

Empirical evidence suggests adverse climate events have not affected Australian women's health and well-being

Abstract

Objective: To compare the health and well-being of women by exposure to adverse climate events. An Exceptional Circumstance declaration (EC) was used as a proxy for adverse climate events. The Australian government may provide financial support to people living in EC areas, i.e. areas experiencing a one in 20-25 year event (drought, flood or fire) that results in a severe, extended downturn in farm or farm-related income.

Methods: Data from 6,584 53-58 year old non-metropolitan women participating in the 2004 survey of the Australian Longitudinal Study on Women's Health (ALSWH) were linked to EC data. Generalised linear models were used to analyse differences in SF-36 General Health (GH) and Mental Health (MH) and perceived stress by EC for all women. Models were adjusted for demographic, health-related and psychosocial factors potentially on the pathway between EC and health. Given that the effects on health were expected to be greater in vulnerable people, analyses were repeated for women with worse socioeconomic circumstances.

Results: GH, MH and stress did not differ for the 3,366 women in EC areas and 3,218 women in non-EC areas. GH, MH and stress were worse among vulnerable women (who had difficulty managing on available income) regardless of EC.

Conclusion and implications: This research adds to the existing literature on climate change, associated adverse climate events and health, by suggesting that multiple resources available in high income countries, including government support and individual psychosocial resources may mitigate some of the health impacts of adverse climate events, even among vulnerable people.

Key words: climate change, adverse climate events, drought, women's health

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Jennifer R. Powers, Deborah Loxton, Jeanine Baker, Jane L. Rich

Priority Research Centre for Gender, Health and Ageing, The University of Newcastle, New South Wales

Annette J. Dobson

School of Population Health, The University of Queensland

Climate change is seen as a public health priority,¹⁻³ not only in the poorest countries but also in high income countries.⁴ Climate change is expected to lead to more frequent adverse events such as drought, floods and intense storms. These extreme weather events are projected to affect water and food quality and availability,^{5,6} which will disrupt existing social and environmental structures.⁷ Based on current knowledge of how adverse climate events affect health, it has been postulated that there will be an increase in: the number of human deaths due to increased frequency of extreme weather events; allergies, respiratory illnesses, spread of vector-borne diseases; and a shift in the distribution of infectious diseases.⁸ Increased anxiety and distress resulting from awareness of, and concern about, the perceived effects of climate change have also been suggested,⁹ with greater effects expected among vulnerable people, such as those with worse socioeconomic circumstances.¹⁰ Empirical evidence on the impact of climate change on health is needed.¹¹

The need for further research and a plan for prospectively monitoring health outcomes related to drought have been proposed for the United States (US).¹² Drought is a complex scenario differing across geographic regions,

and having major economic impacts on primary producers and their communities, regions and nations.¹³ Although some information is available about the social and economic impacts of drought,⁹ a recent review in the US found only limited data on the effect of drought on public health.¹⁴

By linking existing Australian health data with national climate data, the current paper aims to compare the health of women living in areas that have been subject to extreme weather events, primarily drought, with the health of women in unaffected areas.

In Australia, areas that experience a rare event (one in 20-25 years) such as drought, floods or fires can be declared as areas where Exceptional Circumstances (EC) exist.¹⁵ To be declared an EC area, the event must result in a severe downturn in farm or farm-related income for more than a year that cannot be managed by normal risk management frameworks and that is not part of normal market fluctuations. An EC declaration affords people living in the area access to financial support and interest rate subsidies.¹³ By linking EC data to survey results for the same period from participants in the Australian Longitudinal Study on Women's Health (ALSWH) for women living outside major urban centres, we were able to

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Correspondence to: Jennifer Powers, Priority Research Centre for Gender, Health and Ageing, University of Newcastle, Callaghan NSW 2308;
e-mail: jenny.powers@newcastle.edu.au

compare the health of women living in EC declared areas with that of women not living in EC declared areas and hence shed light on possible effects of climate change on health. Based on limited past research, we hypothesised that women living in EC declared areas would report poorer general and mental health and higher stress levels than women not living in EC declared areas, and that differences in self-rated health and stress would be greater among more vulnerable women.

Methods

In 1996, three cohorts of women (born 1921-26, 1946-51 and 1973-78) were enrolled in the ALSWH to cover important changes in women's lives. This analysis uses data from the cohort of women born between 1946 and 1951 (1946-51 cohort). Full methodological details of the ALSWH are published on the project website,¹⁶ with key points summarised below. The women were randomly selected from the national health insurance database (Medicare Australia), which includes all citizens and permanent residents. Stratified random sampling was used with intentional over-sampling of women living in rural and remote areas. Medicare Australia invited the women to complete the first mailed survey in 1996. Due to possible inaccuracies in the Medicare database, the response rate for the first survey could not be calculated exactly but for this cohort was estimated to be 53%-56%. Follow-up surveys were sent in 1998, 2001, 2004 and 2007. Ethical clearance was obtained from the Universities of Newcastle and Queensland (Ethics approvals H0760795 and 2004000224). This analysis uses data from women who completed the 2004 survey and were living outside major cities. The 2004 survey was used as this was able to be matched with EC data covering the same time period.

Measures

All measures were self-reported. The three main outcomes were self-rated health measured by the General Health (GH) and Mental Health (MH) domains of the Short Form Medical Outcomes Study 36-item (SF-36)¹⁷ and perceived stress.¹⁸ Scores for GH and MH range from 0 to 100, with higher scores indicating better physical and mental health. Lower GH scores are associated with serious physical conditions (e.g. heart disease, hypertension, diabetes, cancer) and are predictive of future morbidity and mortality.¹⁹ Low MH scores are indicative of depression.¹⁷ Scores for perceived stress range from 0 to 4 with higher scores indicating more stress.¹⁸ Other health measures included the number of general practitioner (GP) visits in the last year and the number of doctor diagnosed physical conditions (diabetes, heart disease, hypertension, stroke, asthma, bronchitis/emphysema, and osteoporosis). Additional mental health measures were self-reported doctor diagnosis of depression or anxiety, suicidal thoughts (feeling that life was not worth living in the last week) and deliberate self-harm in the last six months.

The main exposure variable was whether the woman was living in an EC declared area in 2004/05, obtained by linking latitude and

longitude of the woman's address at the 2004 survey with latitude and longitude of EC declared areas in the same year. Variables potentially on the pathway between living in an EC declared area and health were demographic indicators, social factors and health-related factors. Demographic indicators included relationship status (married or living in a de facto relationship; separated or divorced; widowed; single), age (in years, between 53 and 58), highest level of education achieved (10 years or less; 11-12 years, trade or apprenticeship; certificate or diploma; university degree) and ability to manage on available income (five response options ranging from easy to impossible). Geographic area of residence was classified as living in major cities (excluded from this paper), inner regional, outer regional or remote areas using Accessibility/Remoteness Index of Australia (ARIA+), which is recognised as Australia's most authoritative measure of geographic remoteness.²⁰ ARIA+ is derived from measures of road distance between populated localities and service centres within Australia. Inner regional areas are those where access to goods, services and social interaction are somewhat restricted by geographic distance, and include towns such as Tamworth and Dubbo in New South Wales, Ballarat and Echuca in Victoria, Rockhampton and Dalby in Queensland, Tanunda and Murray Bridge in South Australia and Busselton and Collie in Western Australia. Vulnerability to poor health was measured by worse socioeconomic circumstances,¹⁰ defined as lower level of education, or difficulty managing on available income.

Social factors included social support,²¹ perceived control²² and optimism measured by the revised Life Orientation Test (LOT-r).²³ The Medical Outcomes Study (MOS) social support scale was scored from 0-100, with scores of 0-50, 50-75 and 75-100 indicating low, moderate and high levels of social support. Scores of 0-18, 18-24 and 24-30 on the perceived control scale indicated low, moderate and high levels of control. The same scoring system was used for optimism. Health-related factors were smoking status (never smoked, ex-smoker or current smoker) and alcohol intake (non-drinker, occasional drinker, moderate drinker or heavy drinker).

Statistical analyses

All analyses used SAS version 9.2.²⁴ The representativeness of the sample was assessed by comparing the characteristics of the women who completed the 2004 ALSWH survey with those of women of the same age and locations at the 2006 Australian Census. Moran's I was used to test for spatial autocorrelation, and whether the data were randomly distributed. Chi-squared statistics were used to test associations between EC and demographic, psychosocial and health-related factors, and categorical physical and mental health outcome measures. Separate generalised linear models (GLMs) were used to investigate the relationship between GH, MH and perceived stress and living in an EC declared area. The least square means option of the GLM procedure was used to estimate unadjusted means for GH, MH and perceived stress by EC. Least square means adjusted for demographic, psychosocial and health-related factors were also calculated from the observed marginal distributions. To determine

whether vulnerable women would be particularly badly affected by climate change, the analyses were repeated for women with worse socioeconomic circumstances: 1) women who had less than 11 years education, and 2) women who found it impossible or always difficult to manage on their available income. In all models, sample sizes provided 80% to 100% power to detect significant differences of at least four points on the GH and MH scales, and at least 0.2 of a point on the perceived stress scale using a 5% significance level and two-tailed test.

Results

To assess potential selection bias, the characteristics of 6,794 women who lived outside major cities and responded to the 2004 ALSWH survey were compared with those of 239,955 women of the same age and locations in the 2006 Australian Census. Compared with the Census, women were just as likely to live in inner regional, outer regional or remote areas (Census: 65%, 30%, 6% versus ALSWH: 63%, 31%, 6%), had similar levels of education (up to 10 years' school; 12 years' school, Certificate or Diploma; University: 53%, 35%, 12% Census versus 52%, 36%, 13% ALSWH) and were slightly less likely to be Indigenous (2% in Census versus 1% in ALSWH). ALSWH participants were more likely to be married or living in a de facto relationship (83% versus 75%) than women of the same age in the Census.

Women were excluded from the analysis if they did not provide data on the outcome measures: GH, MH, perceived stress or to determine the main exposure variable, EC (n=210). In 2004, 51% of the remaining 6,584 women were living in EC declared areas. Variables that are potentially on the EC-health pathway are shown in Table 1. Compared with women in non-EC areas, women in EC areas were more likely to live in inner regional areas, have 10 years or less education, found it more difficult to manage on their available income and were less optimistic about the future (Table 1). There were no differences in women's perceived control, smoking status or alcohol use. Nor were there differences in the number of GP visits in the last year, the number of diagnosed physical conditions, diagnoses of depression or anxiety, suicidal thoughts or self-harm.

Moran's I indicated data on self-rated health and perceived stress were spatially uncorrelated. The GH and MH means for women living in EC declared areas were not different from those of women living in non-EC declared areas (Table 2). Perceived stress was slightly and marginally statistically significantly higher for women living in EC declared areas but the effect was no longer apparent after adjustment for demographics, health-related and psychosocial factors.

Means for self-rated health and perceived stress for vulnerable women living in EC and non-EC declared areas are shown in Table 3. Mean scores for self-rated health were at least 10 points lower for women who had difficulty managing on available income than for all women (see Tables 2 and 3). Australian National Health

Table 1: Characteristics of 6584 women aged 53-58 years by Exceptional Circumstances (EC) declared areas.

	EC area n=3,366 %	Non-EC n=3,218 %	p
Demographic factors			
Geographic areas			
Inner regional	70.4	54.8	<.0001
Outer regional	25.9	36.5	
Remote or very remote	3.7	8.7	
Education			
10 years or less	53.2	49.2	0.001
11-12 years, trade or apprenticeship	17.9	21.4	
Certificate or diploma	16.0	16.8	
University degree	12.9	12.6	
Relationship status			
Married / in a de facto relationship	82.9	83.6	0.77
Separated / divorced	11.3	11.1	
Widowed	3.8	3.5	
Single	2.1	1.8	
Ability to manage on available income			
Impossible / Difficult all the time	13.9	12.4	0.001
Difficult some of the time	28.7	26.5	
Not too bad	43.7	44.1	
Easy	13.6	16.9	
Psychosocial factors			
Level of social support			
Low	17.9	16.9	0.56
Moderate	26.6	26.6	
High	55.5	56.4	
Optimism			
Low	17.4	14.9	<.0001
Moderate	49.2	46.8	
High	33.5	38.3	
Perceived control			
Low	34.5	32.2	0.14
Moderate	41.5	43.4	
High	24.0	24.4	
Health related factors			
Smoking status			
Never smoked	59.9	59.6	0.51
Ex-smoker	26.5	27.5	
Current smoker	13.6	12.9	
Alcohol intake			
Non-drinker	16.7	16.3	0.79
Occasional drinker	24.5	23.7	
Moderate drinker	52.2	53.4	
Heavy drinker	6.6	6.6	
Physical and mental health measures			
Number of GP visits in last year			
None	6.8	7.5	0.63
One or two	35.6	34.6	
Three or four	28.7	28.7	
Five or more	28.9	29.2	
Number of physical conditions			
None	62.6	63.4	0.54
One	26.6	26.1	
Two	8.7	8.1	
Three or more	2.1	2.4	
Doctor diagnosis of depression or anxiety	16.6	16.4	0.83
In past week, feeling that life wasn't worth living	5.9	6.0	0.92
Deliberate self-harm in the past six months	0.5	0.4	0.54

Survey data show that women with one or more serious physical condition (e.g. cancer, heart disease, diabetes, and hypertension) have GH scores that are eight points lower and MH scores that are four points lower than women who have no serious physical conditions.²⁵ Clearly, vulnerable women had poorer self-rated health and higher levels of stress than other women, however differences in scores by EC-declaration were not significantly different.

Discussion

Contrary to expectations, this analysis found no health or well-being deficit associated with exposure to adverse climate events, primarily drought, defined by living in an EC declared area. Few studies have investigated the effects of drought on health and well-being. Two small studies of adolescent children in drought affected rural and remote areas of Australia found no difference in emotional

Table 2: Least-square mean scores^a for self-rated health and stress for 6,584 women aged 53-58 years by areas declared as experiencing Exceptional Circumstances (EC) in 2004/2005.

	EC area Mean (95%CI)	Non-EC area Mean (95%CI)	Difference Mean (95%CI)	P value
General Health	70.5 (69.8–71.2)	70.8 (70.1–71.5)	-0.31 (-1.31–0.69)	0.54
Adjusted for				
demographics	70.9 (70.2–71.6)	70.9 (70.2–71.6)	-0.04 (-1.04–0.96)	0.94
health-related factors	70.7 (70.0–71.4)	71.1 (70.3–71.8)	-0.36 (-1.37–0.64)	0.48
psychosocial factors	71.0 (70.4–71.6)	70.7 (70.1–71.4)	0.26 (-0.65–1.17)	0.58
all of above	71.1 (70.4–71.7)	70.7 (70.1–71.4)	0.35 (-0.56–1.27)	0.45
Mental Health	74.8 (74.2–75.4)	75.2 (74.5–75.8)	-0.35 (-1.21–0.51)	0.43
Adjusted for				
demographics	75.3 (74.7–75.9)	75.1 (74.5–75.7)	0.22 (-0.64–1.07)	0.62
health-related factors	75.0 (74.4–75.6)	75.3 (74.7–75.9)	-0.30 (-1.17–0.57)	0.50
psychosocial factors	75.3 (74.9–75.8)	75.0 (74.5–75.5)	0.38 (-0.34–1.09)	0.30
all of above	75.4 (74.9–75.9)	74.9 (74.4–75.4)	0.55 (-0.17–1.27)	0.13
Perceived Stress	0.58 (0.57–0.60)	0.56 (0.54–0.57)	0.02 (0.002–0.05)	0.03
Adjusted for				
demographics	0.57 (0.55–0.59)	0.57 (0.55–0.58)	0.00 (-0.02–0.02)	0.89
health-related factors	0.58 (0.56–0.60)	0.56 (0.54–0.57)	0.02 (-0.001–0.05)	0.06
psychosocial factors	0.57 (0.56–0.59)	0.56 (0.55–0.58)	0.01 (-0.01–0.03)	0.30
all of above	0.57 (0.56–0.58)	0.57 (0.56–0.58)	0.00 (-0.02–0.02)	0.93

^a Adjusted least square means (95% confidence interval), estimated using observed marginal distributions for other variables.

Table 3: Least-square mean scores for self-rated health and stress for potentially vulnerable women aged 53-58 years by areas declared as experiencing Exceptional Circumstances (EC) in 2004/2005.

Self-rated health	EC area Mean (95%CI)	Non-EC area Mean (95%CI)	Difference Mean (95%CI)	P-value
Up to 10 years education	n=1,778	n=1,571		
General health				
unadjusted	68.5 (67.5–69.5)	69.1 (68.0–70.1)	-0.61 (-2.06–0.84)	0.41
adjusted ^a	68.9 (68.0–69.8)	69.1 (68.1–70.0)	-0.24 (-1.55–1.08)	0.72
Mental health				
unadjusted	73.5 (72.6–74.3)	73.8 (72.9–74.7)	-0.33 (-1.62–0.95)	0.61
adjusted ^a	73.9 (73.1–74.6)	73.7 (73.0–74.5)	0.11 (-0.95–1.18)	0.83
Perceived stress				
unadjusted	0.57 (0.55–0.59)	0.54 (0.52–0.56)	0.03 (-0.003–0.06)	0.073
adjusted ^a	0.56 (0.55–0.58)	0.55 (0.53–0.57)	0.02 (-0.01–0.04)	0.28
Always difficult or impossible to manage on available income	n=464	N=398		
General health				
unadjusted	59.3 (57.1–61.5)	58.3(55.9–60.7)	0.99 (-2.22–4.21)	0.54
adjusted ^a	59.6 (57.6–61.6)	58.4 (56.2–60.6)	1.22 (-1.79–4.22)	0.43
Mental health				
unadjusted	63.8 (61.9–65.7)	64.6 (62.5–66.7)	-0.77 (-3.62–2.08)	0.59
adjusted ^a	64.5 (62.8–66.1)	64.7 (63.0–66.5)	-0.26 (-2.70–2.19)	0.84
Perceived stress				
unadjusted	0.93 (0.87–0.98)	0.89 (0.84–0.95)	0.03 (-0.04–0.11)	0.41
adjusted ^a	0.91 (0.87–0.96)	0.91 (0.86–0.96)	0.003 (-0.07–0.07)	0.94

^a Least square means (95% confidence interval), estimated using observed marginal distributions for other variables and adjusted for demographic, health-related and psychosocial factors

distress among 330 adolescents and Australian norms in 2004, but emotional distress was higher in 111 adolescents in the same area four years later.^{26,27} A Brazilian study of 204 people, half living in a drought-prone area and half in a drought-free area, found emotional distress was higher in the drought-prone area, particularly among the women.²⁸ The results of these studies and the current study are not directly comparable due to differences in measures of health, well-being and drought, and differences in the samples in terms of country, area, age, gender, and sample size. The current study contributes to this small body of knowledge by providing important empirical evidence.

Although climate change was expected to have a greater effect on vulnerable women, no differences in health or stress were observed. Clearly, vulnerability was strongly related to health and well-being. Women who always had difficulty managing on available income had significantly poorer self-rated health and greater levels of stress than the general population of women, regardless of exposure to adverse climate events. These findings are consistent with two reviews that concluded that poorer health was more strongly associated with poorer socioeconomic circumstances (such as poverty and less education) than living in an urban or rural area in high income countries.^{29,30} A smaller Brazilian study proposed that drought was likely to lead to poorer socioeconomic circumstances, in turn leading to more stress,²⁸ a hypothesis that was not supported by the current study. Apart from differences in study designs, compared to Brazil, high income countries such as Australia can, and do provide support for people in need. This support, such as that provided through the EC scheme, may be enough to tip the health and well-being balance in these circumstances.

Given the unexpected results, a close examination of the limitations of this study is especially warranted. Firstly, EC is a coarse measure of adverse climate events and may not be a sensitive measure of climate change as it does not allow for the severity of events. Nevertheless, the EC criteria allow for the identification of those living in areas affected by chronic climate-related events such as drought rather than acute events such as flood or fire. It is possible that the health impacts of climate events reported in past research³¹ have reflected short term rather than longer term outcomes, when there has been time for adaptation to changed conditions.

A second limitation of the current study is that only women aged 53–58 years were included in the analysis. This leaves open the possibility that the results may vary according to age and/or gender. Male suicide rates are high in rural farming, drought affected areas in Australia.³² The results of the current study showed no difference in suicidal thoughts or self-harm according to EC status among ALSWH participants. Alston suggests that women's roles in agriculture, which involve interacting in the community and monitoring family health, might be protective of mental health compared with men's roles, which are more likely to involve attending to the distress and constant physically demanding work that drought entails.³² One of the most important themes in the literature exploring women and rurality is that of resilience and

strength. Panelli suggests 'women are rarely if ever passive subjects in the rural contexts and conditions they navigate'.^{33,p495} Perhaps this resilience facilitates the similarity of health and well-being of women in EC areas and non-EC areas. Further research is needed to determine whether there is a health impact associated with living in an EC area for men and for women of different ages.

A third limitation concerns a lack of information about whether the women were actually receiving EC assistance. The data only allowed for identification of women who were potentially eligible to apply for assistance, not those who were actually receiving assistance. As we were interested in establishing the impact of a climate event, as opposed to the impact of financial aid, this limitation was not viewed as serious. However, this limitation does prevent a direct evaluation of the EC assistance program in buffering the health impact of climate events.

A fourth potential limitation of the study is that un-partnered women were underrepresented among the ALSWH participants. Past research has suggested that climate events associated with climate change will impact disproportionately on those with less socio-economic resources.³⁴ However, even after adjustment for relationship and economic status (ability to manage on available income and education) there was still no apparent health impact associated with living in an EC area.

The study also has considerable strengths. Data were collected from a large sample of women, almost three percent of the total population of women of the same age living outside major cities in Australia. The women were broadly representative of women of the same age in the Australian population in these areas with some over-representation of partnered women. The exposure measure, living in an EC declared area in 2004, established the presence of long term effects of adverse climate events. Based on the number of broad-acre and dairy farms, an estimated 31% of farmers in EC declared regions received EC support over the 2003–04 and 2004–05 financial years.³⁵ Almost half the recipients of Exceptional Circumstance Relief Benefit received support for one to two years, indicating the chronic nature of conditions that lead to EC declarations.

Considering these strengths, it is important to turn to possible explanations for the unexpected results. As previously mentioned, Australia has cycled through drought and flood throughout living memory. In that sense, identifying EC declared areas, which were predominantly due to drought, is likely to be tapping into rare but not unexpected events. While the length and frequency of droughts might increase due to climate change, their occurrence may be an accepted part of life in the rural areas of Australia. This acceptance may enhance coping through preparation and adaptation, which consequently might act to reduce the potential health impacts of drought. There was some evidence for this in the current study, which showed no differences in perceived control between EC and non-EC areas.

It is also possible that because Australia has cycled through extreme weather events for some time that the people and governments have adapted to these dramatic changes. Indeed

the presence of EC assistance reflects an adaptation strategy as recommended by Keim as a response to climate change.³⁶ In addition, other social movements such as the Country Women's Association in rural areas could be buffering against adverse health effects, as suggested by recommendations by Ebi and Semenza.³⁷

Conclusions

Climate change is expected to lead to more frequent adverse climate events, and to pose risks to human health and well-being, particularly among vulnerable people. Contrary to these expectations, this analysis of Australian data found no health or well-being deficit associated with exposure to adverse climate events, primarily drought. This research is an important addition to existing literature on climate change and health. It suggests that in high-income countries such as Australia there are multiple resources, including government assistance and other forms of social support, which can mitigate some of the health impacts of adverse climate events.

References

- Campbell-Lendrum D, Bertollini R, Neira M, Ebi K, McMichael A. Health and climate change: a roadmap for applied research. *Lancet*. 2009;373(9676):1663-5.
- Costello A, Grant M, Horton R. The Lancet-UCL Commission: health effects of climate change. *Lancet*. 2008;371(9619):1145-7.
- McMichael AJ, Neira M, Bertollini R, Campbell-Lendrum D, Hales S. Climate change: a time of need and opportunity for the health sector. *Lancet*. 2009;374(9707):2123-5.
- Haines A, Kovats RS, Campbell-Lendrum D, Corvalan C. Harben Lecture – Climate change and human health: impacts, vulnerability, and mitigation. *Lancet*. 2006;367(9528):2101-9.
- Capon A, Hanna E. Climate Change: an emerging health issue. *N S W Public Health Bull*. 2009;20(1/2):1-4.
- Haines A. Climate Change and Health: Strengthening the Evidence Base for Policy. *Am J Prev Med*. 2008;35(5):411-3.
- Xun WW, Khan AE, Michael E, Vineis P. Climate change epidemiology: methodological challenges. *Int J Public Health*. 2010;55(2):85-96.
- McMichael AJ, Woodruff RE, Hales S. Climate change and human health: present and future risks. *Lancet*. 2006;367(9513):859-69.
- Edwards T, Fritze J, Wiseman J. Community wellbeing in a changing climate: challenges and Priorities for the Australian community sector. *Just Policy*. 2009;50:80-6.
- Berry HL, Bowen K, Kjellstrom T. Climate change and mental health: a causal pathways framework. *Int J Public Health*. 2010;55(2):123-32.
- Frumkin H, Hess J, Lubet G, Malilay J, McGeehin M. Climate change: The public health response. *Am J Public Health*. 2008;98(3):435-45.
- Centers for Disease Control National Centre for Environmental Health Services. *When Every Drop Counts: Protecting Public Health During Drought Conditions- A Guide for Public Health Professionals*. Atlanta (GA): United States Department of Health and Human Services; 2010.
- Edwards B, Gray M, Hunter B. A Sunburnt Country: The Economic and Financial Impact on Rural and Regional Families in Australia in an Era of Climate Change. *Aust J Labour Economics*. 2009;12(1):109-31.
- Kalis MA, Miller MD, Wilson RJ. Public Health and Drought. *J Environ Health*. 2009;72(1):10-1.
- Department of Agriculture Fisheries and Forestry. *Exceptional Circumstances*. Canberra (AUST): Commonwealth of Australia; 2009 [cited 2009 Aug 30]. Available from: <http://www.daff.gov.au/agriculture-food/drought/ec/background>
- Women's Health Australia. Samples and Response Rates. In: *Australian Longitudinal Study on Women's Health*. Newcastle (AUST): Research Centre for Gender, Health and Ageing, University of Newcastle; 2010 [cited 2010 Aug 25]. Available from: <http://www.alswh.org.au/Project/sample.html>
- Ware J, Kosinski M, Keller S. *SF-36 Physical and Mental Health Summary Scales: A User's Manual*. Boston (MA): The Health Institute, New England Medical Centre; 1994.
- Bell S, Lee C. Perceived stress revisited: The Women's Health Australia project Young cohort. *Psychol Health Med*. 2003;8(3):343-53.
- Powers JR, Young AF. Longitudinal analysis of alcohol consumption and health of middle-aged women in Australia. *Addiction*. 2008;103(3):424-32.
- GISCA. *About ARIA+ (Accessibility/Remoteness Index of Australia)*. Adelaide (AUST): University of Adelaide; 2009 [cited 2009 Dec 3]. Available from: http://gisca.adelaide.edu.au/projects/category/about_aria.html
- Sherbourne CD, Stewart AL. The MOS social support survey. *Soc Sci Med*. 1991;32(6):705-14.
- Lee C, Ford J, Gramotnev H. The Life Control Scale: Validation with a population cohort of middle-aged Australian women. *Int J Behav Med*. 2009;16(2):148-57.
- Scheier MF, Carver CS, Bridges MW. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem) – A reevaluation of the Life Orientation Test. *J Pers Soc Psychol*. 1994;67(6):1063-78.
- SAS: Statistical User's Guide. 8th ed. Cary (NC): SAS Institute; 1999.
- Australian Bureau of Statistics. *4399.0 – National Health Survey Australia, 1995: SF-36 Population Norms*. Canberra (AUST): AGPS; 1997.
- Dean J, Stain H. The impact of drought on the emotional well-being of children and adolescents in rural and remote New South Wales. *J Rural Health*. 2007;23(4):356-64.
- Dean JG, Stain HJ. Mental health impact for adolescents living with prolonged drought. *Aust J Rural Health*. 2010;18(1):32-7.
- Coelho AEL, Adair JG, Mocellin JSP. Psychological responses to drought in Northeastern Brazil. *Interam J Psychol*. 2004;38(1):95-103.
- Judd FK, Jackson HJ, Komiti A, Murray G, Hodgins G, Fraser C. High prevalence disorders in urban and rural communities. *Aust N Z J Psychiatry*. 2002;36(1):104-13.
- Smith KB, Humphreys JS, Wilson MGA. Addressing the health disadvantage of rural populations: How does epidemiological evidence inform rural health policies and research? *Aust J Rural Health*. 2008;16(2):56-66.
- Sartore. Drought and its effect on mental health. *Aust Fam Physician*. 2007;36(12):990-3.
- Alston M. Rural male suicide in Australia. *Soc Sci Med*. 2010. doi:10.1016/j.socscimed.2010.04.036 PubMed PMID: 20541304
- Panelli R. New directions on gender and environment: A review essay. *J Rural Stud*. 2006;22(4):493-6.
- Patz J, Campbell-Lendrum D, Gibbs H, Woodruff R. Health impact assessment of global climate change: Expanding on comparative risk assessment approaches for policy making. *Annu Rev Public Health*. 2008;29:27-39.
- Productivity Commission. *Government Drought Support. Productivity Commission Inquiry Report Number 46, Final Inquiry Report*. Melbourne (AUST): Commonwealth of Australia; 2009 [cited 2009 Aug 25]. Available from: http://www.pc.gov.au/_data/assets/pdf_file/0010/86275/drought-support.pdf
- Keim M. Building Human Resilience: The Role of Public Health Preparedness and Response As an Adaptation to Climate Change. *Am J Prev Med*. 2008;35(5):508-16.
- Ebi KL, Semenza JC. Community-Based Adaptation to the Health Impacts of Climate Change. *Am J Prev Med*. 2008;35(5):501-7.