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Managing health impacts of heat in South East Queensland, Australia

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Abstract
Heatwaves kill more people than any other natural hazard in Australia. Current literature on managing health risks of heatwaves highlights the importance of implementing urban planning measures, and engaging with vulnerable groups on a local level to better understand perceptions of risk and tailor health protection measures. This paper reviews arrangements to reduce heatwave health risks in South East Queensland in response to these themes.

A literature search and document analysis, stakeholder interviews, and multi-stakeholder cross-sectoral workshops revealed that although heatwave management is not always considered by local government and disaster management stakeholders, many urban planning measures to minimise urban heat have been pursued. However, greater information from vulnerable groups is still needed to better inform heatwave management measures.

Keywords: heatwave, health, vulnerable groups, urban planning, disaster management

Introduction
Heatwaves have been associated with increased morbidity, mortality and hospital admissions in many metropolitan regions globally, including the South East Queensland region (SEQ) in Australia. Climate change is projected to increase the frequency and severity of heatwave events in SEQ, along with an increase in mean and maximum temperatures. This could have critical implications for human settlements in the region as urban areas are especially sensitive to heatwave events.
because of the urban heat island effect (UHIE)\textsuperscript{8,1}, thereby exacerbating heat exposure for urban residents.\textsuperscript{9}

This paper contributes to inform multi-scale heatwave management efforts by focusing on the example of SEQ. It draws on the findings of the Human Settlements component of the South East Queensland Climate Adaptation Research Initiative (SEQCARI), a three-year integrated multi-sectoral study of climate change adaptation options for human settlements in SEQ, including urban planning and management, coastal management, physical infrastructure, emergency management and human health. To this end, the paper is structured in three parts. The first part presents the SEQCARI research approach followed by a literature on heatwave management broadly. The second part presents background information on SEQ and investigates cross-sectoral ambivalences to heatwave management and risks based on document analysis, literature review and empirical data derived from stakeholder workshops and interviews. The paper concludes by providing insights that can inform the development of heat management measures under a changing climate.

**Research approach**

The Human Settlements component of SEQCARI aimed to explore and develop a range of appropriate adaptation strategies, policies and practices in each sector and across sectors, for better governance and management in response to the impacts of climate change. The research project was specifically directed to the SEQ region due to the earlier recognition of this region as one of six climate change ‘vulnerability hotspots’ in Australia.\textsuperscript{10} The region is particularly vulnerable because of its coastal location and the distribution and location of its rapidly growing population. The project adopted a case study approach\textsuperscript{11} that took both a systems view of the whole region and focused on key sectors within the SEQ region, including human health as well as urban planning and management, emergency management, physical infrastructure and coastal management.

Data collection involved cross-sectoral workshops and interviews as well as document analysis and literature review. Two series of workshops were carried out

\textsuperscript{1} The UHIE is generally understood as the warming of urban areas in comparison to surrounding rural areas by several degrees (Oke, in Coutts et al 2010, p. 29)
in 2010 and 2011 with stakeholders from state government agencies, non-government organisations (NGOs) and local government working in the sectors of human health, emergency management, urban planning and management, physical infrastructure and coastal management. These workshops generated stakeholder input on preliminary climate adaptation options developed by the SEQCARI team, including adaptation options relating to heatwave management. A total of forty-two stakeholders participated in these workshops.

A total of 30 interviews were carried out with state government representatives, representatives from four local governments and NGOs (see Table 1 for a list of stakeholders representing different sectors which participated in interviews) during 2011. Interview questions related to climate change adaptation in the SEQ region, including impacts and priorities, factors affecting policy development for climate adaptation, barriers to effective action, opportunities for capacity building and integration of climate adaptation actions into other policy objectives. Interview content was analysed using NVivo software with a specific focus on references to heatwaves and hot weather. Based on this analysis, this paper is specifically informed by six interviews with stakeholders working in the human health sector as well as four interviews with stakeholders engaged in urban planning and management, emergency management and coastal management.

[Insert Table 1 here]

In parallel, a document analysis and literature review was undertaken to identify merits and limitations in heatwave management plans globally, and investigate the nature of extreme heatwaves, health impacts and heatwave management in the SEQ region. This included an examination of refereed journal articles, urban planning reports, and regionally based disaster management plans.

**Heatwave management**

The impact of UHIE can be managed through a number of planning measures that often also benefit other urban policy goals such as air quality and energy usage.\textsuperscript{12,13} Nevertheless, a raft of other adaptation measures will be needed to deal with
increased risk of heat-related events and subsequent morbidity and mortality due to climate change.\textsuperscript{9,14} These measures should be focused on increasing adaptive capacity of groups and individuals that are more vulnerable to heat-related morbidity and mortality, determined by social and community factors, as well as people’s physiological characteristics.\textsuperscript{15} Such vulnerable groups include the elderly (particularly women), persons with chronic conditions and/or disabilities, persons in heat-exposed living conditions, the socially isolated, people living in culturally and linguistically diverse communities, and people engaged in strenuous physical activity outdoors.\textsuperscript{16-19} Risk factors may also include housing characteristics, socioeconomic conditions or environmental impacts such as UHIEs.\textsuperscript{18,20}

To address increased risk of heatwave events, a number of cities globally have developed heatwave management plans and other adaptation measures to reduce associated health risks.\textsuperscript{21} This is also the case of health authorities, local governments and NGOs in Australia.

Heatwave management plans have several desired features as shown in Table 2. These features may comprise strategies aimed at supporting vulnerable groups. These include, but are not limited to, early warning systems, hotlines providing heat-related health information, ensuring organisations working with vulnerable groups have protocols and plans in place to manage risks during a heatwave and providing outreach to homeless people.\textsuperscript{2,22-28} These strategies support measures taken by individuals and communities to manage health impacts of heat such as drinking plenty of water, minimising physical activity, checking on vulnerable family members or friends, spending time in cool spaces such as shopping centres or cinemas, planning activities so to avoid being outdoors during the hottest parts of the day, taking cool showers or baths, and keeping homes as cool as possible.\textsuperscript{26}

\textit{[Insert Table 2 near here]}

Moreover, local governments can target community-level intervention, including awareness campaigns reinforcing messages set out by state governments and NGOs, distribute health information in different languages and assist in the identification of local risks that can guide the development of local plans.\textsuperscript{27}
Additionally, local governments can also provide important information related to infrastructure that can assist in tailoring heatwave response plans at the local scale to avoid disruption in services provision during heatwave events, particularly electricity and public transport.\textsuperscript{27}

However, while there are many benefits associated with heatwave management plans as above-mentioned, managing heatwave impacts is not simple and there are challenges concerning the development and implementation of heatwave management measures as shown in Table 2. For example, the development and implementation of heatwave management plans are confronted by limited information regarding vulnerable groups, competing issues, and ambivalence from the public and urban institutions.\textsuperscript{15,19,29} Additionally, perceptions of heatwave risks often differ across policy makers and cultural and demographic groups.\textsuperscript{22,30} Those that are more vulnerable or at risk might not necessarily see themselves as such.\textsuperscript{31} As a result, developments in heatwave management have pointed to benefits of engaging with vulnerable groups and/or communities on a local level to better understand their perceptions of risk and tailor health protection measures.\textsuperscript{15,22,26,31} In particular, individuals from vulnerable groups (defined through common social and/or geographical interests/characteristics) can take an active role in researching needs and assessing hazards and their capacities.\textsuperscript{32,33}

Background – the SEQ context

The SEQ region encompasses 11 local authorities (see Figure 1), which covers an area of approximately 2.2 million hectares. Over the last 100 years, human settlement in SEQ has occurred in the least constrained and easily developed topographical settings, namely the narrow coastal zone and the lower reaches and estuary of the Brisbane River. Hence the majority of the population in SEQ inhabits urban areas with a significant proportion along the urbanised coastal areas extending from the Gold Coast in the south to the Sunshine Coast in the north. The Intergovernmental Panel on Climate Change (IPCC) identifies SEQ as one of the ‘hot spots’ in Australia to be affected by climate change.\textsuperscript{34} Despite the uncertainty surrounding current climate science, models have shown that the region will be affected by changes in average rainfall, increased temperatures, sea-level rise and an increase in extreme weather events.\textsuperscript{6}
Specifically, annual average temperature is projected to increase between 0.5 and 1.5°C by 2030. In SEQ, a heatwave is defined as two or more days of apparent temperature exceeding 36°C. The increase in mean temperatures will also increase the number of days over 35°C in the region, therefore leading to heatwave events. In particular, the current average of 3 days exceeding 35°C is expected to change to 3-6 days by 2030 and 4-35 days by 2070.

There is little reliable information regarding vulnerable groups’ specific behavioural responses to heat in SEQ. In comparison, Australians may exhibit a number of adaptive behaviours during a heatwave such as drinking plenty of water, listening to daily weather forecasts, wearing a hat when going outside, seeking protection of shady areas when outdoors, and/or going for a swim or to an air-conditioned places to cool down.

Although SEQ residents are accustomed to its subtropical climate and warm temperatures, there remains significant health risks associated with heat, particularly for vulnerable groups. For example, heatwaves and increased ambient heat in Brisbane, the largest city in SEQ, have been found to have acute effects on morbidity, mortality, emergency hospital admissions and emergency ambulance calls, particularly for elderly people. In the absence of adaptation measures, predicted population growth, temperature increases and an ageing population could increase heat-related deaths in Brisbane from the current estimated 134 per year to over 1,000 deaths per year by 2050.

Data relating to relationships between ambient high temperatures, mortality and socio-demographic factors is relatively scarce for subtropical regions such as SEQ, and scholars have called for better identification of the region’s most vulnerable groups during heatwave events. Anecdotal evidence of previous heatwaves in SEQ indicates that many elderly people as well as other vulnerable groups were largely ignorant of the risks posed by heatwaves or of measures they could take to reduce risks, and that social isolation exacerbated vulnerabilities of many individuals. A study by Loughnan et al. found a significant correlation between adverse health impacts of heat in SEQ and the following: age (particularly for people aged over 65 years), need for assistance, accessibility to emergency services, urban design, aged care facilities, single-person households, population density, UHIE during night-time, and land cover.
Expanded impervious surfaces appear to have led to increased temperatures in SEQ's urban footprint (including coastal urban areas) due to an increased UHIE.\textsuperscript{42} Built-up areas in SEQ's major urban centre, Brisbane, are generally 2°C warmer than the average temperature, while vegetated areas are up to 3°C cooler.\textsuperscript{43} In some neighbourhoods relatively high heat exposure is compounded with lower socioeconomic status, making them particularly vulnerable to heat impacts as they are more likely to have reduced mobility options and restricted access to air-conditioned environments (such as private air-conditioned transport, shopping centres and libraries).\textsuperscript{31,42} This context calls for additional measures to be put in place as recommended by heatwave management plans, including checking in on vulnerable individuals (through visiting residences or making phone calls), and developing registers of vulnerable people for this purpose; providing accessible cool public spaces and transport to them if necessary; and providing outreach to homeless people.\textsuperscript{2,20-24}

**Results**

In SEQ, existing research shows that health impacts of heat in the region are significant.\textsuperscript{16,17,21,26,35,38-40} Additionally, climate change is likely to exacerbate the risk of heatwaves given the predicted increase in average temperatures in SEQ.\textsuperscript{7,11,35} Hence, heatwave management certainly comprises an important task for stakeholders in SEQ to minimise potential heatwave impacts upon its population. Specifically, seven key themes related to heatwaves emerged from the analysis of the interviews. These included: consideration of heatwaves in disaster management plans, multi-agency approach to managing heatwaves, urban planning measures, improved community engagement and communication, perception of the heatwave problem, role of local government, and community capacity building and resilience. Table 3 shows illustrative quotes for each theme per sector and type of organisation.

[Insert Table 3 near here]

For example, some local governments in the region have included considerations of heatwaves as natural hazards in their local disaster management plans in addition to
a state-level heatwave response plan. For example, a local government interviewee stated that:

“a heatwave would be, or could be, categorised as a natural disaster under our definition of disasters. So our local disaster management group … would be responsible for acting in those situations. So the members of that committee made up of all the different areas of responsible people, … all the relevant players are in that particular group and basically collectively are making decisions on which messages are put out to the public”.

Additionally, a multi-agency approach to respond and manage heatwaves was also highlighted by interviewees. In particular, it was identified that local governments are often in contact with organisations that work closely with many vulnerable groups as a part of the implementation of their disaster management plans. Some interviewees exhibited an appreciation of local government efforts to collaborate with local groups and NGOs to prepare for hot weather, contact vulnerable individuals (such as socially isolated individuals) and send health messages during hot weather. One state government interviewee stressed the importance of locally-based actions that utilise existing networks such as local government personnel, NGOs and community groups servicing people that may be vulnerable to heat:

“Well, I actually like - as I mentioned, the local government work, local conversations about what is a risk for my community in an integrated way rather than say just from a health point of view, so that's helpful.”

Such engagement is important and advantageous for the development of heatwave measures as it facilitates the identification of appropriate and relevant measures for vulnerable groups, including, for example, assisting people to access cool places and providing culturally appropriate information to people of diverse backgrounds to manage health risks.

The impact of UHIE can be managed through a number of planning measures such as building design and performance standards, tree planting programs and improving urban parklands and design guidelines. Our study indicates that there is popularity amongst SEQ agencies to adopt urban planning measures as an ally to manage heatwave events. Additionally, the use of planning measures to reduce UHIE and improve thermal stress in the built environment was well received amongst a wide range of stakeholders involved in workshops. In particular, local government personnel highlighted that many local governments in SEQ have also undertaken urban planning measures that reduce the UHIE and encouraged improvements in
thermal comfort in the built environment. These include building codes to increase energy efficiency and thermal comfort of the built environment, tree protection bylaws and urban forestry plans. Additionally, thermal imaging and surface temperature mapping with high satellite imagery analysis is used by some local governments in SEQ to identify hot spots in urban areas, however the cost incurred can be prohibitive for some local governments.

Cross-sectoral co-benefits associated with those planning measures are also often acknowledged by stakeholders. For example, there is recognition of the potential for initiatives that combat urban heat to co-benefit other urban management and human health policy goals such as climate change mitigation, health promotion through environments fostering active transport and physical recreation and water sensitive urban design. These are exemplified by the statements below:

“Designing sympathetic urban environments that don’t aggravate heat would be interesting and allow for physical activity and things.” (State government interviewee)

“Some of the measures of values that we’ve placed, and when I say values I mean in terms of carbon storage and sequestration estimates, the cooling effects, those kinds of things... that’s a very important part of our strategy for urban greening.” (Local government interviewee)

However, while some workshop participants largely expressed support for improvements to building codes for better thermal comfort in the built environment, and to reduce the UHIE in conjunction with consolidated urban development, others also recommended listening to community responses when planning measures to adapt to increased heat. In particular, some workshop participants called for additional public education and efforts to empower community resilience (although it was not clearly identified how participants agreed this should be done):

“There is a huge return on investment from including the community”
“For heat stress – educate and empower community resilience”

The perceptions of the significance of heatwaves as a health issue varied among stakeholders. One stakeholder from a locally based NGO considered heat events to be a significant climate change impact to plan for, whilst other interviewees saw that heatwaves were not a risk as SEQ residents are accustomed to hot weather and therefore resilient to heatwaves. Some interviewees working with human health and
emergency management issues admitted not engaging with heat as a health issue or having given it consideration:

“And you talk about heat. We know that that’s going to be one of the huge things … it’s a natural disaster but they don’t call it a natural disaster.” (NGO interviewee)

“I’m probably terribly ill-informed but that would be my reading of it. The community is pretty resilient to it. Whether it’s 5 days or 15 [above 35°C] it’s not going to make a massive difference.” (Local government interviewee)

“I would suggest if we had that sort of circumstance, the 35-40°C for 15-20 days or whatever it did, I’m not sure how the community would deal with that. But it’s a reasonable question to ask as it’s probably not something we’ve given much thought to.” (Local government interviewee)

Our study also indicates that there is general appreciation of the role of local governments in addressing heatwave health risks. As outlined by a state government interviewee:

“It needs to be done locally because it’s about personal contact… We know what happens when it gets hot but it is very hard locally to actually get the change in place… It’s much more ‘roll your sleeves up’ engagement from a departmental point of view.”

Community capacity building approaches were recommended by some interviewees, and considered to be an important part of any resilience-building model:

“If a community is resilient, they’re resilient to war, heat events, a meteor, whatever, so I’d like to see us taking an authentic community building approach.” (State government interviewee)

However, vulnerable groups within the community appear to be not often engaged in heatwave management planning. For example, the development of the state based Heatwave Response Plan did not involve engagement tailored to specific vulnerable groups, despite public engagement being a core aspect of the response plan, nor did it explore ways to target and tailor information to specific identified vulnerable groups (NGO interviewee). Awareness materials and engagement activities for heatwave response in SEQ do not appear to be targeted to vulnerable groups. However, at least one local government in SEQ is embarking on research for a greater understanding of perceptions of risk for different social groups. This is viewed as a long-term learning process for better public awareness relating to environmental health (Local government interviewee).
Discussion

Heatwave management plans often address preparation and response capabilities of urban institutions. These plans may include a range of measures such as early warning systems, improved public health response and preparedness, increased public awareness, and guidelines for response roles and responsibilities of agencies and stakeholders (see Table 2). Heatwave management plans can greatly improve both public and health service awareness and preparedness as well as provide a range of strategies to help ensure support for vulnerable groups is prioritised.

Awareness strategies may include hotlines providing heat-related health information, providing culturally appropriate information to people of diverse backgrounds to manage health risks and coordinating mass media announcements encouraging people to take measures to reduce heat-related health risks. Complementary, preparedness strategies could include developing registers of vulnerable people for this purpose and ensuring organisations working with vulnerable groups have protocols and plans in place to manage risks during a heatwave.

Specifically, heatwave measures are often needed for disadvantaged groups who cannot access air-conditioned houses and cars during heatwaves, as well as systems for when power fails or is restricted during extreme heat. It has been argued that social and community-related factors of heat risks are often poorly understood, with social isolation, socio-economic status and neighbourhood characteristics often absent from heatwave management planning. The inclusion of various stakeholder groups provides knowledge about local and/or community-specific conditions as well as potential response actions and their effectiveness. Such stakeholder groups might include organisations representing and working closely with vulnerable groups, including families and carers of vulnerable individuals as well as community and neighbourhood level groups. Additionally, engaging vulnerable groups in the development and review of heatwave management plans and communication systems helps to ensure that they are effective and appropriate for those groups.

Nevertheless, risk awareness measures in SEQ are greatly tailored to broader audiences. This is despite the recognition by stakeholders which is also supported by scholars such as Ebi and Semenza of the importance of developing and testing awareness measures tailored specifically for vulnerable groups such as elderly...
populations. In particular, older Australians and people with disabilities often have limited access to information, resources and/or community participation, making them potentially more difficult to reach. Similarly, people of culturally and linguistically diverse backgrounds may have limited access to health warnings due to linguistic and social isolation, language barriers and low literacy rates. This vulnerability is exacerbated by higher levels of socioeconomic disadvantage, cultural factors, health issues, poor housing conditions and limited access to air-conditioning for many culturally and linguistically diverse communities in Australia.

The development of heatwave management plans in SEQ has involved collaboration of a range of stakeholders, including organisations that work closely with vulnerable groups (such as elderly and homeless people, and lower socioeconomic communities) to address risks. Disaster plans such as these can enable support for vulnerable groups to be prioritised as well as planned contingencies for potential collapse in services during a heatwave. Collaborative disaster management arrangements that allow active involvement of organisations representing the interests of vulnerable groups (such as found in SEQ) enable the auto-assessment of hazards and capacities. These arrangements can also assist in identifying cross-sectoral co-beneficial strategies, barriers and opportunities for heatwave management initiatives as well as in developing actions that are tailored to vulnerable groups. Additionally, Hansen et al. ’s study suggests that strong partnerships at a local level, particularly between government and community organisations facilitate effective heatwave management for vulnerable groups.

However, our study indicates that although SEQ agencies have concentrated efforts to develop and implement heatwave management plans across the region, there remains a critical gap in those efforts which is related to the poor engagement and focus on vulnerable groups. For example, despite the acknowledgement by stakeholders of the importance and advantages of engaging with vulnerable groups, it is not clear that these advantages have translated into formal locally-based heatwave plans for most local governments in SEQ. Literature reveals that there is great variability across groups at risk, that poor understandings of community-related factors can constrain the effectiveness of heatwave management plans, and that better understanding of perceptions of risk and barriers to behavioural change enables tailored health protection measures. Following this evidence
from the literature, heatwave management in SEQ could benefit from greater engagement with vulnerable groups to increase understanding of perceptions of risk and barriers to behavioural change, and tailor heatwave management accordingly. Community capacity building approaches that view vulnerable groups as resources and as people that can play a key role in reducing risks are sought after by many stakeholders. Indeed, expectations that information alone will result in reduced ambivalence to heat risks and changes in behavioural responses to risk may be unrealistic. Community-specific health protection measures that use existing social networks and local community-based organisations can be useful to synthesize a higher level of collective knowledge, and generate a greater understanding of why vulnerable groups may fail to change behaviours to reduce heat-related health risks and/or become ill during heatwaves despite being exposed to public health messages. For example, a post-heatwave focus group of community organisations undertaken in Melbourne, Australia indicated that these measures also may include improvements in funding and communication arrangements between government agencies and community organisations during heatwave response. Additionally, Yardley et al. proposed the development of community-specific action plans and the preparation of needs assessments by people living in vulnerable neighbourhood’s themselves. These measures could increase the understanding of heatwave risks among vulnerable groups thereby facilitating and encouraging behaviour change during heatwave events such as seeking shelter in cooler places and drinking plenty of water.

However, Wolf cautions that strong social networks should not be assumed to translate into greater adaptive capacity to address extreme heat, and that any dangerously low perceptions of risk held in social networks need to be understood and addressed. Comments suggesting ambivalence towards issues of health risks from heatwaves support research findings asserting the presence of ambivalence towards heat in Australia, and assertions of differing perceptions of risk amongst policy makers. Several studies suggest that such ambivalence may be a problem where it leads to a failure to make serious efforts to minimise adverse health impacts of heatwaves, or to even consider health impacts of heat as an important topic of research.
Although many stakeholders said they wanted to see the community empowered to reduce risks associated with heat, could this also be constrained by ambivalence and limited community interest? Additionally, reliance on volunteers and social networks can be problematic where they are not adequately resourced. Consequently, more information is needed on vulnerable subgroups to better understand their perceptions of risk, and potential for risk reduction initiatives that involve active involvement and direction from community groups.

**Conclusion**

This paper aimed to broaden the understanding of how heatwave management measures could be improved as part of climate change adaptation responses by focusing on the example provided by the SEQ region in Australia. Heatwaves in SEQ have a significant impact on morbidity, mortality and hospital admissions. Hence, in the absence of adaptation measures, health risks associated with heatwaves and extreme heat events will increase due to climate change, an ageing population and urban growth. Urban planning measures to reduce the UHIE and improve thermal comfort of the built environment are very popular amongst human health, urban planners and emergency management professionals across the region. As well as reducing urban heat, these measures also often benefit a range of other urban policy goals.

Perceptions of risk of heatwaves differ among stakeholders in SEQ. In particular, more information is needed on vulnerable groups and their perceptions of heat risk. However, to be effective this type of information needs to be constantly updated therefore demanding the allocation of appropriate resources in financial and human terms. More heat-specific engagement may be needed to better understand likely effectiveness of different measures for vulnerable groups and allow community ownership of heat responses where community interest exists. Innovative information dissemination methods are also needed and should be targeted and tailored specifically to vulnerable groups.

In the specific case of SEQ, more research is needed to generate a better understanding of vulnerable groups and the potential for demographic and socioeconomic characteristics to influence and shape behavioural responses to hot weather. This includes information on the efficiency of health messages encouraging
individual and institutional workers to promote adaptive behaviours that can minimise the health impact of heatwave events including appropriate individual hydration and cooling strategies. Research is also needed to generate an understanding of different social groups in the region and how they may interpret and engage with risk communication and heatwave management measures as well as their own perception as to whether they comprise a risk group. This would help informing health organisations of the current behavioural responses to heat of vulnerable groups, as well as the most achievable and suitable behavioural responses to hot weather and associated communication strategies to manage health risks that correspond with local geographical and social contexts.

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The authors of this paper complied with all the legal requirements pertaining to the location in which the work was done.

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Figure 1: The SEQ region and local authorities
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<td>State Government</td>
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<td></td>
<td>Identification of barriers and opportunities to heatwave management initiatives.³¹</td>
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<tr>
<td>Effectiveness of plans (measurement parameters: morbidity and mortality rates; reaching out vulnerable groups)</td>
<td>Locally-based actions can contribute to plans effectiveness.¹⁵, ²⁶</td>
<td>Difficulty in attributing morbidity and mortality rates to heatwave management measures.²⁶</td>
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<td></td>
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<td>Paucity of data regarding effectiveness of plans.²⁴</td>
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<td>Community-related factors of heat risks are often poorly understood.¹⁵</td>
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<tr>
<td>Public health response</td>
<td>Improve both public and health</td>
<td>Competing issues and ambivalence</td>
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</tbody>
</table>
### Desired Features of Heatwave Management Plans*

<table>
<thead>
<tr>
<th>Merits</th>
<th>Challenges</th>
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<tbody>
<tr>
<td>service awareness and preparedness.</td>
<td>from public, workplaces and urban agencies in defining their own roles and responsibilities.</td>
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<tr>
<td>A range of strategies to support vulnerable groups can be included in health response guidelines.</td>
<td>Reliance on volunteers and social networks with limited resources.</td>
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<td>Greater dissemination of alerts.</td>
<td>The effectiveness of initiatives to reduce risks is constrained when the underlying social and economic factors leading to vulnerability are not addressed.</td>
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<tr>
<td>Risk communication targeting vulnerable groups provide information on ways to reduce heat risks.</td>
<td>Limited information regarding vulnerable groups.</td>
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<td></td>
<td>Individuals in vulnerable groups might not perceive themselves as being at risk.</td>
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<td></td>
<td>Need for testing of awareness measures (such as early warning systems and communication strategies) with vulnerable groups.</td>
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<td></td>
<td>Often tailored to broader audience without considering needs of vulnerable groups.</td>
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<td></td>
<td>Awareness initiatives need to consider the needs and perceptions of different groups.</td>
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<td></td>
<td>Risk awareness does not necessarily result in behavioural changes.</td>
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</tbody>
</table>

* Features extracted from literature, sources indicated after each feature.
<table>
<thead>
<tr>
<th>Theme</th>
<th>Quote</th>
<th>Interview Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consideration of heatwaves in disaster management plans</td>
<td>So our local disaster management group … would be responsible for acting in those situations</td>
<td>LG, EM</td>
</tr>
<tr>
<td>Multi-agency approach to managing heatwaves</td>
<td>if you wanted to say like for example, the vulnerability of the aged, then the community sector and the aged care sector together could take that on board and work with it, with local governments and health as a support</td>
<td>SG, HH</td>
</tr>
<tr>
<td>Urban planning measures</td>
<td>working with agencies whether it’s Queensland Health or all of those agencies that have vulnerable clients out there</td>
<td>NGO, EM</td>
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<td></td>
<td>You know, there might be other communities things about how you keep cool, plant more trees, whatever, you know, that’s all not technically complex because it’s pretty straight forward</td>
<td>SG, HH</td>
</tr>
<tr>
<td>Improved community engagement and communication</td>
<td>A climate proofed region is one that has really considered its spatial planning well</td>
<td>NGO, UPM</td>
</tr>
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<td></td>
<td>And there was excess death there but it was mainly in the elderly. So it’s a challenge for aged care institutions, isolated elderly… People had forgotten their basic messages about how to manage in the heat</td>
<td>SG, HH</td>
</tr>
<tr>
<td>Perception of the heatwave problem</td>
<td>And I guess elderly people are big thing there and a lot of people say, “Well, you need to use elderly people as a resource and you need to actually be talking with them and seeing whether the heat wave management measures are appropriate to that particular social group.”</td>
<td>NGO, EM</td>
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<tr>
<td>Role of local government</td>
<td>heat is one of the areas that we’d like to see an investment in and the challenges, we haven’t focused on that. We’re torn between the heatwaves, doing heatwave work and flood work this summer</td>
<td>SG, HH</td>
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<tr>
<td>Community capacity building and resilience</td>
<td>Community has a level of resilience to heat…not unusual for us to get 35+ days for 5-10 days/year</td>
<td>LG, EM</td>
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<td></td>
<td>local government should be especially identifying areas of vulnerability for different kind of health outcomes associated with climate and identifying hot spots, and maybe that could also be done for strengths as well, like in terms of areas where things are going well.</td>
<td>SG, HH</td>
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<td></td>
<td>It’s all - if we could have an integrated mechanism and sincerely invest in building community resilience that would be ideal. But obviously we do need education, we need people to know to respond and we need local things in place in the event.</td>
<td>SG, HH</td>
</tr>
</tbody>
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SG state government; LG local government; NGO non-government organisation, UPM urban planning and management, EM emergency management, HH human health