information and application forms are not appropriate for some low-income elderly households who do not always have access to digital phones or technologies and so alternative strategies to disseminate this information should be considered.

We also found that energy use was very important for helping people to support their health and well-being in a positive manner with a range of energy consumption practices enabling them to be socially active, supporting their leisure interests, engaging their physical and mental dexterity, and providing them with fun and enjoyment in life. Therefore, this positive story about how energy use supports good health and well-being is one that should be acknowledged, recognised and espoused.

Importantly, robust criticisms were raised by our ethnography participants about the Australian energy market, and the privatisation of energy utilities. Our older Australian participants could remember when energy was a public utility and appeared angry at the privatisation of public sector energy infrastructure, the marketisation of energy, rising energy prices, and the profits of energy retailers. Several participants argued that energy is a basic human need that enables people to function and live their lives, and therefore it should not be a privatised market commodity.

IMPLICATIONS AND RECOMMENDATIONS

Based on our findings, there are a number of implications for energy policy and advocacy, and recommendations that could be implemented to promote and support older Australians navigate their energy use, health and well-being as they age.

- Energy, health, and well-being are inexorably linked – therefore policy making, and public policy and programmes should take a holistic perspective that acknowledges these associations including how energy is vital for maintaining, managing and dealing with health and well-being, but also how it can support good health and well-being in a positive manner.

- Energy stakeholders should recognise that energy not only helps older Australians manage their health but can enable their well-being through performance of various social and leisure activities.
- Strong criticisms of the Australian Energy Market emerged from the project participants who were against privatisation of energy utilities and called for renationalisation. Stakeholders need to consider whether the commercial market for energy in Australia is working in the interest of older energy consumers.
- Rising energy bills create major barriers for older Australians to manage their energy use, health and well-being and more robust price regulation and controls may be required.
- Energy should be considered as a basic human right, rather than simply as a free market commodity.
- Further work is required to better map the co-benefits that emerge between domestic energy use, health and well-being.
- Cross-sector working and the development of a more strategic, holistic and systems thinking informed policy and programmes is required that would involve government energy, and health departments – and ideally alongside housing and other relevant departments, and energy stakeholders.
- Robust and well-informed policy and programme responses are required to help support older Australians in the management of their health, well-being and energy use which can become more complex as they age.
- Targeted support for lower-income older Australians is required as they often have to restrict their energy use, and this can lead to negative consequences for their physical, mental and social well-being.

- In the interests of social justice, governments should consider how to subsidise energy generation systems to low-income people older Australians in order to promote healthy aging in place.
- Given the associations between energy use, health and well-being, and capabilities among our project participants; energy stakeholders should seek to build and support the capabilities of older Australians to enable better energy, health and social outcomes.
- The development of social marketing strategies that encourage older Australians to utilise heating and cooling appliances efficiently and economically in order to maintain quality of life and better physical, mental and social health outcomes is recommended.
- One example is to offer free domestic appliance replacement schemes for low-income older Australians who are ageing in home.
- Another intervention would be to promote energy rebates for essential medical devices through point of contact e.g. medical practitioners and hospitals to raise awareness of their availability.
- A further recommendation would be to provide a broader programme of energy rebates/subsidies for reverse cycle air conditioning. Current rebates are only for householders who are diagnosed with an inability to self-regulate body temperature.
- Subsidies could be provided for equipment such as electric beds, electric armchairs, stair lifts, life pendants and other equipment that promotes mobility and independence to reduce the cost burden to those ageing at home – especially among lower income older Australians.
- Stakeholders should ensure that energy market legislation takes into account that connection and supply charges are often equal to, or more than, usage charges for low

income households. Energy retailers could consider the development of a reducing scale of supply or connection charges according to usage levels that fall below recommended benchmark standards.

- The implementation of programmes that assist elderly households to improve energy efficiency in the home would help them manage their health and well-being as they age.
- Stakeholders should acknowledge that some lower-income households cannot access information easily via technology because they may not have the equipment or the capacity – information and education is not enough.
- Rather, strategic and multi-faceted social marketing behaviour change programmes that seek to shift outcomes across multiple levels of influence are needed.

CONCLUSIONS

While strategies which aim to reduce energy demand are one policy avenue for addressing climate change, elderly households are not necessarily a suitable target market for this strategy. Thus, alternative strategies that can promote reasonable levels of household comfort efficiently should be developed. Maintaining independence and ageing well at home are important goals for people and they align with government policies to reduce the public health cost burden. However, there needs to be more consideration of how the cost burden is shifted onto individual households, and that this does not play out evenly across income groups. Greater support for and recognition of the challenges of managing health and well-being in the light of increasing energy costs will help ease the financial burden of ageing at home, improve health outcomes and ensure more equitable costing systems are implemented in the retail energy market. We recommend that energy be reconceptualised as a basic human

right associated with dignity, rather than as a demand driven commodity in a free-market economy.

REFERENCES

ABS. (2014). Australian Historical Population Statistics, 2014. Cat. no. 3105.0.65.001 Canberra: ABS.

ABS. (2015). Australian Demographic Statistics, Dec 2014. Cat. no. 3101.0. Canberra: ABS.

AIHW. (2017). Ageing. Canberra: Australian Institute of Health and Welfare. Available at: http://www.aihw.gov.au/ageing/.

Akhmat, G., Zaman, K., Shukui, T., and Sajiid, F. 2014. Does energy consumption contribute to climate change? Evidence from major regions of the world. *Renewable and Sustainable Energy Reviews*, 36, 123-134.

Armstrong, F., Tait, P. (2014). Health and energy choices: Background Briefing Paper. Clifton Hill Victoria: Climate and health alliance.

Aro, R. 2017. 'A bigger living room required a bigger TV': Doing and negotiating necessity in well-to-do households. *Journal of Consumer Culture*, online first: https://doi.org/10.1177/1469540517745706.

Australian Government Department of the Environment and Energy, 2018. Solar PV and batteries. Canberra: Australian Government Department of the Environment and Energy. Available at: https://www.energy.gov.au/households/solar-pv-and-batteries

Australian Human Rights Commission, 2019. Face the Facts; Older Australians Available at: https://www.humanrights.gov.au/our-work/education/face-facts-older-australians

Bates, C. (ed.) 2015. *Video Methods: Social Science Research in Motion*. New York: Routledge.

Belk, R.W., Kozinets, R.V. 2005. Videography in marketing and consumer research. *Qualitative Market Research: An International Journal*, 8(2): 128-141.

Boomsma., C., Pahl, S., Jones, R.V., Fuertes, A. 2017. "*Damp in bathroom. Damp in back room. It's very depressing*!" exploring the relationship between perceived housing problems, energy affordability concerns, and health and well-being in UK social housing. *Energy Policy*, 106: 382-393.

Brown S., and Walker G., 2008. Understanding heat wave vulnerability in nursing and residential homes, Building Research & Information, (36): 363-372.

Brounen, D., Kok, N., and Quigley, J.M. 2011, Residential Energy Use and Conservation: Economics and Demographics, *European Economic Review,* 56 (5):931-945

Butler, K., Gordon, R., Rogeeveen, K., Waitt, G., Cooper, P. 2016a. Social marketing and value-in-behaviour: Perceived value of using energy efficiently among low income older residents. *Journal of Social Marketing,* 6(3): 144-168.

Chester, L. 2010. Conceptualising energy security and making explicit its polysemic nature. *Energy Policy*, 38(2), 887-895.

Chester, L. 2013. The impacts and consequences for low-income Australian households of rising energy prices", University of Sydney.

Chester, L. 2014. Energy impoverishment: Addressing capitalism's new driver of inequality. *JEI: Journal of Economic Issues*, 48(2), 395-403.

Cohen, S., Kamarck, T., & Mermelstein, R. 1983. A global measure of perceived stress. Journal of Health and Social Behavior, 24, 385-396.

Cooper P., Gordon, R., Waitt, G., Petkovic, D., Burroughs, N., Tibbs, M., Butler, K., Roggeveen K, McDowell C, Kokogiannakis G, Ledo Gomis L, and Magee C. 2016. *EE3A: Pathways and initiatives for low-income older people to manage energy: Final Report.* Canberra: Department of Industry, Innovation and Science. Available at

http://www.environment.gov.au/system/files/energymog/files/rdai.pdf [Accessed 17/11/2017].

Council of Australian Governments. 2015. *National energy productivity plan 2015-2030*. Canberra, Commonwealth of Australia.

Dalip, J., Phillips, G.A., Jelinek, G.A., Weiland, T.J., 2015. Can the elderly handle the heat? A retrospective case-control study of the impact of heat waves on older patients attending an inner city Australian emergency department. Asia-Pac. J. Public Health 27, 1837–1846. http://dx.doi.org/10.1177/1010539512466428.

Davidson, P., Saunders, P., Bradbury, B. and Wong, M. (2018), Poverty in Australia, 2018. ACOSS/UNSW Poverty and Inequality Partnership Report No. 2, Sydney: ACOSS.

https://www.acoss.org.au/wp-content/uploads/2018/10/ACOSS_Poverty-in-Australia-Report_Web-Final.pdf

Day, R., Hitchings, R., 2011. "Only old ladies would do that": age stigma and older people's strategies for dealing with winter cold. Health Place 17, 885–894.

Department of Climate Change and Energy Efficiency. 2012. *Securing a Clean Energy Future: Implementing the Australian Government's Climate Change Plan.* Canberra: Department of Climate Change and Energy Efficiency. Available online at: http://www.budget.gov.au/2012-13/content/ministerial_statements/climate/download/climate_change.pdf [Accessed 7/11/2017].

Department of the Environment, Water, Heritage and the Arts (DEWHA). 2008. Energy use in the Australian residential sector 1986–2020. Canberra: DEWHA.

Department of Resources, Energy and Tourism., 2012. *Energy white paper*. Canberra: Commonwealth of Australia.

DeWaters, J. 2009. Energy Literacy Survey: A Broad Assessment of Energy-Related

Knowledge, Attitudes and Behaviors, Clarkson University, Potsdam, NY.

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The Satisfaction with Life Scale. Journal of Personality Assessment, 49, 71-75.

Diener, E., Wirtz, D., Tov, W., Kim-Prieto, C., Choi. D., Oishi, S., & Biswas-Diener, R. (2009). New measures of well-being: Flourishing and positive and negative feelings. *Social Indicators Research, 39,* 247-266.

Fink, A., Kosecoff, J. (1998). *How to conduct surveys: A step-by-step guide* (4th edition.). Thousand Oaks, CA: Sage Publications.

Gadenne, D., Sharma, B., Kerr, D., & Smith, T. (2011). The influence of consumers' environmental beliefs and attitudes on energy saving behaviours. Energy Policy, 39(12): 7684-7694.

Gasparrini, A. Guo, Y. Hashizume, M. Lavigne, E. Zanobetti, A. Schwartz, J. Tobias,A. Tong, S. Rocklöv, J. Forsberg, B. Michela Leone, Manuela De Sario, Michelle L Bell, Yue-Liang Leon Guo, Chang-fu Wu, Haidong Kan, Seung-Muk Yi, Micheline de Sousa Zanotti Stagliorio Coelho, Paulo Hilario Nascimento Saldiva, Yasushi Honda, Ho Kim, Ben Armstrong, 2015, Mortality risk attributable to high and low ambient temperature: a multicountry observational study. *Lancet* 386: 369–75.

Geddes, I., Bloomer, E., Allen, J., Holdblatt, P., 2011. The Health Impacts of Cold Homes and Fuel Poverty. Friends of the Earth and Marmott Review Team, University College London. Accessed 16/02/2019. https://friendsoftheearth.uk/sites/default/files/downloads/cold_homes_health.pdf

Gladhart, P.M., Roosa, M.W. 1982. Family lifestyle and energy consumption an energy adaption model. *Journal of Consumer Studies and Home Economics*, 6(3): 205–222.

Gordon, R., Oades, L. (2016). Social marketing and well-being. In Slade, M., Oades, L., Jarden, A. (Eds.). Well-being, recovery and mental health. Cambridge: Cambridge

University Press.

Gordon, R., Harada, T., Waitt, G. 2019. Familial-Energy Arrangements- Parenting, care, and making home in a context of energy capitalism. Working Paper. Sydney: Macquarie University.

Hansen, A.; Bi, P.; Nitschke, M.; Pisaniello, D.; Newbury, J.; Kitson, A., 2011 Perceptions of heat-susceptibility in older persons: barriers to adaptation. I*nternational Journal of Environmental Research and Public Health*, 8, 4714-4728.

Healy, J.D., Clinch, J.P. 2002. Fuel poverty, thermal comfort and occupancy: Results of a national household-survey in Ireland. Applied Energy, 73(3-4): 329-343.

Hitchings, R., Day, R., 2011. How older people relate to the private winter warmth practices of their peers and why we should be interested. Environ. Plan. A 43, 2452–2467.

Huber, M., Knotterus, J.A., Green, L., van der Horst, H. et al. (2011). How should we define health? BMJ, 343:d4163 doi: 10.1136/bmj.d4163.

Huizenga, C., Abbaszadeh, S., Zagreus, L., Arens, E. A. (2006). Air quality and thermal comfort in office buildings: Results of a large indoor environmental quality survey. Proceedings of Healthy Buildings, Lisbon, Portugal, III, 393 – 397.

Jayasinghe, L. 2015. Video Ethnography, Researcher Reflexivity, and Constructions of Advertising Response in the Australian Family Living Room. *Australasian Marketing Journal (AMJ), 23* (4): 267-276.

Judd, B., Olsberg, D., Quinn, J., Groenhart, L.A., Demirbilek, O., 2010. Dwelling, Land and Neighbourhood use by Older Home Owners. Australian Housing and Urban Research Institute. Accessed 21/4/2015 from: ⟨http://www.ahuri.edu.au/research/ final-reports/144⟩.

Karatasou, S., Laskari, M., Santamouris, M. 2014. Models of behavior change and residential energy use: A review of research directions and findings for behavior-based energy

efficiency. *Advances in Building Energy Research*, 8(2): 137-147.

Kinnear, T.C. and Taylor, J.R. (1996) Marketing Research: An Applied Approach. New York: McGraw-Hill.

Kitzinger, J. (1994) The methodology of focus groups: the importance of interaction between research participants. *Sociology of Health & Illness*, 16, 1, pp. 103–121.

Kleinschafer, J., Morrison, M. 2014. Household norms and their role in reducing electricity consumption. *International Journal of Consumer Studies*, 38(1): 75-81.

Klenk, J., Becker, C., Rapp, K., 2010. Heat-related mortality in residents of nursing homes. Age Ageing 39, 245–252. http://dx.doi.org/10.1093/ageing/afp248.

Lathan, C.E., Bogner, M.S., Hamilton, D. and Blanarovich, A. (1999) Human-centered design of home care technologies. NeuroRehabilitation, 12 (1):3-10.

Lorgelly, P.K., Lorimer, K., Fenwick, E., Briggs, A., Anand, P. 2015. Operationalising the capability approach as an outcome measure in public health: The development of the OCAP-18. *Social Science and Medicine*, 142: 68-81.

Laurier, E, Strebel, I., Brown, B. 2008. Video analysis: Lessons from professional video editing practice. *Forum Qualitative Social Research*, 9(3): http://www.qualitative-research.net/index.php/fqs/article/view/1168/2579

Liddle, B., 2011. Consumption-driven environmental impact and age structure change in OECD countries: a cointegration-STIRPAT analysis. Demogr. Res. 24, 749–770.

Lopes, M.A.R., Antunes, C.H., Martins, N. 2012. Energy behaviours as promoters of energy efficiency: A 21st century review. *Renewable and Sustainable Energy Reviews*, 16(6): 4095-4104.

Lorimer, J. 2010. Moving image methodologies for more-than-human geographies. *Cultural Geographies*, 17(2): 237-258.

Maller, C.J. & Strengers, Y. 2011. Housing, heat stress and health in a changing climate:

promoting the adaptive capacity of vulnerable households, a suggested way forward. Health Promotion International. 26:492-8.

Murtaghab, N., Gaterslebena, B. & Uzzell, D. A 2014. qualitative study of perspectives on household and societal impacts of demand response. *Technology Analysis & Strategic Management*, 26 (10) 1131-1143.

Naci, H., Ioannidis, J.P.A (2015). Evaluation of Wellness Determinants and Interventions by Citizen Scientists. JAMA. 314: 121.

Newsom, J. T. (2015). *Longitudinal structural equation modelling: A comprehensive introduction*. New York: Routledge.

OECD Library. *Energy Prices and Taxes, Volume 2017 Issue 3 Third Quarter 2017*. Paris: OECD. Available online at: http://www.oecd.org/publications/energy-prices-and-taxes-16096835.htm [Accessed 1/11/2017].

Office of Environment and Heritage (OEH). 2013. *New South Wales Energy Efficiency Action Plan*. Sydney: Office of Environment and Heritage. Available online at: http://www.environment.nsw.gov.au/resources/energyefficiencyindustry/130588-energy-efficiency-action-plan.pdf [Accessed 04/07/2017].

Organo, V. Head, L. and Waitt, G. 2012. Who does the work in Sustainable households? A time and gender analysis in New South Wales, Australia. Gender, Place and Culture, 20 (5), 559-577.

Ortiz, M.A., Kurvers, S.R., Bluyssen, P.M. 2017. A review of comfort, health, and energy use: Understanding daily energy use and wellbeing for the development of a new approach to study comfort. *Energy and Buildings*, 152(1): 323-335.

Otaa, T. Kakinaka, M., Koji Kotani, K. 2018. Demographic effects on residential electricity and city gas consumption in the aging society of Japan, Energy Policy, 115: 503-513.

Pink, S. (2005). Dirty laundry: Everyday practice, sensory engagement and the constitution of

identity. *Social Anthropology,* 13(3): 275-290.

Pink, S., Morgan, J. 2013. Short-term ethnography: Intense routes to knowing. *Symbolic Interaction*, 36(3): 351-361.

Ritchie, J.R.B., McDougall, G.H.G., Claxton, J.D. 1981. Complexities of household energy consumption and conservation. *Journal of Consumer Research*, 8(3): 233-242.

Roelofsen, P., 2015. Healthy Ageing: differences between elderly and non-elderly in temperature sensation and dissatisfied. Intell. Build. Int., 1–15. http://dx.doi.org/10.1080/17508975.2015.1063474.

Romanach, L., Hall, N., Meikle, S. 2017. Energy consumption in an ageing population: Exploring energy use and behaviour of low-income older Australians. *Energy Procedia,* 121: 246–253.

Rowley, J., Jones, R., Vassiliou, M., Hanna, S. 2012. Using card-based games to enhance the value of semi-structured interviews. *International Journal of Market Research*, 54 (1): 93-210.

Shove, E. 2003. *Comfort, cleanliness and convenience: The social organisation of normality.* Oxford, Berg.

Shove, E., Walker, G., 2014. What is energy for? Social practice and energy demand. *Theory, Culture and Society*, 31(5): 41-58.

Simpson, P. 2011. 'So, as you can see…': Some reflections on the use of video methodologies in the study of embodied practices. *Area*, 34: 343-352.

Simshauser, P., Nelson, T., Doan, T., 2011. The boomerang paradox – Part II: policy prescriptions for reducing fuel poverty in Australia. *The Electricity Journal*, 24(2): 63–75.

Smolander, J. (2002). Effects of cold exposure on older humans. International Journal of Sports Medicine, 23(2): 86-92.

Spitzer RL, Kroenke K, Williams JBW, Lowe B. 2006. A brief measure for assessing generalized anxiety disorder. Arch Inern Med.,166:1092-1097.

Stafoggia, M., Forastiere, F., Agostini, D., Biggeri, A., Bisanti, L., Cadum, A., Caranci, N., de'Donato, F., De Lisio, S., De Maria, M., Michelozzi, P., Miglio, R., Pandolfi, P., Picciotto, S., Rognoni, M., Russo, A., Scarnato, C., Perucci, C., 2006. Vulnerability to heat-related mortality. A multicity, population-based, case-crossover analysis. *Epidemiology* 17, 315–323.

Strauss, A., Corbin, J. 1990. *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Newbury Park, CA: Sage.

Strengers, Y. (2010) Air-conditioning Australian households: a trial of Dynamic Peak Pricing. Energy Policy, 38, 7312– 7322.

Strengers, Y., Maller, C. 2011. Integrating health, housing and energy policies: Social practices of cooling. *Building Research & Information*, 39(2): 154-168.

Sullivan, L.E. (2009). *General Linear Model (GLM). The Sage Glossary of the Social and Behavioural Sciences.* Thousand Oaks, CA: Sage.

Thøgersen, J., Gronhøj, A. 2010. Electricity saving in households – A social cognitive approach. *Energy Policy*, 38(12): 7732-7743.

Tonn, B., and Eisenberg, J., 2007. The aging US population and residential energy demand. Energy Policy, 35: 743–745.

United Nations Environment Programme. 2014. *The emissions gap report 2014: A UNEP synthesis report*. Nairobi, UNEP.

Van Hoof, J., Kort, H., Hensen, J., Duifnstee, M., Rutten, P., 2010. Thermal comfort and the integrated design of homes for older people with dementia. Build. Environ. 45, 358–370. http://dx.doi.org/10.1016/j.buildenv.2009.06.013.

von Borgstede, C., Andersson, M., & Johnsson, F. (2013). Public attitudes to climate change and carbon mitigation – Implications for energy associated behaviours. Energy Policy, 57: 182-193.

Waitt, G., Roggeveen, K., Gordon, R., Butler, K., Cooper, P., 2016. Tyrannies of thrift: Governmentality and older, low-income people's energy efficiency narratives in the Illawarra, Australia. *Energy Policy*, 90: 37-45.

Ware, J.E., Sherbourne, C.D. (1992). The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. Medical Care, 30(6): 473-483.

World Health Organization (2005). Energy and Health. Geneva: World Health Organisation, Sustainable Development and Healthy Environments Cluster.

World Health Organization. (2008). The world health report 2008: primary health care now more than ever. Geneva: World Health Organization. Available at: http://www.who.int/whr/2008/whr08_en.pdf.

Yamasaki, E., and Tominaga, N., 1997. Evolution of an aging society and effect on residential energy demand. *Energy Policy*, 25,903–912.

Yergin, D.H. 2006. Ensuring energy security. *Foreign Affairs*, 85(2), 69-82.

APPENDICES

Appendix 1: Participant information sheet and consent form

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Participant Information and Consent Form

Project title: Exploring the nexus of energy use, ageing, and health and wellbeing among older Australians

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Dr Theresa Harada, Macquarie University, Department of Marketing and Management, Macquarie University. E: mary.harada@mq.edu.au

You are invited to take part in a study that aims to examine the the relationships between ageing, health and domestic energy use.

The project is funded by Energy Consumers Australia, a public body established by the Council of Australian Governments (COAG) Energy Council to promote the interests of energy consumers and deliver better outcomes for them.

If you agree to participate, the researchers will visit your home with your permission to conduct an interview in which you will be asked some questions about how you use energy in the home, health and ageing – for example how do you heat the house in winter or keep cool in summer to help manage your health. The interviews are likely to last approximately one hour. This will be followed by another shorter interview one to two weeks after the original appointment during which time you will be asked to participant in a brief video ethnography tour of your home. During the video ethnography you will be asked to demonstrate to the research team your energy use practices related to managing your health and wellbeing (for example how do you keep warm when suffering from a cold, or how do you recharge health monitoring devices). This will also involve an activity that uses word cards relating to energy use and health. This 2nd interview will last around 30 minutes and will be video recorded by the researcher.

No major risks or discomforts are anticipated from your participation. If you have concerns regarding any health issues discussed we can refer you to our colleagues at the Community Industry Group, who build, support and celebrate excellence and innovation in community services that will sustain the community's resilience, health

and wellbeing in the Illawarra region. You can also contact the Community Industry Group directly on T: 02 4256 4333 E: info@cigroup.org.au

The interviews will be digitally audio recorded and the video ethnography home tour will be video recorded. However, the researchers will securely store the digital files. Any information you provide will be kept confidential, except as required by law, and you are not required to provide your name or other personal details on the audio recording. Personal information (e.g. name/address/date of birth) will not be identifiable in any reports or publications that arise from this research.

Confidentiality and consent
Your participation is entirely voluntary and you are free to withdraw from the study at any stage. Refusal to participate or withdrawal from the study will not affect your relationship with the researchers, Macquarie University, or Energy Consumers Australia in anyway. Any information or personal details gathered in the course of the research are confidential, except as required by law. Any personal information recorded in the interview will be de-identified. No secretive use of video recording will take place, and you are free to request that the video recording is stopped at any time. Video clips will be de-identified through blurring of faces, photographs, and views from windows, if used beyond the research team for scholarly purposes. All data files will be password protected, stored in a safe and secure location at Macquarie University, and any data will only be accessible by the project team. Information collected during the interview and video ethnography will potentially be used for a research paper and possibly other published studies for the University.

In recompense for your time and effort each family member that participates in the study will be issued with a $50 Coles/Myer Voucher for taking part in the first interview and a $50 Coles/Myer Voucher for taking part in the video ethnography home tour. The vouchers will be issued following the second interview.

You will be requested to sign the Consent Form below prior to the research commencing to confirm your understanding of these things and to indicate that you are happy to participate in the study.

I, _____have read *(or, where appropriate, have had read to me)* and understand the information above and any questions I have asked have been answered to my satisfaction. I agree to participate in this research, knowing that I can withdraw from further participation in the research at any time without consequence. I have been given a copy of this form to keep.

Participant's Name:_____
(Block letters)

Participant's Signature: _____ Date:_____

Investigator's Name:_____
(Block letters)

Investigator's Signature: _____ ___ Date:_____

The ethical aspects of this study have been approved by the Macquarie University Human Research Ethics Committee. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Director, Research Ethics & Integrity (telephone (02) 9850

7854; email ethics@mq.edu.au). Any complaint you make will be treated in confidence and investigated, and you will be informed of the outcome.

Appendix 2: Interview discussion guide

Exploring the nexus of energy use, ageing, and health and wellbeing among older Australians

Interview discussion guide

You have kindly agreed to take part in this research project that focuses on domestic energy use, ageing, and health

Understanding of the householders relationship to the house as home

1. Could you tell me about how long have you lived in this house?
2. Who else lives here with you? Or has shared this house with you over the last several years?
5. Can you tell me about how you heat the house in winter? Is this house easy to keep warm? What are the challenges? Can you talk about the appliances that you use e.g. portable electric heaters, RC Air conditioners, gas heaters, strip heaters- how long have you had them? Do they work well? Are they costly to run in your opinion?
6. Can you tell me about how you cool the house in summer? Is this house easy to keep cool? What are the challenges? Can you talk about the appliances you use to keep cool e.g. desk fans, pedestal fans, misting fans, ceiling fans, RC Air conditioners-how long have you had them? Do they work well? Are they costly to run in your opinion?
7. Tell me about the other major electrical appliances you have in your home- fridges, stoves, ovens, televisions, dishwashers, washing machines, clothes dryers etc. Can you remember when you purchased them? What were the reasons for choosing the type of appliance? Did you consider things like energy star ratings, cost, and brand at the time of purchase?
8. To each family member - Tell me about **how you see yourself** in this home? What is your role (e.g. mother, partner, cook, cleaner, handyperson, entertainer)
9. Do you have any health conditions that you are managing now or have been dealing with/dealt with over the past few years? How do these conditions impact on your

quality of life? For example, are there special things you need to do to keep yourself in good health- have the temperature of the home higher or lower than normal? Eat special foods? Or use specialist medical equipment? Is this constant or does it change at different times of the year? Are there things that you would like to do but can't do because of health concerns?

10. What about other householders – do they have any health conditions that they are managing now or have been dealing with/dealt with over the past few years?
11. How does this impact on household energy use?

Understanding of the importance of energy saving in context of their home and a wider context

1. OK, the focus of this project is on **energy use, aging and health.** Can you tell me how you **think t**hese three things are linked?
2. Does health become more important as you age?
3. What role do you think energy plays in being healthy?
4. **When** did you become aware of this idea?
5. What about for other householders? Does aging mean they use more energy to stay healthy? Or less energy to stay healthy?
6. What are your routines for staying healthy? Tell me about the things you do to maintain health e.g. food preparation, washing, bathing, cleaning, socializing etc.
7. Are there any conflicts around wanting to stay healthy and the cost of energy?
8. How do you negotiate any potential conflicts around cost? Do you use less energy at times because of cost? Or do you use the energy you need without thinking of the cost?
9. Tell me about how you make those decisions.
10. **How** would you say your energy use has changed as you have become older?

How energy is consumed in the home for health

1. What room or rooms do you spend most of your time in at home?
2. What do you do?
3. Are there any rooms you avoid? Why? (Probe - are they too hot or cold for example?
4. Can you tell me on an average day what appliances/materials you use that consume energy? (e.g. Fridge, Cooker, TV, computer, phone, other appliances).
5. Do you use any health devices/devices for managing your health or existing health conditions that use energy?

---------- (Take note of these health devices)

How energy is consumed in the home generally

1. What do you think about how much energy YOU use personally in this home?
2. What do you think about how much energy that the whole family uses in this home?
3. Do you think any of this is related to your or other householder's health?

4. Do you ever talk to other members of your family about energy use

Final Few Questions

1. Thinking about energy use and health, I have three questions for you:

Who do you think should be responsible for helping Australians to manage their energy use and health as they age? (e.g. Commonwealth/State/Local Government/Family/Social Services/People themselves)

a) If you could tell the government one thing about energy use at home and health, what would it be?

b) If you could ask the government, or anyone else, to do something to help people manage their domestic energy use and their health, what would it be?

2. Finally, do you have any other things you would like to say about using energy in this home and health?

Thank you for your time and responses today

Exploring the nexus of energy use, ageing, and health and wellbeing among older Australians

Interview discussion guide PART 2

You have kindly agreed to take part in this research project that focuses on domestic energy use, ageing, and health.

In this follow up interview I am going to record a video of you as you take part in an activity. It may take between 5 and 15 minutes. When we are finished the card activity I would like to continue to video record as you show me the appliance you identify and how you use it. This will take around 5 minutes.

So here I have a board with three terms – ENERGY and HEALTH and WELL BEING.

I have some smaller cards with different appliances on them. I wonder if you could arrange them in the middle of the board between the two terms so that we can better understand how you use energy to maintain your health and well-being.

As you go through the cards, I would like you to talk about the importance of appliance and how you use it to maintain your health. Tell me about which are the most important to you and why.

If there are any appliances that are not listed I have some blank cards that we can fill in.

E.g. hair dryer, electric blanket.

PROMPTS:

Why is this important to you?

Does this help with a health or medical condition?

When would you use this appliance usually?

For how long would you use it?

How much energy do you think the appliance consumes?

Does the cost of energy come into the decision to use or not use the appliance?

Are there any appliances that you just can't live without? Why?

ENERGY

WELL-BEING

[eating well, keeping warm/cool,

bathing, washing socialising]

HEALTH

[blood pressure, heart problems, breathing

problems, circulation problems, sleeping problems]

Appendix 3: Questionnaire survey

Screening out question

Before taking this survey, please confirm that you are 60 years or older?

- Yes, I am 60 years or older
- No, I'm aged less than 60 years

Participant information sheet and consent

Participant Information and Consent Form

Project title: Exploring the nexus of energy use, ageing, and health and wellbeing among older Australians

Researchers: Professor Ross Gordon, Professor Gordon Waitt, Professor Paul Cooper, Dr Alisha McGregor, Dr Theresa Harada

Approximately one year ago, you kindly agreed to take part in a study that aims to examine the the relationships between ageing, health and domestic energy use. As we outlined to you at that time, we are now inviting you to complete the same survey again to help us measure any changes in responses over time.

The project is run by Macquarie University and has been funded by an Energy Consumers Australia, a public body established by the Council of Australian Governments (COAG) Energy Council to promote the interests of energy consumers and deliver better outcomes for them.

What is the survey?
The project aims to examine the relationships between ageing, health and domestic energy use. We are particularly interested in the views and experiences of people like yourself. Your contribution to the study would be extremely valuable. Macquarie University is conducting surveys with people to explore their experiences, knowledge, attitudes and behaviours in relation to energy use in the home, ageing, and health.

What will happen during the survey? During the survey, you will be asked some questions about: Your knowledge of issues relating to energy use; Your attitudes towards energy use; Your behaviours in relation to energy use; Your health and wellbeing, and Information on your household type and size, income, and demographic questions e.g. age, gender, occupation, ethnicity.

Confidentiality and consent
Your participation is entirely voluntary and you are free to withdraw from the study at any stage. Refusal to participate in the study will not affect your relationship with Macquarie University. Any personal information recorded in the survey will be de-identified, and the data files will be password protected, stored in a safe and secure location at Macquarie University, and any data will only be accessible by the project team. Information collected during the survey will potentially be used for a research paper and possibly other published studies for the University.

You will be requested to provide consent prior to the survey to confirm your understanding of the information contained within this Participant Information Sheet and to indicate that you are happy to participate in the study. This research has been reviewed by the Human Research Ethics Committee of the Macquarie University. If you have any concerns or complaints regarding the way this research has been conducted, you can contact the Macquarie University Ethics Officer on (02) 9850 7850 or email ethics@mq.edu.au

Do you consent to participate in the survey?

Yes

No

Energy attitudes

SECTION 1
This section explores your attitudes towards energy use.

Q1 Please tick one box only for each statement.

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
I would do more to save energy if I knew how.					
Saving energy is important.					
All electrical appliances should have a label that shows the resources used in making them, their energy requirements, and operating costs.					
Australians should conserve more energy.					
	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
I believe that I can contribute to solving energy problems by making appropriate energy-related choices and actions.					
I believe that I can contribute to solving energy problems by working with others.					
PLEASE READ THIS ITEM CAREFULLY: The way I personally use energy does NOT really make a difference to the energy problems that face our nation (such as resource depletion and energy-related environmental problems).					
PLEASE READ THIS ITEM CAREFULLY: We DO NOT have to worry about conserving energy, because new technologies will be developed to solve the energy problems (such as resource depletion and energy-related environmental problems) for future generations.					

Thermal comfort

SECTION 2
This section explores your views on the thermal comfort of your home (i.e., keeping your home at a comfortable temperature).

Q2 Please rate the level of comfort, in terms of temperature, of:

	1 (hot)	2	3 (comfortable)	4	5 (cold)

Your home overall.	○	○	○	○	○
The main living room of your home.	○	○	○	○	○
Your bedroom.	○	○	○	○	○

Q3 Please indicate how satisfied you are with the following:
(Please tick one box only for each question)

	Very dissatisfied	Dissatisfied	Neither dissatisfied nor satisfied	Satisfied	Very satisfied
How satisfied are you with the temperature of your home overall during summer?	○	○	○	○	○
How satisfied are you with the temperature of your home overall during winter?	○	○	○	○	○
How satisfied are you with the temperature of your main living room during summer?	○	○	○	○	○
	Very dissatisfied	Dissatisfied	Neither dissatisfied nor satisfied	Satisfied	Very satisfied
How satisfied are you with the temperature of your main living room during winter?	○	○	○	○	○
How satisfied are you with the temperature of your bedroom during summer?	○	○	○	○	○
How satisfied are you with the temperature of your bedroom during winter?	○	○	○	○	○

Energy behaviours

SECTION 3
This section is about your own energy use at home.

Q4 How frequently are each of the following household appliances used in your household?

(Please tick the most appropriate box for each statement.)

	Multiple times per day	Once per day	Most days	Some days	Rarely	Never	I don't own one
Washing Machine	○	○	○	○	○	○	○
Clothes Dryer	○	○	○	○	○	○	○
Dishwasher	○	○	○	○	○	○	○

Q5 How frequently are each of the following household appliances used in your household?

	Continuously	A few hours each day	Most days	Some days	Rarely	Never	I don't own one

Desktop Computer	○	○	○	○	○	○	○
Laptop / iPad / Tablet	○	○	○	○	○	○	○
Television	○	○	○	○	○	○	○
Separate Freezer	○	○	○	○	○	○	○
Air Conditioner (in summer)	○	○	○	○	○	○	○
Fan (in summer)	○	○	○	○	○	○	○
Heater (in winter)	○	○	○	○	○	○	○
Reverse cycle air conditioner (in winter)	○	○	○	○	○	○	○

Q6 Compared to this time last year, has your household energy use increased, decreased or remained the same?

- ○ Increase in energy use.
- ○ Decrease in energy use.
- ○ No change in energy use.

Q7 (Please tick one box only for each question)

	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree	Don't own one
I always fill up my washing machine when washing.	○	○	○	○	○	○
For drying, I USUALLY tumble dry my clothes.	○	○	○	○	○	○
I always turn off the lights in those rooms I'm not in.	○	○	○	○	○	○
	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree	Don't own one
I never leave electrical appliances at home in standby mode.	○	○	○	○	○	○
I always unplug the mobile charger when it's not in use.	○	○	○	○	○	○
I try to buy energy efficient household appliances.	○	○	○	○	○	○

Q8 (Please tick one box only for each question)

	Never	Sometimes	Often	Always	Not applicable
I reduce the temperature in my hot water system.	○	○	○	○	○
I keep heating / air conditioning low to save energy.	○	○	○	○	○
I turn the heating / air conditioning off in unused rooms.	○	○	○	○	○

Q9 Do you use solar power?

- Yes
- No

Q10 What was the amount of your most recent electricity bill? (For example, $380.00)

- Please write in dollars ($) below:
- I don't remember.

Q11 How much electricity did you use in your bill?

- Please write in kilowatthours (kWh) below:
- I don't remember.

Q12 What was the billing period? (please write dates e.g. 1/12/2018 to 1/3/2019)

- Please write in here:
- I don't remember

Damp, mould and condensation

SECTION 4
In this section you are asked about the presence of mould etc. in your home.

Q13 Do you have any problems with condensation?

- Yes
- No

Q14 Do you have any problems with dampness?

- Yes
- No

Q15 Do you have any problems with mould?

- Yes
- No

Q16 Are you able to keep your home warm enough when needed?

Yes

No

Q17 Are you able to keep your home cool enough when needed?

Yes

No

Health

SECTION 5
In this section you are asked about your physical and mental health and how it impacts your social activities and work.

Q18 In general, would you say your health is:
Please select only one response.

Excellent

Very good

Good

Fair

Poor

Q19 Compared to one year ago, how would you rate your health in general now?
Please select only one response.

Much better now than one year ago.

Somewhat better now than one year ago.

About the same.

Somewhat worse now than one year ago.

Much worse now than one year ago.

Q20 The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?
Please select only one response.

	Yes, limited a lot	Yes, limited a little	No, not limited at all
Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports.			
Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling or playing golf.			
Lifting or carrying groceries			
Climbing several flights of stairs.			

Climbing one flight of stairs.	○	○	○
Bending, kneeling or stooping.	○	○	○
Walking more than a kilometre.	○	○	○
Walking several blocks.	○	○	○
Walking one block.	○	○	○
Bathing or dressing yourself.	○	○	○

Q21 During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?
Please select only one response.

	Yes	No
Cut down the amount of time you spent on work or other activities.	○	○
Accomplished less than you would like.	○	○
Were limited in the kind of work or other activities.	○	○
Had difficulty performing the work or other activities (for example, it took extra effort).	○	○

Q22 During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?
Please select only one response.

	Yes	No
Cut down the amount of time you spent on work or other activities.	○	○
Accomplished less than you would like.	○	○
Didn't do work or other activities as carefully as usual.	○	○

Q23 During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbours, or groups?
Please select only one response.

- ○ Not at all
- ○ Slightly
- ○ Moderately
- ○ Quite a bit
- ○ Extremely

Q24 How much bodily pain have you had during the past 4 weeks?
Please select only one response.

- None
- Very mild
- Mild
- Moderate
- Severe
- Very severe

Q25 During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?
Please select only one response.

- Not at all
- A little bit
- Moderately
- Quite a bit
- Extremely

Q26 These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. Please select only one response per question.

How much of the time during the past 4 weeks...

	All of the time	Most of the time	A good bit of the time	Some of the time	A little of the time	None of the time
Did you feel full of pep/ vitality?	○	○	○	○	○	○
Have you been a very nervous person?	○	○	○	○	○	○
Have you felt so down in the dumps that nothing could cheer you up?	○	○	○	○	○	○
Have you felt calm and peaceful?	○	○	○	○	○	○
Did you have a lot of energy?	○	○	○	○	○	○
Have you felt downhearted and blue?	○	○	○	○	○	○
Did you feel worn out?	○	○	○	○	○	○
Have you been a happy person?	○	○	○	○	○	○
Did you feel tired?	○	○	○	○	○	○

Q27 During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?
Please select only one response.

- All of the time
- Most of the time
- Some of the time

- A little of the time
- None of the time

Q28 How TRUE or FALSE is <u>each</u> of the following statements for you. Please select only one response per statement.

	Definitely true	Mostly true	Don't know	Mostly false	Definitely false
I seem to get sick a little easier than other people.					
I am as healthy as anybody I know.					
I expect my health to get worse.					
My health is excellent.					

Well-being (satisfaction with life and flourishing)

SECTION 6
This section asks you questions about your overall well-being.

Q29 Below are thirteen statements. Using the response categories, please indicate how much you agree or disagree with each of the statements. Please select only one response per statement.

	Strongly agree	Agree	Slightly agree	Neither agree nor disagree	Slightly disagree	Disagree	Strongly disagree
In most ways my life is close to my ideal.							
The conditions of my life are excellent.							
I am satisfied with my life.							
So far I have gotten the important things I want in life.							
If I could live my life over, I would change almost nothing.							
I lead a purposeful and meaningful life.							
My social relationships are supportive and rewarding.							
I am engaged and interested in my daily activities.							
I actively contribute to the happiness and well-being of others.							
I am competent and capable in the activities that are important to me.							
I am a good person and live a good life.							
I am optimistic about my future.							
People respect me.							

Stress, anxiety and positive and negative affect

SECTION 7
This section asks you about your feelings, emotions and thoughts.

Q30 The questions in this scale ask you about your feelings and thoughts during THE LAST MONTH. In each case, please indicate your response by clicking on the dot which represents HOW OFTEN you felt or thought a certain way.
Please select only one response per question.

	Never	Almost never	Sometimes	Fairly often	Very often
In the last month, how often have you felt confident about your ability to handle your personal problems?	○	○	○	○	○
In the last month, how often have you felt that things were going your way?	○	○	○	○	○
PLEASE READ THIS ITEM CAREFULLY: In the last month, how often have you felt that you were UNABLE to control the important things in your life?	○	○	○	○	○
PLEASE READ THIS ITEM CAREFULLY: In the last month, how often have you felt difficulties were pilling up so high that you could NOT overcome them?	○	○	○	○	○

Q31 Over the last 2 weeks, how often have you been bothered by the following problems?
Please select only one response per statement.

	Not at all	Several days	More than half the days	Nearly everyday
Feeling, nervous, anxious or on edge.	○	○	○	○
Not being able to stop or control worrying.	○	○	○	○
Worrying too much about different things.	○	○	○	○
Trouble relaxing.	○	○	○	○
Being so restless that its hard to sit still.	○	○	○	○
Becoming easily annoyed or irritable.	○	○	○	○
Feeling afraid as if something awful might happen.	○	○	○	○

Q32 Please think about what you have been doing and experiencing during the past four weeks. Then report how much you experienced each of the following feelings, using the scale below. Please select only one response per statement.

	Very rarely or never	Rarely	Sometimes	Often	Very often or always
Positive	○	○	○	○	○
Negative	○	○	○	○	○
Good	○	○	○	○	○
Bad	○	○	○	○	○
Pleasant	○	○	○	○	○
Unpleasant	○	○	○	○	○
Happy	○	○	○	○	○
Sad	○	○	○	○	○
Afraid	○	○	○	○	○
Joyful	○	○	○	○	○
Angry	○	○	○	○	○
Contented	○	○	○	○	○

Capabilities

SECTION 8
This section asks you a range of questions to get an idea about your overall capabilities.

Q33 Does your health in any way limit your daily activities, compared to most people of your age?
Please select only one response.

- ○ Yes
- ○ No

Q34 Are you able to meet socially with friends, relatives or work colleagues?
Please select only one response.

- ○ Yes
- ○ No

Q35 At present how easy or difficult do you find it to enjoy the love, care and support of your family and friends?
Please select only one response.

- ○ Very easy
- ○ Fairly easy
- ○ Neither easy nor difficult
- ○ Fairly difficult
- ○ Very difficult

Q36 In the past 4 weeks, how often have you lost sleep over worry?
Please select only one response.

- Always
- Most of the time
- Some of the time
- Hardly ever
- Never

Q37 In the past 4 weeks, how often have you been able to enjoy your recreational activities?
Please select only one response.

- Always
- Most of the time
- Some of the time
- Hardly ever
- Never

Q38 The next question asks you to think about your life expectancy:

Until what age do you expect to live, given your family history, dietary habits, lifestyle and health status?
(Please write your response using numbers, for example 89)

Q39 Please indicate how strongly you agree or disagree with the following statements:
Please select only one response per statement.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
I am able to influence decisions affecting my local area.					
I am free to express my views, including political and religious views.					
I am able to appreciate and value plants, animals and the world of nature.					
I respect, value and appreciate people around me.					
I am free to decide for myself how to live my life.					
I am free to use my imagination and to express myself creatively (e.g., through art, literature, music etc.).					

Q40 Which of the following applies to your home?
Please select only one response.

- I own my home outright or on a mortgage.
- Rented from housing association or local authority.

Rented from private landlord.

Rented from other.

Other

Don't know.

Q41 For which of the following reasons, if any, have you NOT bought your home?
Please select ALL responses that apply.

I cannot afford to buy.

I cannot obtain a mortgage.

I think its a bad time to buy.

There is a lack of available housing to buy.

Some other reason.

Q42 How suitable or unsuitable is your home for your current needs?
Please select only one response.

Very suitable

Fairly suitable

Neither suitable nor unsuitable

Fairly unsuitable

Very unsuitable

Q43 Please indicate how safe you feel walking alone in the area near your home:
Please select only one response.

Very safe

Fairly safe

Neither safe nor unsafe

Fairly unsafe

Very unsafe

Q44 Please indicate how likely you believe it to be that you will be assaulted in the future (including sexual and domestic assault):
Please select only one response.

Very likely

Likely

Neither likely nor unlikely

Unlikely

Very unlikely

Q45 In your CURRENT OR ANY FUTURE employment, how likely do you think it is that you will experience discrimination (e.g., because of your race, gender, religion, age or sexual orientation)?
Please select only one response.

- Very likely
- Likely
- Neither likely nor unlikely
- Unlikely
- Very unlikely
- Not applicable

Q46 Outside of any employment, in your everyday life, how likely do you think it is that you will experience discrimination (e.g., because of your race, gender, religion, age or sexual orientation)?
Please select only one response.

- Very likely
- Likely
- Neither likely nor unlikely
- Unlikely
- Very unlikely

Demographics

SECTION 9
This section asks some questions about you and your family.

Q47 What is your age?

Q48 What is your date of birth? (*Enter as dd/mm/yyyy)*

Q49 What is your gender?

- Male
- Female

Q50 Do you have any HEALTH CONDITIONS?

- Yes
- No

Q51 Please select your HEALTH CONDITION from the list below.
[Note: you can ONLY select ONE health condition from the list].

Health conditions

Q52 Do you have any other health conditions?

- Yes
- No

Q53 Please select your HEALTH CONDITION from the list below.

Health conditions

Q54 Do you have any other health conditions?

- Yes
- No

Q55 Please select your HEALTH CONDITION from the list below.

Health conditions

Q56 Do you have any other health conditions?

- Yes, please indicate any other health conditions in the space below
- No

Q57 Do you (or anyone in your household) own any health devices, such as a dialysis machine or a blood pressure monitor that uses electricity?

- Yes
- No

Q58 Which device(s) do you own? Please select from the list of devices below. You are able to select multiple devices from the list.

- [ ] Mobility scooters
- [ ] Electric wheelchairs
- [ ] Kidney dialysis machines
- [ ] Home ventilators
- [ ] Oxygen therapy machines
- [ ] Blood glucose monitors
- [ ] Blood pressure monitors
- [ ] Air ioniser
- [ ]

- [ ] Air purifier
- [ ] Apnea monitor
- [ ] CPAP machine
- [ ] Nasal cannula
- [ ] Pulse oximeter
- [ ] Infusion pumps
- [ ] Stair-lifts/ mobility lifts
- [ ] Other

Q59 Do you have any children, and if yes, how many?

Q60 If you do have a child or children, how many are currently living with you at home?

Q61 Do you regard yourself as belonging to any particular religion?

- ◯ Catholic
- ◯ Anglican (Church of England)
- ◯ Uniting Church
- ◯ Presbyterian
- ◯ Orthodox
- ◯ Chinese Popular Religion
- ◯ Taoism
- ◯ Buddhist
- ◯ Hindu
- ◯ Jewish
- ◯ Muslim
- ◯ Sikh
- ◯ Atheist
- ◯ Agnostic
- ◯ None
- ◯ Other - please specify

Q62 What is your ancestry? *Please tick up to two boxes only.*

- [ ] Aboriginal / Torres Strait Islander
- [ ] Australian
- [ ] Italian
- [ ] Lebanese
- [ ] Filipino
- [ ] English
- [ ] Greek
- [ ] Dutch
- [ ] Irish
- [ ] Scottish
- [ ] Maltese
- [ ] Croatian
- [ ] Chinese
- [ ] German
- [ ] Polish
- [ ] Vietnamese

☐ Indian ☐ Other - please specify

Q63 In which country were you born?

Q64 Which of these best describes you?

- ○ Married
- ○ Living with partner
- ○ Single (never married and not living with partner)
- ○ Widowed
- ○ Separated
- ○ Divorced

Q65 What is the occupation of the head of the household in which you live?

- ○ Retired
- ○ Volunteer worker
- ○ Manager
- ○ Professional
- ○ Technician and Trades Worker
- ○ Community and Personal Service Worker
- ○ Clerical and Administrative Worker
- ○ Sales Worker
- ○ Machinery Operator and / or Driver
- ○ Labourer
- ○ Other

Q66 What is your annual disposable income (after tax and Medicare levy)? (Please DO NOT include your partners income if you have one).

Q67 What is the highest level of education you have completed?

- ○ Less than High School
- ○ High School
- ○ College / TAFE
- ○ University Degree (3 years)

- Honours Degree (4 years)
- Master's Degree
- Doctoral Degree
- Professional Degree (MD / JD)

Q68 Which of the following best describes your housing situation? Do you live in:

- A house
- A flat / unit / apartment / villa / townhouse
- Mobile home / caravan / cabin / houseboat
- Retirement village / self-care unit
- Nursing home
- Hostel
- Other, please specify

Q69 How many people (including yourself) currently live in your household?

Q70 What is your postcode?

On behalf of the research team, thank you very much for taking the time to complete this survey, and the one last year on ageing, health and energy use. Your answers are very important and the research team greatly appreciate your time and attention.

FINAL REPORT: Using social marketing to support energy efficiency practices among low income families

Professor Ross Gordon, Dr Theresa Harada, Dr Lisa Schuster, Dr Alisha McGregor, Professor Gordon Waitt, Professor Paul Cooper