ABSTRACT

Heatwaves are dangerous and have killed more people in Australia than all other climate related disasters combined. Urban environments are considered especially vulnerable to heatwaves due to the Urban Heat Island effect. Increasing death rates from heatwaves are predicted to become one of Australia's most detrimental impacts of climate change (IPPC 2014) with major implications for emergency services and public policy development. The catastrophic dimensions of heatwave mortality are not spread evenly across society but are concentrated among specific population groups. Older people, especially women, are overrepresented in heatwave related excess mortality statistics internationally. Using a critical perspective, this paper aims to present a literature review exploring current research on social vulnerability of older women during urban heatwaves. It will illustrate how heatwave vulnerability is largely socially constructed through the intersection of deeply entrenched gender inequality with systemic socio-economic disadvantage. The review will highlight the need for heatwave intervention to be guided by a social justice perspective, to avoid older, poorer women becoming the shock absorbers of the climate crisis.

This paper is part of my PhD research project at Monash University: 'Denaturalising heatwaves: gendered social vulnerabilities in urban heatwaves and the use of public cool spaces as a primary heat health measure'. The research has ethics approval.

Peer-reviewed article

Denaturalising heatwaves: gendered social vulnerability in urban heatwaves, a review

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Introduction

> *It is not the body-object described by biologists that actually exists, but the body as lived by the subject.*
>
> Beauvoir (1953, pp 69)

Heatwaves are dangerous and have historically been responsible for 95 per cent of deaths of all climate hazards in post-industrial societies (Poumadere et al. 2005). Although heatwaves have killed more people in Australia than all other climate related disasters combined (Coates et al. 2014), they have only recently started to be considered a serious health threat in public consciousness and discourse. Exposure to extreme heat poses a serious health risk to the community and heatwave mortality rates are set to increase dramatically as more climate change related extreme weather events are forecast due to rising greenhouse gas emissions (Forzieri et al. 2017; Intergovernmental Panel on Climate Change [IPCC] 2018; Mora et al. 2017).

Growing heatwave deaths are predicted to become one of Australia's most detrimental impacts of climate change (IPPC 2014) with major implications for emergency services and public policy development. The effects of extreme heat are determined by the unique intersection of geographical, climatic and human characteristics of a given location affected by the hazard. Cities rate particularly high on the heatwave risk index due to the complex interaction of a growing and aging population, the built environment and the Urban Heat Island effect, posing unique challenges to urban populations (Bambrick et al. 2011: Harlan et al. 2006). The negative health impacts of heatwaves are not shared equally across society but are concentrated among specific population groups.

Heatwave vulnerability rises dramatically with age and poverty, with older women overrepresented in international research conducted into heatwave mortality statistics (Borrell et al. 2006; Keller 2013; Poumadere et al. 2005; Staffogia et al. 2006; van Steen et al. 2019; Tong 2015).

In his study on the infamous deadly 2003 heatwave in Paris, of which 64.25 per cent of victims were older women (Poumadere et al. 2005), Keller (2015, p88) draws out physical locations as simultaneous critical settings and sources of disaster. The tiny, badly insulated and marginal apartments many of the poverty stricken heatwave victims occupied, were not simply places where disaster struck but became literally agents of mortality (Keller 2015). The study draws attention to the link between risk in urban geography, such as poor housing, with social biographies of economic disadvantage.

The research presented in this literature review highlights that heatwave vulnerability is to a large extent socially constructed and challenges the proposition that heatwave disasters are 'natural', hence unavoidable and inevitable.

Aim

This literature review has drawn together existing international and national heatwave research from a range of disciplines and aims to contribute to current knowledge and gain important insights on heat vulnerability for older women in urban environments that can inform heat adaptation programs and ultimately help save lives. Although an increased number of studies and publications related to the multidimensional impacts of heatwaves are being generated, there is a need to explore in more detail the lived experience of the most affected and give voice to their concerns.

Scope and methodology

The literature search concentrated on research published in English between 1996- 2019. This review is limited in scope and only focuses on the vulnerability of older women during urban heatwaves in major cities in Australia, Europe and the U.S. Although mental health, disability and homelessness are considered important risk factors in existing heatwave research, they are not explored as separate heat vulnerability factors in the literature presented. Research on how these risk factors intersect specifically with gender in urban heatwaves is in the emerging stages and data very limited.

Information related to gender represented in this review is confined to 'male' and' female' categories only, due to the lack of accessible research available on this topic that is reflective of a non-binary gender spectrum.

The topic was explored across a range of disciplines and practice fields using online searches of Academic Search Premier, ProQuest, Web of Science, Google Scholar, Geobase and keyword combinations included 'climate change', 'urban heatwave', 'social vulnerability', 'gender', 'heat stress', 'adaptive behaviour', 'resilience', 'public health'. The search included reference lists from peer-reviewed articles and books. Grey literature is also included in the form of publications from key international agencies, such as the World Health Organisation and the International Panel on Climate Change (IPCC), Australian government departments and relevant Australian non–government agencies.

Heatwaves, climate change and health

Human existence has been largely shaped and informed by our interaction with nature and our capacity to adapt to changed environmental circumstances, but the biological limit to heat tolerance is narrow. Extreme heat affects the human body on a continuum and while some deleterious health impacts are directly related to heat, it can also function on an indirect level and exacerbate pre-existing health concerns (Costello et al. 2009; Loughnan et al. 2013).

A substantial body of literature has emerged over the last decade warning that climate change is considered the biggest threat to global health in the 21st century and argues that peoples' involuntary exposure to it's multifaceted consequences, such as heatwaves, represents health inequity on a grand scale (Patz et al. 2007; Watts et al. 2018). The Intergovernmental Panel on Climate Change (IPCC) warned in 2014 that increasing deaths from heatwaves could become one of Australia's most detrimental impacts of climate change in the future, with major implications for emergency services and public policy development (IPPC 2014). Current global warming of 1°C above a preindustrial baseline has already created a 'new normal climate', characterised by more extreme weather patterns, including a dramatic increase in heatwave frequency, duration and intensity (Perkins-Kirkpatrick & Pitman 2018). Over 200 climate records were broken during the Australian summer of 2016- 2017 which was also marked by several high intensity heatwaves across the entire continent (Steffen et al. 2018). In January 2019, the hottest ever recorded month in Australian history, defined by rolling heatwaves unprecedented in duration and geographical reach, Melbourne experienced warmer than average maximum and minimum temperatures (BOM 2019a) and Adelaide recorded its highest ever temperature of 46.6 degrees in the city on January 24 (BOM 2019b). All Australian urban centres are predicted to experience more short-term heatwaves in the future (Papalexiou at al. 2018), with a threefold increase in heatwave days projected for capital cities (Herold et al. 2017).

In 2009 and 2014 over 500 people lost their lives in two major heatwave events in Victoria alone (Coates et al. 2014), well eclipsing deaths from bushfires in the same period. Studies conducted in Europe have mirrored the disproportionate death rate from heatwaves compared to other natural hazards. Research into excess mortality during the notorious 2003 European heatwave recorded well above 35,000 deaths, of which 15,000 occurred in France alone (Keller 2013, Vandentorren et al. 2006). From 1999 – 2003 over 3,400 deaths were associated with extreme heat in the U.S. (Harlan et al. 2006), and the 2010 Eastern European and Russian heatwave was also catastrophic, killing around 55,000 people (Coates et al. 2014). New research is projecting a significant expansion of the global population's exposure to lethal heatwaves (Mora at al. 2017), with global heatwave mortality rates to make up 99 per cent of future climate-related deaths by the end of the 21st century (Forzieri et al. 2017).

Heatwaves and urbanisation

It is argued that climate related phenomena, such as heatwaves, are part of global meteorological processes but that their effect will be felt uniquely on the local level depending on the given ecological and 'human environment'

(Costello et al. 2009; Keller 2013; Klinenberg 2002). For the first time in history city dwellers outnumber people living in rural communities and the UN Framework Convention on Climate Change (2017) estimates urban populations to double by 2050. This is an issue warranting significant attention in the Australian context, where 67 per cent of the population live in capital cities (ABS 2017) and the percentage of people over 65 is expected to double in 50 years, with single households occupied by people aged 75+ set to grow significantly (ABS 2010).

While acknowledging cities to be pivotal sites of innovation, creativity and social connectivity, increasing urban expansion poses challenges and risks to human wellbeing and future ecological sustainability. The loss of natural habitat and green space from growing suburban sprawl threatens ecosystems, diminishes biodiversity and local food production and exacerbates existing health hazards in urban environments (Bambrick et al. 2011). Dawson (2017) argues that urbanisation and its associated environmentally harmful consumption patterns are significant contributors to greenhouse gas emissions and suggests that these interrelated processes are stark embodiments of a growth-centered fossil fuel powered capitalist economy that is compromising human and planetary wellbeing.

Cities are highly vulnerable to the deleterious effects of heatwaves due to a complex interplay of natural factors with the physical and social environments present at a given point in time. Cities are warmer than rural areas, due to urbanisation processes (Harlan at al. 2006; Li & Bou-Zeid 2013; Steffen, W, Hughes, L & Perkins, S 2014). A combination of large amounts of heat absorbing building material combined with heat creation from air-conditioned buildings, a lack of shade and green space, create an 'urban heat island effect' (UHI), which results in higher day time temperatures and less cooling at night (Kovats & Hajat 2008; Li & Bou-Zeid 2013). A range of heatwave studies across continents identified warmer neighbourhoods with little green space and a densely built up environment as risk factors of heat vulnerability (Harlan at al. 2006; Loughnan et al. 2013; Poumadere et al. 2005; Vandentorren et al. 2006).

Social vulnerability: age, gender and poverty

Social vulnerability

Patz et al. (2007) make the point that everybody can feel the impact of heatwaves, but the associated burdens are not evenly spread across society, earning heatwaves the title of 'silent and invisible killers of silenced and invisible people' (Klinenberg 2002). This suggests the existence of underlying disaster risk drivers creating different levels of vulnerability for some population groups.

The IPCC defines vulnerability as '…the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt' (IPCC 2014, p. 5). This definition is an important expansion of earlier versions used by the IPCC and climate change literature which focused on vulnerability in physical systems to also reflect the varied impact of environmental changes on human/social systems. The recognition of the social dimension of differential risks draws attention to the fact that susceptibility to climate events and adaptive capacity of individuals or communities is influenced by a range of factors beyond the actual nature of the climate hazard itself (Alston, Hazeleger & Hargraves 2019; Ford, Smit & Wandel 2006; IPPC 2104). The term 'social vulnerability' is increasingly used to discuss levels of resilience to natural hazards beyond the spatial dimension of location and to analyse the structural and situational aspects that increase risks for certain social groups and communities (Alston 2017).

Age, gender and poverty

Age classification is context specific and has varied over time and between countries, and most of the studies used did not include a precise definition for 'older or elderly people'. In Australia, 65+ is considered the onset of older age as it also correlates to retirement age (ABS 2012). Older people are significantly overrepresented in heatwave related excess mortality statistics internationally, partly due to biological factors, such as reduced thermal regulatory capacity, increased frailty and higher rates of pre-existing chronic illnesses (Kovats & Hajat 2008; Loughnan et al. 2013; Semenza et al. 1996). Age vulnerability is further compounded by poverty, low quality housing and social isolation (Steffen, W, Hughes, L & Perkins, S 2014; VCOSS 2013; Department of Health and Human Services 2018).

A critical orientation, reflecting the intersectionality of systems of power acting upon people's lives, understands human experience to be intensely subjective and at once structured through the existence of discriminatory social relations that create shared experiences among population groups. Greig, Lewins and White (2003, p. 39) suggest that 'although an individual's health is played out as a subjective experience of their own body, the experience itself is a product of social inequalities that inscribe disease on the body'. Heatwave-related multi stress vulnerability seems most prevalent among low-income earners and the socially isolated, as it reduces their ability to access protective resources, such as appropriate housing and affordable cooling options (Klinenberg 2002, Semenza et al. 1996, Vandentorren et al. 2006, VCOSS 2013). A Melbourne research project conducted by the Victorian Council of Social Services (VCOSS) found that seniors in rooming houses and poor-quality public housing had limited social interaction between residents, increasing their vulnerability (VCOSS 2013). The same housing options, which are heavily associated with residents from precarious and low socioeconomic background, were also identified as key stressors during a heatwave, transforming these accommodation options literally into 'hot boxes' (VCOSS 2013, p.16).

Cannon (1994 cited in Neumayer & Pluemper 2007, p 552) also points to low socioeconomic status and class as major risk factors in determining the extent of human vulnerability to climate hazards, claiming that 'there are no generalised

opportunities and risk in nature, but instead there are sets of unequal access to opportunities and unequal exposures to risks which are a consequence of the socio-economic system'. This implies that poverty, defined through lack of access to power and resources, becomes a key deciding factor in the circumstances of people's lived experience and their adaptive capacities.

Systemic gender oppression, associated with entrenched discriminatory gender roles, power imbalances and reduced access to economic resources, is identified as a key climate and heat health risk factor for women, who make up the vast bulk of the global poor (Alston 2013a; Burns et al. 2017; Dankelman 2010; Denton 2002; Enarson 1998). Neumayer and Pluemper (2007) found that the lower the socio-economic status of women, the higher their mortality rate, compared to men, in climate disasters. These findings are supported by research into several fatal heatwaves, which uncovered an overrepresentation of women in mortality statistics (Keller 2013; Poumadere et al. 2005; Staffogia et al. 2006; Borrell et al. 2006; van Steen et al. 2019; Tong et al. 2014). Although some authors speculate that physiological reasons, such as menopause related reduced thermo-regulation and hormonal changes, may well contribute to increased female vulnerability (Tong et al. 2014; van Steen et al. 2019), our understanding of the complex interaction of human bodies with heatwaves is still rather limited and warrants further exploration. Women's general longer life expectancy may also account for a higher mortality rate in heatwaves.

Despite Australia's diverse ethnic population, warming climate and propensity to heatwaves, literature on this topic is very limited, creating a serious gap in public health knowledge. One exception is the Hansen et al's 2014 study, using focus groups and interviews across three major Australian cities. It found that older CALD community members might experience increased vulnerability based on language barriers and sociocultural factors. No specific research data is available to date that focuses specifically on the health impacts of urban heatwaves on older women from culturally and linguistically diverse (CALD) or Indigenous backgrounds. Existing studies can be enhanced through in-depth qualitative case studies and interviews and ethnographic work which place underrepresented population groups as key stakeholders in the inquiry process, hereby generating knowledge and meaning for transformative and emancipatory purposes.

Further research into the gendered nature of heatwaves is particularly important as women have a longer life expectancy than men but also less economic recourse in old age. Petersen & Parcell (2014) found that more and more Australian women heading into retirement age are falling into poverty and housing stress, due to low — or lack of — superannuation, high living costs and expensive housing, increasing women's vulnerability to future heatwaves.

Table 1: Excess heatwave mortality risk based on age (75+age group) and gender (male and female only).

Heatwave events	Age (75+ age group) and gender	Source
Australia 1988- 2009	Increase of excess mortality risk:	Tong et al. 2014
Brisbane	Odds ratios for men [95% CI] of 1.33 [1.13 to 1.56] and 1.61 [1.42 to 1.82] for women	
Melbourne	Odds ratios for men [95% CI] of 1.38 [1.19 to 1.61] compared to 1.63[1.44 to 1.85] for women	
9 European cities 1990 - 2004 (excluding 2003)	Increase of excess mortality risk:	D'Ippolite et al. 2010
North- continental cities:	11.55% men compared to 16.65% women	
Mediterranean cities:	25.2% men compared to 34.45% women	
France 2003	82.49% of excess deaths 35.75% men compared to 64.25% women	Poumadere et al. 2006
4 Italian cities 1997 – 2003	Increase of excess mortality risk: odds ratios [95% CI] of 1.28 [1.18–1.40] for men compared to 1.44 [1.30–1.59] for women	Stafoggia et al. 2006
Serbia 2007 Belgrade	90% of excess deaths excess mortality for men rose to 23% compared to 54% for women	Bogdanovic et al. 2013

Intersection of social and spatial vulnerability

International literature critically investigating the intersection of 'physical' space with the lived 'social' space asserts that human vulnerability to contemporary natural disasters is to a large extent the result of the interaction of human decisions with geography and culture, in other words, socially and historically constructed (Harlan et al. 2006; Keller, 2013; Klinenberg 2002; Poumadere et al. 2005; VCOSS 2013). Space and location can then be understood as dynamic processes patterned through the interactions between individuals, human and ecological systems that occur within a set of unequal and oppressive power relations, constraining human development, social functioning and good quality of life (Harvey 2001). Some authors argue that the wide-ranging impacts of extreme heat events have also laid bare the deleterious consequences of ideologically driven welfare policies pursued by the political class that privilege privatisation over community wellbeing and the protection of life affirming social capital (Klinenberg 1999; Keller 2013).

Heatwave studies in the U.S. and Europe have drawn correlations between social and spatial heatwave vulnerability and found that catastrophic dimensions of heatwave disasters are concentrated among the socially isolated and economically disadvantaged elderly (Keller 2013; Klineneberg 1999; Poumadere et al. 2006; Semenza et al. (1996) and higher in suburbs characterised by economic inequality, poor housing, precarious living conditions and weak social connections (Harlan et al. 2006; Klinenberg 1999). In Australia Loughnan et al. (2013) used spatial heat vulnerability mapping in their research design and found that there was a higher concentration of at-risk areas in Melbourne's Western and Northern regions compared to other regions in Melbourne, due to higher population density and increased numbers of poorer older people.

Klinenberg (1999) and Keller (2013) aim to 'denaturalise disaster' with their respective Chicago 1996 and Paris 2003 heatwave studies exposing the largely hidden social conditions that gave rise to the unexpected loss of life of what Klinenberg (1999, p242) called a 'structurally determined catastrophe'. More than heat itself, the non-natural dimensions of the older heatwave victims' existence, such as socioeconomic disadvantage, marginal and badly insulated accommodation, lack of cooling options and social disconnectedness, became critical factors in the level of mortality rates experienced (Klinenberg 2002; Keller 2013). As Keller (2013) argues, the heatwave lifted the veil from the state's inability to care for and protect its most vulnerable citizens and shone a light on the break down in social solidarity, contributing significantly to the high death rate.

Socially just responses: building resilience

Considering the projected increase of heatwave related mortality, the need to understand the nexus between underlying disaster risk drivers, gendered vulnerability, adaptation and building resilience for effective disaster risk reduction is critical (Drolet et al. 2015; Hazeleger 2013).

Although interpretations of resilience are varied, there is consensus that it is best understood as a dynamic process that encompasses the ability to 'bounce back' from crises and difficulties and maintain functioning in the face of stress and disturbance (Alston, Hazeleger & Hargraves 2019; Saniotis et al. 2015). Resilience also reflects the ability to access material and psychosocial resources and take intentional action to strengthen individual, communal and institutional capacity to effectively respond to and influence a dramatic change. How well individuals and communities can cope with crises will also depend on the level of social cohesion towards common outcomes (Saniotis et al. 2015).

On an international level, the Sendai Framework for Disaster Risk Reduction 2015-2030 specifically calls for a holistic approach to combine risk management action with poverty eradication measures to build community resilience and reduce climate vulnerability for marginalised population groups (UNISDR 2015)

Recent initiatives, such as the creation of the National Gender and Emergency Management Guidelines (Parkinson et al. 2018) for Australia are an important contribution to the Sendai Framework's call for an embedded gender perspective in all aspects of disaster practice and policies. Nevertheless, there is still a gap in gender analysis and gender disaggregated data on climate disaster prevention and mortality rates. Even though international initiatives such as the Sendai framework provide a blueprint for governments to play the main role in disaster risk reduction (UNISDR 2015), there is also insufficient evidence on its application and effectiveness with regards to heatwave adaptation in the Australian context.

Feminist environmentalism critically analyses women's systemic oppression as being rooted in the same economic and social structures responsible for environmental destruction and climate change (Dominelli 2012; Alston 2013a). Mellor (1997) argues that although ecological awareness is important in crafting a 'politics of nature' that helps regulate human-nature relations, but to understand that human-nature relations are a living process and historically constructed within human-human relations is essential (p. 148). This suggests that unless structural inequality within human society is addressed and the various forms of domination dismantled, the existential threat posed by environmental destruction falls disproportionately on women and oppressed minorities.

Conclusion

Heat related mortality is expected to rise significantly in the future, posing a formidable challenge to existing public health strategies. Effective adaptation and mitigation measures are required to reduce health risks and protect the community from the multifaceted effects of extreme heat events. This

literature review highlights the growing body of knowledge on urban heatwave vulnerability for older people in the U.S., Europe and Australia. The research found that older women who experience multi-stress vulnerability, are most at risk from heatwave related deaths.

The literature identified most of the heat stress factors as socially constructed, illuminating how social systems of power create most heat related vulnerability. It also acknowledges that there are real human limits to being able to absorb the consequences of disasters resulting from a carbon-intensive economy. Although there is a growing body of literature internationally on the intersection of gender and climate change, data on why and how heatwaves disproportionately affect older women is in the emerging stages. Considering women's heightened vulnerability to climate change and heatwaves due to entrenched discriminatory gender relations and 'gender-blind policies and practices' (Alston 2013b, pp. 352), a research focus on women's experiences is warranted.

2019 may well become the hottest year on record yet with rolling and record-breaking heatwaves occurring right across the globe. New research on heatwave vulnerability and socially just adaptation measures that focuses on the marginalised and most affected will be critical in safeguarding life and preparing the community for a hotter future.

References

ABS 2012, *Reflecting a Nation: Stories from the 2011 Census*, 2012–2013, Cat no. 2071.0, Commonwealth of Australia, Canberra, 21 June, viewed 10 May 2019, http://www.abs.gov.au/ausstats/abs@.nsf/lookup/2071.0main+features752012-2013

ABS 2013, *2071.0 - Reflecting a Nation: Stories from the 2011 Census, 2012–2013*: viewed 10 May 2019, http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/2071.0main+features602012-2013

ABS 2017, *2071.0 - Census of Population and Housing: Reflecting Australia - Stories from the Census*, 2016. Available from: https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2071.0~2016~Main%20Features~Ageing%20Population~14

Alston, M 2013a, 'Environmental Social Work: Accounting for Gender in Climate Disaster', *Australian Social Work*, vol. 66, no. 2, pp. 218-233.

Alston, M 2013b, 'Women and adaptation', *WIREs Cim Change*, vol.4, pp. 351 – pp.358.

Alston 2017, 'Ecosocial work: reflections from the global south', in *Aila-Leena Matthies and Kati Nahri* (eds), The ecosocial transition of societies: the contribution of social work and social policy. London and New York, Routledge, pp 91-104.

Alston, M, Hazeleger T & Hargraves, D 2019, *Social Work and disaster a handbook for practice*, New York, Routledge.

Bambrick, H, Capon, A, Barnett, G, Beaty, R & Burton, A 2011, 'Climate Change and Health in the Urban Environment: Adaptation Opportunities in Australian Cities', *Asia-Pacific Journal of Public Health*, vol. 23, no. 2, pp. 67S – pp. 79S.

Bogdanovic, DC, Milosevic, ZG, Lazarevic, KK, Dolicanin, ZC, Randelovic, DM & Bogdanovic, SD 2013, The impact of the July 2007 heat wave on daily mortality in Belgrade, Serbia, *Cent Eur J Public Health*, vol. 21, no. 3, p. 140 & 5.

Borrell, C, Mari-Dell'Olmo, M, Rodriquez-Sanz, M, Garcia-Olalla, P, Cayla, J, Benach, J & Muntaner, C 2006, 'Socioeconomic position and excess mortality during the heat wave of 2003 in Barcelona', *European Journal of Epidemiology*, vol. 21, pp. 633 – pp. 640.

Beauvoir, S 1953, *The Second Sex*, Alfred A. Knopf Inc., USA

Bureau of Meteorology 2019a*, Special Climate Statement 68—widespread heatwaves during December 2018 and January 2019*, viewed February 2019. Available from: http://www.bom.gov.au/climate/current/statements/scs68.pdf.

Bureau of Meteorology 2019b, *Seasonal Climate Summary for Greater Adelaide, Greater Adelaide in summer 2018–19: warmer and drier than average*, viewed September 15 2019. Available from: http://www.bom.gov.au/climate/current/season/sa/archive/201902.adelaide.shtml#recordsTmaxDailyHigh.

Burns, B, Sharma, A, Hall, L, Zhou, V & Garma, S 2017, 'Pocket Guide to Gender Equality under the UNFCCC', *European Capacity Building Initiative*, viewed 03 February 2019. Available from: https://ecbi.org/news/2018-edition-pocket-guide-gender-equality-under-unfccc

Cannon, T 1994, 'Vulnerability analysis and the explanation of 'natural' disasters', in *Disasters, Development and Environment*, ed. A. Varley, pp. 13-30. Chichester: John Wiley & Sons.

Coates, L, Haynes, K, O'Brien, J, McAneney & Dimer de Oliveira, F 2014, 'Exploring 167 years of vulnerability: An examination of extreme heat events in Australia 1844-2010', *Environmental Science & Policy*, vol. 42, pp. 33 – 44.

Costello, A, Abbas, M, Allen, A, Ball, S, Bell, S, Bellamy,R, Friel, S, Groce, N, Johnson, A, Kett, M, Lee, M, Levy, C, Maslin, M, McCoy, D, McGuire, B, Montgomery, H, Napier,D, Pagel, C, Patel, J, Antonio, J, de Oliveira, P, Redclift, N, Rees, H, Rogger, D, Scott, J, Stephenson, J, Twigg, J, Wolff, J & Patterson, C 2009, 'Managing the health effects of climate change', *Lancet*, vol. 373, pp. 693-733.

Dankelman, I (ed) 2010, *Gender and Climate Change: An Introduction*, Earthscan Ltd, London UK.

Dawson, A 2017, *Extreme cities: the peril and promise of urban life in the age of climate change*, Verso, London, New York.

Denton, F 2002, 'Climate Change Vulnerability, Impacts, and Adaptation: Why Does Gender Matter?', *Gender and Development*, vol. 10, no. 2, pp. 10-20, viewed 6 March 2018. Available from: http://www.jstor.org/stable/4030569.

Department of Health and Human Services 2018, *Protecting health and reducing harm from extreme heat*, viewed 21 January 2019, https://www2.health.vic.gov.au/public-health/environmental-health/climate-weather-and-public-health/heatwaves-and-extreme-heat.

D'Ippoliti, D, Michelozzi, P, Marino, C, de'Donato, F, Katsouyanni, K, Kirchmayer, U, Analitis, A, Medina-Ramon, M, Paldy, A, Atkinson, R, Kovats, S, Bisanti, L, Schneider, A, Lefranc, A, Iniguez, C & Perucci C 2010, 'The impact of heat waves on mortality in 9 European cities: results from the Euro- HEAT project', *Environmental Health*, vol. 9, no. 37.

Dominelli, L 2012, *Green social work: from environmental crises to environmental justice*, Polity, Cambridge, UK; Malden, MA.

Drolet, J, Dominelli, L, Alston, M, Ersing, R, Mathbor, G & Wu, H 2015, 'Women rebuilding lives post-disaster: innovative community practices for building resilience and promoting sustainable development', *Gender & Development*, vol. 23:3, pp. 433-448.

Enarson, E 1998, 'Through women's eyes: a gendered research agenda for disaster social science', *Disasters*, vol. 22, no. 2, pp. 157-173.

Ford JD, Smit, B, Wandel, J 2006,

Vulnerability to climate change in the Arctic: A case study from Arctic Bay, Canada, Global Environmental Change, v.16, no. 2, May 2006, Pages 145–160, viewed 5 March 2014, http://www.sciencedirect.com.ezproxy.lib.monash.edu.au/science/article/pii/S0959378005000786

Forzieri, G, Cescatti, A, Batista e Silva, F & Feyen. L 2017, Increasing risk over time of weather-related hazards to the European population: a data-driven prognostic study. The Lancet Planetary Health, Vol. 1 (5): e200 DOI: 10.1016/S2542-5196(17)30082-7

Greig, A, Lewins, F & White, K 2003, Inequality in Australia, Cambridge University Press

Hansen, A, Bi, P, Nitschke, M, Saniotis, A, Benson, J, Tan, Y, Smyth, V, Wilson, L, Han, G & Mwanri, L 2014, 'Extreme heat and cultural and linguistic minorities in Australia: perceptions of stakeholders', *BMC Public Health*, vol. 14.

Harlan, S, Brazel, A, Prashad, L, Stefanov, W & Larsen, L 2006, 'Neighborhood microclimates and vulnerability to heat stress', *Social Science & Medicine*, vol. 63, pp. 2847-2863.

Hazeleger, T 2013, 'Gender and disaster recovery: strategic issues and action in Australia', *Australian Journal of Emergency Management*, vol. 28, no. 3, pp 40-46.

Herold, N, Ekstr, M, Kala, J, Goldie, J & Evans, J 2018, 'Australian climate extremes in the 21st century according to a regional climate model ensemble: Implications for health and agriculture', *Weather and Climate Extremes*, vol. 20, pp. 54-68.

Intergovernmental Panel on Climate Change (IPCC) 2014, *Summary for Policy Makers, Climate Change 2014: Impacts, Adaptation, and Vulnerability*, viewed 2 April 2014. Available from: http://ipcc-wg2.gov/AR5/images/uploads/IPCC_WG2AR5_SPM_Approved.pdf

Intergovernmental Panel on Climate Change (IPCC) 2018, 'Summary for Policymakers', in *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening*, viewed 13 December 2018. Available from: https://www.ipcc.ch/sr15/chapter/summary-for-policy-makers/.

Keller, R 20013, 'Place Matters: Mortality, Space, and Urban Form in the 2003 Paris Heatwave Disaster', *French Historical Studies*, vol. 36, no. 2.

Keller, R 2015, 'Fatal Isolation: The Devastating Paris Heat Wave of 2003 Chicago', University of Chicago Press.

Klinenberg, E 1999, 'Denaturalizing Disaster: A Social Autopsy of the 1995 Chicago Heat Wave', *Theory and Society*, vol. 28, no. 2, pp. 239 –295.

Klinenberg, E 2002, 'Heat Wave: A Social Autopsy of Disaster in Chicago, Chicago', IL, *University of Chicago Press.*

Kovats, S & Hajat, S 2008, 'Heat stress and Public Heath: A Critical Review', *Annual Review of Public Health*, vol. 29, pp. 41-55.

Li, D Bou-Zeid, E 2013, 'Synergistic interactions between urban heat islands and heat waves: The impact in cities is larger than the sum of its parts', *Journal of Applied Meteorology and Climatology*, vol. 52, no. 9, pp. 2051-2064.

Loughnan, ME, Tapper, NJ, Phan, T, Lynch, K & McInnes, JA 2013, 'A spatial vulnerability analysis of urban populations during extreme heat events in Australian capital cities', *National Climate Change Adaptation Research Facility*, Gold Coast.

Mellor, M 1997, *Feminism & Ecology*, Polity Press, UK.

Mora, C, Dousset, B, Caldwell, IR, Powell, FE, Geronimo, RC, Bielecki, CR, Counsell, CWW, Dietrich, BS, Johnston, ET, Louis, LV, Lucas, MP, McKenzie, MM, Shea, AG, Tseng, H, Giambelluca, TW, Leon, LR, Hawkins, E & Trauernicht, C 2017, 'Global risk of deadly heat', *Nature Climate Change*, vol. 7, no.7, pp. 501-506.

Neumayer, E & Pluemper T 2007, 'The gendered nature of natural disasters: the impact of catastrophic events on the gender gap in life expectancy, 1981 – 2002', *Annals of the Association of American Geographers*, vol. 97, no. 3, pp. 551-566.

Papalexiou, SM, AghaKouchak, A, Trenberth, KE & Foufoula-Georgiou, E 2018, 'Global, Regional, and Megacity Trends in the Highest Temperature of the Year: Diagnostics and Evidence for Accelerating Trends', *Earth's Future*, vol. 6, pp. 71-79.

Parkinson, D, Duncan, A, Archer, F, Dominey-Howes, D, Gorman-Murray, A & McKinnon, S 2018, 'Introducing new national Gender and Emergency Management (GEM) Guidelines to support more inclusive disaster risk reduction work' in *Diversity in Disaster; Australian Journal of Emergency Management, Monograph No. 3*. Available from: https://knowledge.aidr.org.au/media/6031/diversity-in-disaster-monograph.pdf.

Patz, J, Gibbs, H, Foley, J, Rogers, & Smith, K 2007, 'Climate Change and Global Health: Quantifying a Growing Ethical Crisis', *EcoHealth*.

Perkins-Kirkpatrick S & Pitman A 2018, 'Extreme events in the context of climate change', *Public Health Res Pract*., vol. 28, no. 4.

Petersen, M & Parsell, C 2014, 'Older Women's Pathways out of Homelessness in Australia', *Mercy Foundation*, viewed 15 April. Available from: http://www.mercyfoundation.com.au.

Poumadere, M, Mays, C, Le Mer, S & Blong, R 2005, 'The 2003 Heat Wave in France: Dangerous Climate Change Here and Now', *Risk Analysis*, vol. 25, no. 6, pp. 1483-1494.

Saniotis, A, Hansen, A, Kralik, D, Arbon, P, Nitschke, M & Bi, P 2015, 'Building community resilience to heatwaves in South Australia', *Transactions of the Royal Society of South Australia*, vol. 139, no. 1, pp. 113-120.

Semenza, J, Rubin, C, Falter, K, Selanikio, J, Flanders, D, Howe, H & Wilhelm, J 1996, 'Heat-related deaths during the July 1995 heat wave in Chicago', *The New England Journal of Medicine*, pp. 84-90.

Stafoggia, M, Forastiere, F, Agostini, D, Biggeri, A, Bisanti, L, Cadum, E, 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*, vol. 17, no. 3, pp. 315-323.

Steffen, W, Hughes, L & Perkins, S 2014, 'Heatwaves: Hotter, Longer, More Often', *Climate Council of Australia*, viewed 10 April 2014. Availabe from: https://www.dropbox.com/s/7d9mrhw92p1y405/cc.heatwave.report_april2014.web.pdf.

Steffen, W, Rockström, J, Richardson, K, Lenton, T, Folke, C, Liverman, D, Summerhayes, C, Barnosky, A, Cornell, S, Crucifix, M, Donges, J, Fetzer, I, Lade, S, Scheffer, M, Winkelmann, R & Schellnhuber J 2018, 'Trajectories of the Earth System in the Anthropocene', *PNAS* , vol. 115, no. 33, pp. 8252-8259.

Tong, S, Wang X, Yu, W, Chen, D & Wang X, 2014, 'The impact of heatwaves on mortality in Australia: a multicity study', *BMJ Open 2014*, vol. 4.

UNFCCC 2017, *Initiatives in the area of human settlements and adaptation Summary report by the secretariat*, viewed 21 January 2019, https://unfccc.int/sites/default/files/resource/docs/2017/sbsta/eng/inf03.pdf.

UNISDR, 2015, 'Sendai framework for disaster risk reduction 2015–2030', *United Nations International Strategy for Disaster Reduction*. Available from: https://www.preventionweb.net/sendai-framework/sendai-framework-for-drr.

van Steen, Y, Ntarladima, A, Grobbee, R, Karssenberg D & Vaartjes I 2019, 'Sex differences in mortality after heat waves: are elderly women at higher risk?', *International Archives of Occupational and Environmental Health*, vol. 92, no. 1, pp. 37-48.

Vandentorren, S, Bretin, P, Zeghnoun, A, Mandereau-Bruno, L, Croisier, A, Cochet, C, Ribe´ ron, J, Siberan, I, Declercq, B & Ledrans, M 2006, 'August 2003 Heat Wave in France: Risk Factors for Death of Elderly People Living at Home', *European Journal of Public Health*, vol. 16, no. 6, pp. 583–591.

Watts, N, Ayeb-Karlsson, S, Belesova, K, Berry, H, Bouley, T, Boykoff, M, Byass, P, Cai, W, Campbell-Lendrum, D, Chambers, J, Daly, M, Dasandi, N, Davies, M, Depoux, A, Dominguez-Salas, P, Drummond, P, Ebi, K, Ekins, P, Fernandez-Montoya, L, Fischer, Helen et al. 2018, 'The 2018 report of the Lancet Countdown on health and climate change: shaping the health of nations for centuries to come', *The Lancet*, vol. 392, no. 10163, pp. 2479-2514.

Victorian Council of Social Services 2013, *Feeling the heat: Heatwaves and social vulnerability in Victoria*, viewed 2 April 2014, http://vcoss.org.au/documents/2013/03/VCOSS-Heatwave-Report-2013.pdf.