Heatwave disasters in rural Australia: planning for an ageing population

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Abstract
Relevance: Heat-waves are increasing in frequency, intensity and duration due to global climate change, and account for more deaths in Australia than any other natural hazard. Research has identified the aged, and those living in residential aged care facilities (ACFs), at increased risk of heat-related morbidity and mortality. Rural Australia experiences high summer temperatures and is home to proportionally more elderly residents than urban settings. Rural ACF buildings are more likely to be older, or not ‘purpose-built’ compared to their urban counterparts.

Aims: The study aims were to: 1) investigate current heat-wave planning policies and heat prevention strategies in urban and rural ACFs and 2) identify barriers to successful implementation of adequate heatwave health care in rural and urban ACFs in three Australian states (NSW, Queensland and South Australia).

Methods: Residential ACFs were identified across three states using Department of Health and Ageing databases, white pages and internet searching. Participating facilities were asked to provide informed consent and invited to nominate two staff members to participate in a 15 minute Computer Assisted Telephone Interview (CATI). Participants were asked to detail current plans and policies which addressed residents’ heat-wave health, strategies used to keep residents well during periods of extreme heat and barriers to the implementation of heatwave health care. Data was entered into a purpose-built database and analysed using Statistical Package for the Social Sciences (SPSS) Version 19.

Results: One hundred and sixty eight rural ACFs participated in the study. Ninety per cent of facilities had a current ACF emergency plan, although only 30% included heat-wave emergency planning. Staff used a range of strategies to keep residents cool in extreme heat, although strategies were not consistent across all states or facilities. One third of rural ACFs in two states did not have air-conditioning, instead relying on other cooling methods such as fans and evaporative cooling. Barriers to heat-wave health included; poor building design, low staffing levels and poor cooling equipment.

Conclusions: This study identifies the current policies and strategies rural ACFs use to keep residents well, and highlights the barriers to maintaining wellness in the residential aged during periods of extreme heat. As the Australian population ages, planning for the health effects of extreme heat in elderly rural residents is critical to ensure wellness in this population group is maintained.

Introduction
Globally, average daily temperatures are increasing as a result of climate change. In Australia, annual daily temperatures have increased by approximately 0.9°C since the 1950s and are predicted to continue to rise. There is a large body of literature supporting global increases in mean daily temperature, and the increased frequency, duration and intensity of periods of extreme heat.

Australians are ageing, with around 27% of the population expected to be over the age of 65 years in the year 2036. Combined, an ageing population and increased periods of extreme heat could be expected to result in an increase in morbidity and mortality across the community unless appropriate planning and intervention measures are put into place.

Major aged care reforms are currently under way in Australia. These changes are designed primarily to address the accommodation and health care needs of the increasingly aged population. The latest aged care reform package is the first in almost thirty years, and aims to redress the present aged care focus on institutional care. Instead, the new aged care reform package focuses on the workforce implications of an ageing population, the promotion of ageing in situ (in the family home) and on the benefits of
employing a wellness model in ageing.6 As a result of the new aged care reforms, aged care facilities (ACFs), previously termed nursing homes, will become home to the most vulnerable elderly; those who are frail, chronically ill or experiencing severe dementia.6

Australian and overseas research has highlighted the vulnerability of older people to extreme heat.7,8 As a group, people aged 65+ have a higher level of heat related morbidity and mortality. Those aged 75+, who are more likely to be frail, have chronic illnesses and/or cognitive impairment are at particular risk of heat-related illness and death.9,10,11 This group is also the most likely to be living in residential ACFs. Overseas research has shown that older residents of nursing homes and those in institutionalised care are at greater risk of heat related illness or death although this has not previously been studied in the Australian setting.12,13,14

Residents of rural and remote Australian communities have poorer access to health services than their urban counterparts.15 This is particularly the case in the ageing population, who have limited options for aged care services and long distances to travel for complicated medical care, or in times of emergency.16 In addition, rural residents are exposed to a variety of environmental hazards, including extreme weather conditions, which have the potential to impact on health and travel for care.17 In this setting, the majority of older residents stay in their own home for as long as possible, due not only to lack of access to services but for financial reasons and because family or social support networks are generally available.16 As a result, residents of rural ACFs are generally older and sicker than those in urban ACFs.18,19

Australian rural and remote settings are not only home to a large proportion of aged residents20, but are exposed to some of the most extreme temperatures in the state.21 Health care professionals are often the first line of care for elderly residents in rural and remote areas and, as a result, need government and organisational support (in the form of flexible policy, guidelines and plans for rural and remote health) as well as a broad set of skills which are appropriate to the local environment, the community and their needs.22,23

This study investigates the preparedness of ACF staff for projected increases in extreme heat in urban and rural ACFs in three Australian States. Evidence suggests rural facilities are generally older, smaller and hotter than urban facilities so this paper focuses on the implications of (poor) heatwave preparedness in an ageing, rural population. The paper makes recommendations for strategies to ensure rural aged care facility staff are prepared for future heatwaves. Where rural facility results differ significantly from those of urban settings results of comparative analysis are presented.

Setting

This study of Australian ACFs is a large multi-state research project (Heat-Ready) investigating the adaptive capacity of urban and rural ACFs to extreme heat in three states. The Heat-Ready study, funded through the National Climate Change Research and Adaptation Facility (NCCARF) investigates the adaptive capacity of ACFs during periods of extreme heat. The study commenced in December 2011 and was approved by the Ethics Committee of the University of Sydney. This paper presents the quantitative results from the rural ACFs who consented to enrolment in the study.

Methods

Aged Care Facilities across NSW, Queensland and SA were identified using Department of Health and Ageing (DoHA) databases, Internet searching and White Page directories. A total of 546 rural and 1,324 urban ACFs were identified however, with removal of duplicates and merged or closed facilities the final number eligible for contact was 1561 (450 rural and 1111 urban). The Rural Remote or Metropolitan Area Classification (RRMA) system was used to determine whether a facility was urban or rural.23
Recruitment
Each ACF was contacted by letter and invited to participate in the study. Follow-up telephone calls were made to all facilities. Interested ACFs were sent an Information Sheet and Informed Consent document. Study participation was voluntary, and facilities who wished to participate returned the consent form to the researchers. To be included in the study an ACF consented to nominate one each administrative and clinical staff member to complete a 20 minute validated semi-structured telephone interview. Upon receipt of signed consent documents ACFs were contacted by researchers. Suitable times were made to interview two staff in each ACF. Facilities could nominate the members of staff they wished to participate in the study interviews.

Interview tools
The Victorian Department of Health Aged Care Facility Heatwave Ready Resource24 was used to develop an amended survey instrument. The instrument was piloted in six NSW ACFs prior to implementation across the study cohort. Alterations were made to questions as required for each state, and repetitive questions were removed. Purpose built Computer Assisted Telephone Interview (CATI) software was developed based on the amended survey instrument. Interviewers were trained in telephone interview technique and use of the CATI software.

Data capture
Quantitative data collected from the participants included, but were not limited to: role of interview respondent (clinical or admin), ACF size (number of beds), location (urban or rural), presence of an ACF Plan, presence of a current heat-wave plan, cooling status, building design (number of storeys), roof type, in-service training and whether there was a back-up power supply.

Rural ACF results
Between 15 December 2011 and 31 October 2012 (inclusive), 450 rural ACFs in the three states were contacted by letter and invited to participate in the study. All ACFs were contacted by telephone if no response to the initial invitation had been received after 4 weeks.

Across the rural cohort, 202 ACFs initially agreed to participate in the study. However even after repeated follow-up many organisations did not provide consent after further consideration of the study, or later declined participation for other reasons, including ‘too busy’, ‘already involved in research’ or ‘not interested as heat does not affect us because we are air-conditioned’. At the close of study, consent forms and telephone interviews had been completed for 168 rural facilities.

Aged care facilities from rural areas were enrolled in the study in each of the three states. Facilities ranged in size from 12 to 283 beds, with a mixture of high and low dependency beds, and a median number of 60 beds.

Demographics
There were 168 rural ACFs enrolled in the study (NSW = 119; Qld = 29; SA = 21). Not all rural ACFs were able to provide a clinical and administrative staff member response. This was due primarily to staff numbers in each facility and current workload. All responses were included in data analysis, and responses between clinical and administrative staff were consistent.

Across the three states, clinical staff described themselves similarly; either as registered nurses (RNs), ‘clinical staff’ (care co-ordinators or personal care assistants) or assistants in nursing (AINs). Administrative respondents were selected from a range of backgrounds including: non-clinical or managerial staff, clerical staff, hospitality staff and maintenance and other staff. In some cases managerial staff also had a clinical background (i.e. Directors of Nursing in Managerial roles) and commented that they were answering the questions from a mixed perspective. Management, administrative and clinical responses were consistent, indicating accurate and truthful responses.
ACF Planning and policy
All respondents were asked whether the rural ACF in which they worked had an ACF Plan or policy. This plan or policy could incorporate a disaster plan or similar crisis response plan. Staff in almost all rural facilities (89%) across the three states reported that their facility had an ACF Plan in place although not all of these included preparation for heat emergencies.

Heatwave policy and planning is an important component of aged care, particularly in view of the recent periods of extreme heat in NSW, Queensland and SA. The states differed in the way they approached policy and planning for extreme heat. Comparison of the data on whether rural ACFs had a heatwave policy in place showed that in Queensland (80%) and SA (100%) heatwave policies were relatively common, however in NSW rural facilities (60%) such policies were less common.

ACF building characteristics
Aged care facilities were categorised into size based on the number of beds in each facility using the categories outlined in the Profile of Aged Care report.25 Rural ACFs tended to be smaller than urban facilities with an average of 67 beds compared to 80 beds in urban settings. This was not statistically significantly different between states or rural and urban locations (p = 0.097, 95% CI -26.04–1.97).

The majority of rural ACFs in all states were more likely to be single or two storey buildings. Urban facilities were significantly more likely to have multiple storeys than rural facilities ($\chi^2=41.9$, 2df, $p<0.0001$), which is not an unexpected finding, given the cost and availability of land in urban areas compared to rural settings.

Respondents were asked to describe the facility’s roof type, as this may have an impact on the internal temperature of the building. The majority of rural facilities in all states had steel/aluminium roofs (73%) and were significantly more likely to have pitched steel/aluminium roofs compared to urban centres ($\chi^2= 16.95$, 2df, $p<0.001$). These results may indicate older buildings in rural centres, but are typical of single storey developments. Reflective paint is thought to reduce temperature under the roof surface, and for this reason we asked respondents whether their facility had reflective paint on the roof. The majority of respondents said they did not have, or were not aware whether there was reflective paint on the roof however, 12% of roofs in rural facilities in the three states combined did have reflective paint.

Solar panels are a cost efficient power source, particularly as electricity costs rise. Solar panels located on roofs were reported in 12% of NSW rural facilities but were not a prominent feature in SA where only 3% of rural ACFs had installed solar panels; similarly in Queensland solar roof panels were reported in 7% of rural facilities. There were no statistically significant differences in solar panel installation between urban and rural facilities ($\chi^2=1.155$, df=2, $p=0.561$).

The use of shading materials on windows and doors is a common strategy to reflect heat and keep buildings cool. When asked about window shading, 98% of ACF staff reported that windows could be shaded on the inside of the building, through items such as ‘blinds’ and ‘curtains’. In SA, 52% of facilities noted that all windows could be shaded on the outside of the building through the use of ‘awnings’ or ‘tinted windows’. A number of SA facilities noted that only the west facing windows could be shaded on the outside. Many Queensland ACFs used shutters or louvered windows on the outside of buildings to reflect heat and to assist airflow through the building.

Cooling strategies
Study participants were asked the type of cooling used most frequently by their facility. The amount of air-conditioned ACFs varied substantially between states. In SA almost all rural facilities (98%) were fully air-conditioned with the remainder (2%) partially air-conditioned. In Queensland, 30% of rural facilities said they did not have any form of air-conditioning in their facility, instead relying on fans or natural ventilation such as open windows. Similarly in NSW, only 65% of rural ACFs had full or partial
air-conditioning. The remainder said they used fans, evaporative coolers, under floor cooling, opening windows or a combination of strategies to help keep elderly residents cool.

**Backup power supply**

One of the common occurrences during periods of extreme heat is power overload and subsequent power outage. Most ACFs commented that they rely solely on powered devices to keep their residents cool in very hot weather, which is an unreliable strategy if power supplies are vulnerable. Participants were asked whether their facility had a back-up power supply in the form of a generator or solar power. ACFs in SA reported the presence of back-up generators in 70% of facilities however generator back-up was not as frequent in Queensland (30%) or NSW (20%).

**Education and training**

There is a well recognised shortage of aged care nursing staff across the industry, and we investigated whether staff felt there was a shortage of staff in their facility, which, if faced with extreme weather could impact on patient care.

Whilst all NSW facilities reported that their facility utilised the skills of agency staff, 75% of current staff reported that orientation to the facility for agency staff did not include care procedures to be implemented in very hot weather.

Clinical in-service training for staff on a regular basis was conducted in 98% of NSW and Queensland and 100% of SA ACFs. In NSW, only 34% of current staff said they had ever had in-service training that had covered heat-related illness and caring for the elderly in very hot weather, while in SA 50%, and in Queensland 57%, of staff had experienced such training.

**Discussion**

This study highlighted policies and strategies used by rural ACF staff during periods of extreme heat. There was a notable difference in the heat-wave policies, plans, and guidelines for staff to use in hot weather across the three states. Almost all facilities surveyed had an ACF Plan—which was designed to address functional issues including emergency and disaster management. However not all ACF plans included extreme heat as an emergency, nor had they developed any contingency planning to implement in such an event.

Dedicated heatwave plans were not a common finding in NSW ACFs. In the other warmer states, and where heatwave plans have been directed by government, many facilities had dedicated heatwave plans in place. This was particularly evident in SA where almost all facilities had a heatwave plan, and in Queensland where almost half of ACFs had a dedicated heatwave plan. The questions raised by the CATI survey led to many participants commenting on the need for a comprehensive and consistent heatwave policy and plan for aged care service providers, particularly in view of the evidence for the increasing likelihood of heatwave events.

Some rural facilities still struggle with outdated buildings and inadequate infrastructure which has the potential to place residents at risk of adverse health effects in the heat. Rural facilities in all states were more likely to have aluminium or steel roofs, which unless well insulated, can lead to high internal temperatures. Some of these roofs were painted with reflective paint, a cost-effective way of reducing the impact of extreme heat on the internal building temperature. Building design and building age was raised by participants in all states as an important factor when managing the effects of heat in the elderly. Although many rural facilities are of an older design or not purpose-built for aged care provision, there are many options for retro-fitting or heatwave adaptation. Retro-fitting older style buildings is costly and often inefficient, however subsidising these alterations may lead to more power efficiency and reduced health care costs in the longer term. Some ACF managers raised the rising costs of power as a barrier to full air-conditioning in the facility, however fewer facilities than expected had
solar panels on the roof, which can offset the high costs of running cooling equipment during hot weather.

Unlike SA and Queensland, only 65% of rural ACFs in NSW were fully air-conditioned, with air-conditioning generally only available in either patient rooms or common areas in those who were partially air-conditioned. This is of concern in extremely hot rural areas, as overseas studies have highlighted positive contribution of air-conditioning to health in an institutional setting. Almost all facilities in each state commented that fans were used as a supplement to air-conditioning, both in common areas and in resident rooms to assist with cooling. Research suggests that in cool or hot dry air (when humidity is low) fans may be detrimental to the health of older people, particularly in very hot weather. Staff in SA were more aware of the detrimental nature of using fans in the elderly population, possibly because of the hot, dry climate experienced in SA, whereas less staff in Queensland and New South Wales were familiar with the limitations of fan use.

Although most rural ACFs said they had some form of in-service education, the regularity of these sessions was variable and the majority did not include any information or education on caring for the elderly in extreme heat. Overall the staff in all states who participated in the study commented that updated, consistent training on ways to minimise heat-related health risk, both to residents and staff in ACFs was badly needed.

Rural SA facilities were more likely to receive heatwave warnings through SAFECOM or SA Health, with fewer facilities in NSW and Queensland commenting that notifications directly aimed at aged care service providers were received prior to an extreme weather event. This highlights the need for a dedicated communication strategy to be developed in each state, driven by the lead agency (Health or Emergency services), which can be disseminated prior to an anticipated heatwave.

Communication was highlighted as a major factor in minimising heatwave risk. Although many participants commented that communication about heatwave protection strategies within ACFs could be improved, communication with residents’ families was raised as a particular issue. The investigation of this area is outside the scope of this data collection, but is an area for future research.

**Strengths and limitations**

This study is the first of its kind to investigate the strategies rural ACF staff use to care for aged nursing home residents in the Australian context. The response rate in all states is lower than anticipated, however finding time to complete a telephone interview whilst conducting daily clinical and administrative tasks can be difficult, and is probably reflective of the current workload of ACF staff.

The states participating in this study were chosen because of their differing climate and geography, although it was not within the scope of this study to study geographical variation between states. Each state varies in its current development of a Heat Health Plan. South Australia has a clearly defined Heatwave Plan administered by SA Health and SAFECOM (under the State Emergency Plan), whilst Queensland has incorporated the state heatwave plan into the State Emergency Plan (but does not clearly define heatwave response). At present New South Wales does not have a State-wide Heatwave Plan, but is currently developing a Heat Health Warning System. As such, the results of this study may not be generalisable to other Australian States where Heatwave Plans and Policies are already in place.

**Conclusions**

Although the Australian rural population is far less than the urban population, the proportion of residents aged 65+ is greater in rural towns than in major cities. The limited aged care options for rural residents mean that they will almost certainly be older, sicker and frailier by the time they need to enter an ACF. This in itself makes this group the most vulnerable of the vulnerable when it comes to experiencing the effects of extreme heat.
There is substantial evidence to support the increasing likelihood of extreme heatwaves in New South Wales, Queensland and SA. In conjunction with the increasingly aged rural population who are known to be at risk, extreme heat may lead to an increase in morbidity and mortality in this group. Recommendations have been divided into five key areas which address the key deliverables of this research project. The following recommendations are made as a result of the findings of this research study:

- A consistent policy for the management of aged care facility residents during periods of extreme heat should be developed in collaboration with aged care service providers, DoHA and the Aged Care Association of Australia.

- Continuous monitoring and review of response to extreme heat should be part of regular continuous improvement strategy.

- Upskilling staff on the importance of caring for the elderly in periods of extreme heat should be a part of regular in-service for all aged care facility staff. This training should be made mandatory prior to each summer season.

- An educational resource for aged care staff and service providers which focuses on maintaining wellness in the heat needs to be developed.

- Where possible sustainable options for cooling should be investigated especially in older rural facilities that are not purpose built as aged care facilities. E.g. solar power, reflective paint, adequate ventilation.

References


