Lack of association between drought and mental health in a cohort of 45–61 year old rural Australian women

Jennifer R. Powers,[1] Annette J. Dobson,[2] Helen L. Berry,[3] Anna M. Graves,[1] Ivan C. Hanigan,[4] Deborah Loxton[1]

Abstract

Objective: To evaluate the impact of drought on the mental health of rural Australian women and those in vulnerable sub-populations: women who were more isolated, poorer and less educated; and women who had histories of chronic disease or poor mental health.

Methods: Surveys were mailed in 1996, 1998, 2001, 2004 and 2008 to 6,664 women born between 1946 and1951 who were participating in the Australian Longitudinal Study on Women's Health. The surveys included the Mental Health Index of the Medical Outcomes Study Short-Form 36 (MHI). Drought was assessed by linking the latitude and longitude of women's place of residence at each survey to the Hutchinson Drought Index. Associations between MHI and drought were assessed using linear mixed-models.

Results: While 31% of the women experienced drought in 1998 and 50% experienced drought in 2007; experience of droughts was less common in the other years. Although drought varied from survey year to survey year, mental health did not vary with drought conditions for rural women or vulnerable sub-populations.

Conclusions: These findings are contrary to the long-held assumption that droughts increase mental health problems in Australia.

Implications: While similar results may not be true for men, empirical evidence (rather than assumptions) is required on associations between drought and mental health.

Key words: mental health, drought, women, vulnerable

Mental health is an important public health issue.[1] About one in four people experience at least one mental health problem in any given year in the United States[2] and in England.[3] Australian mental health surveys indicate the prevalence of mental health problems has remained at 20% for a decade.[4,5] Any factor that is likely to adversely affect mental health is a major concern.

Drought has been hypothesised to lead to increased mental health problems indirectly due to its damaging effects on physical health and, especially, on the economic and social base of communities; and directly through feelings of chronic loss and failure.[6-8] This hypothesis is supported by qualitative findings of poorer mental health associated with drought[9,10] and destruction of the landscape.[11] Quantitative evidence on the effect of drought on mental health is scant[12] and inconclusive.[7,13-16] In cross-sectional drought studies, no effect was found on the mental health of 2,462 rural adults,[14] or of 6,584 rural women,[16] although increased anxiety and emotional distress was found in a small Brazilian study of 204 adults.[7] In New South Wales, Australia, suicide rates were found to be associated with lower rainfall (1964–2001),[15] and were higher in 10–49 year old rural males, but not rural females, exposed to drought between 1970 and 2007.[13] Stronger evidence of the effect of drought on mental health may be provided by longitudinal studies.

Evidence is mounting of more intense droughts,[17] particularly between 25 and 40 degrees latitude,[18] with considerably decreased rainfall resulting in more intense droughts in the mid-latitudes of Australia, the Mediterranean, Central America and Mexico, central North America and southern Africa.[19,20] Furthermore, drought and other adverse weather events are expected to differentially affect vulnerable sub-populations.[6,21] A number of factors contribute to vulnerability, including geographic isolation, lower socioeconomic status and poorer health, and these may all result in increased risk of adverse health effects as a result of climate change. In addition, mental health problems are more common among socially disadvantaged people,[22] and so adverse weather events are expected to have a greater effect on the mental health of vulnerable subpopulations.[23]

Longitudinal data are needed to strengthen the evidence base for policy.[24] By using longitudinal data, the effects of drought on mental health can be investigated in the same individuals, effectively using the individuals

1. Research Centre for Gender, Health and Ageing, University of Newcastle, New South Wales
2. School of Population Health, University of Queensland
3. Faculty of Health, University of Canberra, Australian Capital Territory
4. National Centre for Epidemiology and Population Health, Australian National University, Australian Capital Territory
Correspondence to: Ms Jennifer Powers, Research Centre for Gender, Health and Ageing, University of Newcastle, Callaghan, NSW 2308; e-mail: jenny.powers@newcastle.edu.au
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as their own controls. This paper uses 12 years of longitudinal data to: 1) investigate whether drought is associated with poorer mental health among women living in rural Australia; and 2) determine whether drought is more likely to affect the mental health of women who are more geographically isolated, poorer and less educated or have histories of chronic disease or poor mental health.

Methods

Participants

Potential participants were invited to join the Australian Longitudinal Study on Women's Health in 1996. Women were randomly selected from the national health insurance database, Medicare Australia, which includes all Australian citizens and permanent residents. To ensure that women living in rural and remote areas were adequately represented, they were sampled at twice the rate of women in urban areas.

The first mailed survey was completed by 13,715 women aged 45 to 50 years (the 1946–1951 cohort), with an estimated response of 53% to 56%.[25] Respondents were broadly representative of women of the same age in the Australian population, with some over-representation of Australian-born and educated women.[25] Women were resurveyed in 1998 (47–52 years), 2001 (50 to 55 years), 2004 (53–58 years) and 2007 (56–61 years). Contact was maintained by newsletters, postal mail, telephone and email. Non-respondents were tracked using multiple methods[26] and vital status of non-respondents was established by annual linkage to the National Death Index.[27] Further details of the study are available online.[25] Ethics approvals were obtained from the University of Newcastle (H0760795) and University of Queensland (2004000224). Written informed consent for participation in the study was obtained from participants.

The Accessibility/Remoteness Index of Australia was used to classify the women's area of residence: major cities; inner regional; outer regional; or remote or very remote.[28] Women were included in the present analyses if they were living outside major cities in 1996 and between 25 and 40 degrees south of the equator, as these are the latitudes where drought is commonly experienced in Australia.[29] In 1996, 6,664 women (49% of the total sample of 13,715) met these inclusion criteria.

Measures

Unless indicated otherwise, all measures were taken at all five surveys.

Mental health: Mental health was measured using the Mental Health Index of the well-validated Medical Outcomes Study Short Form 36 (SF36).[30] The Mental Health Index was used for these analyses because it is a valid and reliable measure[30,31] and has been shown to distinguish between groups differing in the presence and severity of psychiatric disorders.[32] Furthermore, it is responsive to change over time.[33-35] The Mental Health Index contains five items measuring: nervousness; low mood; feeling down; feeling calm and peaceful; and being happy. Scores range from 0 to 100, with higher scores indicating better mental health. In these analyses the Mental Health Index was used as both a continuous and categorical measure. A score of less than 53 for the Mental Health Index is indicative of depression[30,36] and was used to define a subgroup of women with poor mental health. Normative data from the 1995 Australian National Health Survey show that a four-point lower mean score for the Mental Health Index is associated with the presence of a serious physical condition;[37] this information provides a benchmark for assessing the clinical importance of differences between groups of women.

Drought: Many measures exist for defining climatic drought, including the Palmer Drought Severity Index[38] and annual rainfall deciles,[39] and a modified version of these two indices – the Hutchinson Drought Index.[40] The Hutchinson Drought Index counts consecutive months of lower-than-median rainfall based on percentiles of rainfall recorded at each location.[13,40] A comparison of NSW agricultural drought declarations and the Hutchinson Drought Index, published in 1992, showed good agreement when the Hutchinson Drought Index score indicated at least ten months of abnormally dry conditions. Another advantage of the Hutchinson Drought Index is that it allows valid comparisons of drought across different regions and different years.[40] The Hutchinson Drought Index was added to participant data based on the latitude and longitude of each woman's place of residence[41] at the time she completed each of the five surveys. Women were defined as living with drought if they had experienced at least ten months of abnormally dry conditions. Over the 12 years of this study, women could experience drought at one or more of the surveys and no drought at other surveys, thus acting as their own control in longitudinal data analysis.

Explanatory factors: Several factors might mediate the impact of drought on mental health. Demographic factors included age and educational attainment in 1996, and area of residence, relocation to a major city, ability to manage on available income and relationship status at each of the five surveys. Highest level of education attained in 1996 was categorised as: 10 or less years of school; 11–12 years of school, apprenticeship or trade; certificate or diploma; or university. Ability to manage on available income was classed as: always difficult; difficult some of the time; not too bad; and easy. Relationship status was classified as: married or living in a de facto relationship; separated or divorced; widowed; or single.

Health-related factors that may mediate the impact of drought on mental health included tobacco and alcohol intake measured at every survey. Smoking categories were: never smoker; ex-smoker; current smoker of fewer than 10 cigarettes a day; or current smoker of 10 or more cigarettes a day. Alcohol intake was based on reported frequency (drink rarely; less than once a week; 1 or 2 days a week; 3 or 4 days a week; 5 or 6 days a week; or every day) and quantity of alcohol usually consumed per day (1 or 2 drinks; 3 or 4 drinks; 5 to 8 drinks; or 9 or more drinks) measured at all surveys except 2001. At the 2001 survey, alcohol intake (grams/day) was measured using the Cancer Council of Victoria food frequency questionnaire. Three categories were defined: non-drinker; moderate drinker (up to 14 drinks per week); and heavy drinker (15 or more drinks per week). Women were defined as having chronic disease if they reported in 1996 being diagnosed with any of the following: diabetes; heart disease; hypertension; stroke; bronchitis; asthma; or osteoporosis. In addition, experience of partner violence (ever in a violent relationship) may affect the impact of drought on mental health. Whether a woman had ever experienced partner violence was available for every survey.

Statistical analysis

All analyses were conducted in SAS version 9.3 (SAS Institute, Cary, NC). Associations between categorical explanatory factors and drought in 1996 were tested using chi-squared. The general linear model in SAS was used to test associations between the explanatory factors and continuous Mental Health Index scores. Explanatory factors were considered potential intermediary factors if

they were significantly associated with either drought or with Mental Health Index scores. Linear mixed models (the MIXED procedure in SAS) were used to analyse the longitudinal data, taking into account the correlated data within individuals. Up to five Mental Health Index scores were available per participant between 1996 and 2007. Mixed-models were fitted with random effects (intercept) for individual women, with all other effects fixed. Robust standard errors were estimated. The outcome measure was continuous Mental Health Index scores and the main explanatory variable was drought. Models were adjusted for demographic and health-related factors and experience of partner violence at each survey. All models included survey year (fitted as a categorical variable with 1996 as the reference year). Interaction terms for time (survey year) and drought were fitted to models where both main effects were statistically significant.

Few data were missing for individual variables at any survey, and 95% of the women answered at least two of the five surveys. Missing data, mainly due to loss to follow-up, were addressed by the use of the MIXED procedure[42] and the following sensitivity analyses. Complete case analyses were conducted for all eligible women. Separate models were also fitted for potentially vulnerable sub-groups of women identified as isolated, poorer, less educated, and women with histories of chronic disease or poorer mental health based on their characteristics measured in 1996. Isolated women were defined as those living in outer regional or remote areas, the most geographically isolated and furthest from services. Poorer women were those who said they always had difficulty managing on available income. Less-educated women were those who reported their highest educational level was up to 10 years of school. Women with a history of chronic disease were those with at least one chronic condition, and women with poor mental health reported a score of less than 53 for the Mental Health Index in 1996. For all sub-groups, the sample sizes were adequate to detect a clinically significant difference of four points or more in the Mental Health Index at 5% significance level with 80% power.

Results

Of the 6,664 women included in the current study, loss to follow-up between 1996 and 2007 was due to death or incapacity (n=177), withdrawal (n=411) or lack of contact (n=320) during the 2007 survey. Eighty-two per cent of the women (n=5,441) completed four or all five surveys. Completion and loss to follow-up were not associated with drought. While drought was not common in 1996, 2001 and 2004, one-third of the women experienced drought in 1998 and half the women experienced drought in 2007 (Figure 1). Thirty-five per cent of women did not experience drought at any survey; 43% experienced drought at one survey; 20% at two surveys; 2% at three surveys; two women at four surveys; and none experienced drought at all five surveys. Being in drought in 1996 was associated with area

Figure 1: Percentages of women living in drought and their mean Mental Health Index at each survey.

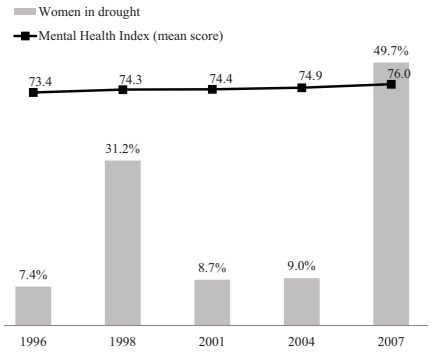

Table 1: Characteristics of 6,664 Australian women by drought[a] and Mental Health Index in 1996.

	N	Not in drought N=6172 %	Drought N=492 %	Mental Health Index mean (95% CI)
Demographic factors				
Area of residence		*p*<0.01		*p*=0.05
Inner regional	4,492	68.5	53.5	73.1 (72.6, 73.6)
Outer regional	1,871	27.9	29.9	73.7 (72.9, 74.5)
Remote or very remote	301	3.6	16.7	75.5 (73.5, 77.5)
Relocation to a major city between 1996 and 2007		*p*=0.81		*p*=0.19
Yes	690	10.9	10.5	73.0 (71.6, 74.3)
No	5,666	89.1	89.5	73.9 (73.4, 74.3)
Highest educational level		*p*<0.01		*p*<0.01
10 years school or less	3,598	54.9	48.6	72.0 (71.4, 72.6)
11-12 years school or trade	1,213	17.9	23.8	74.6 (73.7, 75.6)
Certificate or diploma	1,013	15.4	14.1	76.1 (75.0, 77.2)
University	783	11.7	13.5	74.6 (73.4, 75.8)
Ability to manage on income		*p*=0.07		*p*<0.01
Always difficult	1,025	15.7	12.9	63.5 (62.4, 64.5)
Difficult some of the time	2,033	30.8	28.6	71.9 (71.1, 72.6)
Not too bad	2,718	40.9	42.6	76.5 (75.9, 77.2)
Easy	854	12.6	15.9	79.0 (77.9, 80.2)
Relationship status		*p*<0.01		*p*<0.01
Married or de facto	5,686	85.1	89.6	74.3 (73.9, 74.8)
Separated or divorced	678	10.5	5.7	66.7 (65.3, 68.0)
Widowed	123	1.8	2.9	69.4 (66.3, 72.6)
Single	168	2.6	1.8	71.4 (68.7, 74.0)
Health-related factors				
Smoking status		*p*=0.08		*p*<0.01
Never-smoker	3,481	53.8	58.4	75.2 (74.6, 75.7)
Ex-smoker	1,793	27.9	27.9	73.6 (72.7, 74.4)
Smoke less than 10 cigarettes/ day	206	3.2	2.7	71.9 (69.5, 74.3)
Smoke 10 or more cigarettes/day	953	15.0	11.0	68.3 (67.2, 69.4)
Alcohol consumption		*p*<0.05		*p*<0.01
Non-drinker	1,021	15.6	13.7	73.6 (72.6, 74.7)
Moderate drinker	5,231	78.9	83.1	73.8 (73.3, 74.3)
Heavy drinker	349	5.5	3.3	68.7 (66.8, 70.6)
Any diagnosed physical condition[b]		*p*=0.25		*p*<0.01
Yes	2,976	45.2	42.5	71.2 (70.5, 71.8)
No	3,636	54.8	57.5	75.3 (74.7, 75.9)
Ever experienced partner violence		*p*<0.01		*p*<0.01
Yes	1,054	16.2	11.6	66.3 (65.3, 67.4)
No	5,592	83.8	88.4	74.8 (74.3, 75.2)

a: Drought was defined as at least 10 months abnormally dry conditions.

b: Self-reported diagnoses of diabetes, heart disease, hypertension, stroke, bronchitis, asthma or osteoporosis.

of residence, education, relationship status, alcohol consumption and experience of partner violence, but not with relocation to a major city, difficulty managing on income, smoking or history of chronic disease (Table 1). The Mental Health Index was associated with all variables except area of residence and relocation to a major city.

A small improvement was seen in the Mental Health Index between 1996 and 2007; however, the Mental Health Index did not differ by drought, even though drought varied from survey year to survey year (Table 2, Figure 1). Women who had difficulty managing on their available income and women with poor mental health in 1996 had significantly poorer Mental Health Index (Table 3) compared with the general population of women (Table 2). The Mental Health Index of women in vulnerable sub-populations improved significantly over time and was unrelated to drought (Table 3). In adjusted models, two results deviated from this pattern of findings: less-educated women and women with poor mental health in 1996 who had experienced drought had slightly better Mental Health Index, as would be expected due to regression to the mean. Complete case analyses for women who responded to all surveys provided similar results (Tables 4 and 5).

Table 2: Mixed models for mental health for 6,664 Australian women by drought.

	Unadjusted model Estimate (SE) N=6,664	Adjusted model* Estimate (SE) N=6,538
Intercept	**73.31 (0.22)**	**74.63 (0.59)**
Survey year		
1996	reference	reference
1998	**0.56 (0.21)**	0.44 (0.23)
2001	**0.44 (0.22)**	0.24 (0.24)
2004	**0.99 (0.23)**	**0.88 (0.24)**
2007	**1.80 (0.25)**	**1.52 (0.27)**
Drought status		
Not in drought	reference	reference
Drought	0.24 (0.21)	0.38 (0.21)

** Model adjusted for age, area of residence, education, income, marital status, smoking, alcohol consumption and experience of partner violence.*

Statistically significant estimates (at 0.05 level) are shown in bold.

Two further mental health questions were asked at the 2001, 2004 and 2007 surveys: 'Have you consulted a counsellor, psychologist or social worker for your own health in the last twelve months?' and 'In the past week, have you been feeling that life isn't worth living?' Prevalence of consultation did not differ by experience of drought or not (6.0% versus 6.7% in 2001, 8.3% versus 6.7% in 2004 and 7.2% versus 8.8% in 2007). Nor were women more likely to feel life was not worth living (6.8% versus 7.8% in 2001, 6.3% versus 5.8% in 2004 and 5.4% versus 6.4% in 2007). Furthermore, drought conditions were more severe in 2007, yet women living in drought were not more likely to consult counsellors or feel that life was not worth living.

Discussion

No association was found between drought and women's mental health, either generally, or in potentially vulnerable groups. The results were unexpected given hypotheses of adverse mental health impacts as a result of drought.[6,19,43] It is possible 45–61 year old women are adaptable and cope with the chronic nature of drought without showing a direct mental health effect. In support of this alternative explanation, previous research showed no mental health deficit attributable to living in an area sufficiently affected by climate events to be eligible for relief payments.[16] Furthermore, a large New South Wales study (1970–2007) found an increased relative risk of suicide for 10–49 year old rural males with increasing drought, but not for females or older males.[13] These findings suggest that rural women are less affected by drought than men, providing hope that identifying factors that keep women healthy could inform prevention interventions for men in drought-affected communities.

The findings did not support contentions that poor mental health is likely to be exacerbated among vulnerable groups exposed to drought in high-income countries.[19,44] Vulnerability to poorer mental health is known to vary with socioeconomic and health status, age and gender[22,45] – findings

Table 3: Mixed models for Mental Health Index for subgroups of vulnerable women by drought.

	Isolated women Estimate (SE)	Poorer women Estimate (SE)	Less educated Estimate (SE)	Chronic disease Estimate (SE)	Poor mental health Estimate (SE)
Unadjusted	N=2,172	N=1,025	N=3,598	N=2,976	N=883
Intercept	**73.83 (0.38)**	**63.34 (0.64)**	**71.91 (0.31)**	**71.07 (0.34)**	**54.49 (0.76)**
Survey year					
1996	reference	reference	reference	reference	n/a
1998	0.61 (0.35)	**1.58 (0.64)**	**0.80 (0.30)**	0.37 (0.33)	reference
2001	0.45 (0.39)	**1.97 (0.68)**	**0.65 (0.32)**	**0.78 (0.34)**	**1.99 (0.80)**
2004	**0.87 (0.40)**	**3.23 (0.72)**	**0.86 (0.34)**	**1.11 (0.35)**	**3.86 (0.81)**
2007	**1.86 (0.43)**	**3.55 (0.79)**	**1.35 (0.36)**	**1.81 (0.39)**	**4.34 (0.83)**
Drought status					
Not in drought	reference	reference	reference	reference	reference
Drought	0.40 (0.37)	0.91 (0.65)	**0.74 (0.30)**	**0.64 (0.32)**	1.40 (0.76)
Adjusted model*	N=2,132	N=998	N=3,548	N=2,913	N=790
Intercept	**73.00 (1.35)**	**65.06 (1.82)**	**74.66 (5.01)**	**71.95 (0.90)**	**54.85 (2.12)**
Survey year					
1996	reference	reference	reference	reference	n/a
1998	0.60 (0.38)	**1.46 (0.69)**	**0.74 (0.34)**	0.26 (0.36)	reference
2001	0.44 (0.44)	**1.75 (0.74)**	0.64 (0.35)	0.31 (0.37)	**2.56 (0.87)**
2004	**0.94 (0.42)**	**3.39 (0.76)**	**0.97 (0.35)**	**0.97 (0.37)**	**4.40 (0.89)**
2007	**1.64 (0.47)**	**3.26 (0.84)**	**1.24 (0.38)**	**1.54 (0.42)**	**4.24 (0.91)**
Drought status					
Not in drought	reference	reference	reference	reference	reference
Drought	0.69 (0.38)	1.22 (0.67)	**0.94 (0.31)**	0.56 (0.34)	**2.15 (0.81)**

** Model adjusted for age, area of residence, education, income, marital status, smoking, alcohol consumption and experience of partner violence.*

Statistically significant estimates (at 0.05 level) are shown in bold.

Table 4: Mixed models for Mental Health Index for complete cases (women who answered all surveys).

	Unadjusted model Estimate (SE) N=4,465	Adjusted model* Estimate (SE) N=4,439
Intercept	**75.04 (0.25)**	**75.66 (0.68)**
Survey year		
1996	reference	reference
1998	0.04 (0.24)	0.12 (0.24)
2001	-0.05 (0.25)	-0.15 (0.26
2004	0.46 (0.26)	0.51 (0.27)
2007	**1.25 (0.27)**	**1.18 (0.29)**
Drought status		
Not in drought	reference	reference
Drought	0.30 (0.22)	0.38 (0.23)

** Model adjusted for age, area of residence, education, income, marital status, smoking, alcohol consumption and experience of partner violence.*

Statistically significant estimates (at 0.05 level) are shown in bold.

that were demonstrated for the women in this study. However, women who lived through droughts did not have worse mental health than other women, even when they were more isolated, less educated, poorer or living with chronic conditions. In a developed country such as Australia, access to resources such as information and technology, as well as the potential for financial assistance and social networks, may work to decrease vulnerability[46] and thus alleviate any mental health effects of drought. Evidence suggests that women have higher levels of social support and greater resilience than men;[47-50] factors that may explain women's ability to cope with drought.

This study has several strengths. It is the only longitudinal prospective study of the effects of drought on mental health. The measure of drought, calculated using a century of rainfall data validated against drought declarations, allowed for objective identification of drought over the period of this study. Furthermore, this study of the mid-latitudes of Australia has relevance to other parts of the world (the Mediterranean, Central America, Mexico, central North America and southern Africa) where longer-term drying is increasingly being observed.[19,20]

The data were collected prospectively over 12 years, allowing for change in mental health to be measured as drought conditions changed. The wide range of mental health scores and poorer mental health status that was evident for women in lower socioeconomic groups show that the mental health measure was responsive to differences between groups. The comprehensive nature of the surveys also allowed socioeconomic and psychosocial vulnerabilities to be taken into account.

While the large-scale, nationally representative sample of 45–61 year old women is a further strength, the findings may not apply to women of other ages. Although broadly representative of women of the same age in the Australian population, there was some over-representation of more-educated women.[25] As a result, participants would be expected to have better mental health than Australian women of the same age, which appears to be the case. Before and after adjustment for education, mental health was no worse for women living in drought and non-drought areas. Furthermore, sensitivity analysis of less-educated women revealed women living with drought had better mental health than those living in non-drought areas. These results are consistent with the findings of two smaller studies in rural and remote Australian communities.[14,51] Both studies found that the mental health of men and women was associated with individual characteristics rather than with drought.

About 20% of women were non-respondents in 2007. Not only was loss to follow-up (due to death or incapacity, withdrawal or lack of contact during the 2007 survey) the same by drought, but women were equally likely to be non-respondents across drought. While the mental health of women who were lost to follow-up may have differed by drought, complete case analyses and sub-group analyses (including women with poorer mental health) showed no association between drought and mental health.

Table 5: Mixed models for Mental Health Index for subgroups of vulnerable women (complete cases).

	Isolated women Estimate (SE)	Poorer women Estimate (SE)	Less educated Estimate (SE)	Chronic disease Estimate (SE)	Poor mental health Estimate (SE)
Unadjusted	N=1,442	N=584	N=2,262	N=1,957	N=532
Intercept	**75.40 (0.45)**	**65.69 (0.81)**	**74.02 (0.37)**	**72.96 (0.40)**	**54.65 (0.90)**
Survey year					
1996	reference	reference	reference	reference	n/a
1998	0.21 (0.39)	1.37 (0.77)	0.22 (0.35)	-0.15 (0.37)	reference
2001	0.06 (0.44)	0.97 (0.82)	0.08 (0.37)	-0.07 (0.39)	**2.30 (0.90)**
2004	0.55 (0.44)	**2.63 (0.85)**	0.31 (0.38)	0.38 (0.40)	**4.23 (0.91)**
2007	**1.37 (0.47)**	**2.82 (0.90)**	0.71 (0.40)	**1.16 (0.43)**	**4.35 (0.93)**
Drought status					
Not in drought	reference	reference	reference	reference	reference
Drought	0.48 (0.40)	1.10 (0.73)	**0.78 (0.33)**	0.56 (0.35)	**2.29 (0.85)**
Adjusted model*	N=1,433	N=583	N=2,261	N=1,946	N=526
Intercept	**74.13 (1.49)**	**67.59 (2.24)**	**68.20 (5.36)**	**72.33 (1.04)**	**54.68 (2.38)**
Survey year					
1996	reference	reference	reference	reference	n/a
1998	0.41 (0.40)	1.51 (0.77)	0.42 (0.36)	-0.09 (0.38)	reference
2001	0.09 (0.48)	1.23 (0.85)	0.21 (0.38)	-0.15 (0.41)	**2.34 (0.93)**
2004	0.76 (0.46)	**3.00 (0.88)**	0.59 (0.39)	0.50 (0.41)	**4.30 (0.97)**
2007	**1.34 (0.50)**	**2.91 (0.94)**	**0.84 (0.42)**	**1.15 (0.45)**	**3.86 (0.98)**
Drought status					
Not in drought	reference	reference	reference	reference	reference
Drought	0.62 (0.40)	1.17 (0.73)	**0.83 (0.33)**	0.59 (0.36)	**2.55 (0.88)**

** Models were adjusted for age, area of residence, education, income, marital status, smoking, alcohol consumption and experience of partner violence.*

Statistically significant estimates (at 0.05 level) are shown in bold.

Conclusions

This paper answers repeated calls for empirical studies on the effects of adverse weather events – such as drought – on mental health[52,53] and, as recommended, provides a thorough investigation of the association between mental health and drought, taking into account influences other than drought.[54,55] Over the 12 years of this longitudinal prospective study, drought was not associated with poorer mental health in mid-aged women in general, or in groups of potentially vulnerable women. The finding that, compared with men, women were at reduced relative risk of suicide during drought[13] suggests that rural women appear to be less affected by drought than rural men. As with all epidemiological studies, the findings relate to average effects and so may not hold true for individual women, whose mental health may be affected by drought.

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