

ORIGINAL RESEARCH

A population view of mental illness in South Australia: broader issues than location

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Submitted: 13 January 2006; Resubmitted: 1 May 2006; Published: 14 June 2006

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Rural and Remote Health 6: 541. (Online), 2006

Available from: <http://rrh.deakin.edu.au>

A B S T R A C T

Introduction: There is growing evidence in Australia and elsewhere to indicate that prevalence rates of mental illness are no higher in rural and remote areas than in urban areas. However, it is generally perceived that people from rural and remote areas are at heightened risk of mental illness, because many psychosocial determinants of health are magnified by factors related to remoteness. In this study we attempt to unpack the factors guiding prevalence rates of mental illness to determine if remoteness *per se* is an important determinant of mental illness.

Methods: Analysis of data from a cross-sectional, population-based, computer-assisted telephone interview survey in 2000. Respondents included 2545 South Australian adults, aged 18 years or more. The mental illness measure was self-reported, medically confirmed depression, anxiety or stress related problems in the previous 12 months and receiving treatment. Remoteness was determined using the Accessibility and Remoteness Index of Australia (ARIA). Psychosocial measures consisted of major stressful life events, perceived control of life events, socio-demographic characteristics and lifestyle behaviours.

Results: Unadjusted odds of mental illness were lower among residents of accessible and remote/very remote areas than for those from highly accessible areas (OR [odds ratio] 0.67, 95% CI 0.50-0.91 and OR 0.73, 0.54-1.00). After controlling for the joint effects of stressful life events, perceived control of life events, socio-demographic characteristics and lifestyle behaviors, odds of mental illness did not vary by ARIA category (highly accessible [reference category]; accessible: OR 0.90 95% CI 0.60-1.31; moderately accessible: OR 0.80, 95% CI 0.45-1.43; remote/very remote: OR 0.70, 95% CI 0.44-1.03). The most important



predictors of mental illness in the multivariate logistic model were female sex; smoking; low consumption of vegetables; low exercise; a physical condition; perceived lack of control with life in general, personal life, job security or health; and major stressful events such as family or domestic violence and the death of someone close.

Conclusions: Remoteness *per se* was not associated with mental illness, either directly or indirectly, as an important confounder in stressful life event/mental illness associations. Psychosocial factors were more important determinants of mental illness.

Key words: ARIA, CATI, cross sectional survey, mental illness, psychosocial determinants.

Introduction

Mental illness contributed to almost 11% of the total world disease burden in 1990 and is predicted to reach 15% by 2020¹. In Australia, nearly 20% of individuals suffer from a mental illness such as anxiety, depression or substance abuse, and almost one half of these are affected long term^{2,3}. Moreover, mental disorders are the leading cause of years of life lost due to chronic disability⁴. Psychosocial determinants of health such as socioeconomic position, social networks and support, discrimination, stressful events and a sense of control (in work and life generally) are now understood to play an important part in disease development and prognosis⁵⁻⁷. Psychosocial determinants can mediate the effects of social structural factors on individual health outcomes or, in turn, are modified by the social structures and contexts in which they exist⁸.

Rural and remote Australians experience significant inequalities in health for many health indicators such as suicide, circulatory diseases, respiratory diseases, diabetes, some cancers, injuries and access to adequate health care⁹. It is generally perceived that people from rural and remote communities are at heightened risk of mental illness because many of the psychosocial determinants of health are magnified by factors related to remoteness, such as isolation, economic restructuring and unpredictable ecological conditions¹⁰. Previously we have shown no spatial variation in prevalence rates of mental illness across South Australia, and the overall age-sex standardised prevalence of depression, anxiety and stress-related problems was 12.7%

(95% CI: 11.4-14.0)¹¹. However, it is unknown whether remoteness *per se* (as distinct from other aspects of areas) is an important risk factor for mental illness.

The aim of this study was to determine if remoteness *per se* was associated with mental illness, by examining the relationship between stressful life events and mental illness, when controlled for the potential confounding effects of remoteness.

Methods

Survey design and sample selection

Data were obtained from the South Australian component of the Western Australia, Northern Territory and South Australia collaborative 'Health and Wellbeing' (WANTS), Computer Assisted Telephone Interview (CATI) survey, conducted during October and November 2000, by the former Centre for Population Studies in Epidemiology, Department of Human Services, South Australia, Australia¹². CATI is a telephone monitoring system designed to provide high quality data and is an efficient means of monitoring self-reported aspects of population health, particularly in rural and remote areas¹³.

The survey was administered to South Australian residents via a 15 min telephone interview. All households with a telephone number listed in the latest version of the Australian Electronic White Pages were eligible for



inclusion and, in each selected household, the last person to have a birthday was selected. The survey used a stratified, random sampling method where separate random samples were drawn from each of three geographic regions (metropolitan, rural and remote) and oversampling was undertaken in non-metropolitan areas. The aims, methods and initial findings of the survey have been reported elsewhere¹².

Survey measures

Mental health: Self-reported, but medically confirmed, mental illness was derived from the question, 'In the last 12 months, have you been told by a doctor that you have anxiety, depression, a stress-related problem, any other mental health problem or receiving treatment for this?'

Geographical dispersion: Remoteness was determined using the Accessibility and Remoteness Index of Australia (ARIA)¹⁴. ARIA is a geographical index that defines remoteness as accessibility to 201 service centres across Australia based on road distances. Remoteness values for 11 338 populated localities are derived from the road distance one has to travel to reach service centres in four different categories based on population size (A:>250 000 people; B:48 000-249 999; C:18 000-47 999; D:5000-17 999), and a weighting factor is applied for islands. Using geographical information system capabilities, distances for each populated locality are converted to a continuous variable with values that range from zero for high accessibility to 12 for extreme remoteness. ARIA values were then grouped into five aggregate categories using 'natural breaks' in the zero to 12 continuous variables, ('highly accessible' [0-1.84]; 'accessible' [1.84-3.51]; 'moderately accessible' [3.51-5.80]; 'remote' [5.80-9.08]; 'very remote' [9.08-12.0]). ARIA was developed so that the locational disadvantage of a place can be assessed as distinct from other aspects of areas (such as socioeconomic status and population size factors), to increase the scope for examining the relationship between remoteness and other

aspects. Data for remote and very remote categories were combined to produce a sufficient sample size.

Psychosocial determinants: *Socio-demographic data and lifestyle behaviours* Respondents were asked their age, sex, marital status, country of birth, type of work they had done for most of their lives, employment status, educational attainment, total annual combined household income, current money situation ('spend more money than get, have just enough to get through to next pay day, have some left over each week, can save a bit every now and then or can save a lot') or whether they were in receipt of a pension or benefit from Centrelink, the Department of Veterans Affairs or overseas.

Data were obtained on alcohol consumption ('non drinker/no risk, low risk, intermediate, very high risk'), smoking status ('non-smoker, ex-smoker and smoker'), height (in metres) and weight (in kilograms). Body mass index was derived from self-reported height and weight, scored (weight (kgs)/height [m]²) and classified into four categories; underweight (less than 20), normal weight (20-25), overweight (>25-30) and obese (>30), according to current international criteria¹⁵. The presence or absence of a physical health condition was determined using the SF-12 Physical Component Summary (PCS). The SF-12 was scored as specified in the SF-12 scoring manual¹⁶. The scores range from zero to 100, and a PCS score of 50 or less determines a physical condition¹⁷. Nutritional status was determined by respondent fruit and vegetable consumption and classified according to nationally recommended cut offs (≤ 1 , 2-3 and > 3 serves daily), respectively¹⁸. Measures of physical activity included self-reported low (days walked for at least 10 min at a time), moderate (days engaged in brisk walking, bicycling, vacuuming, gardening or anything else that caused increased breathing or heart rate) or vigorous exercise (days engaged in activities designed to increase muscle strength or tone, such as lifting weights, pull-ups or push-ups).

Perceived control of life events Respondents were asked how much of the time during the past four weeks they felt a lack of control with: life in general, their financial situation,



personal life, job security, work life (paid or voluntary) or health. Similar to questions included in previous Australian health surveys, responses were recorded on a 5-point scale ranging from one, never to five, always¹⁹.

Stressful life events Respondents were asked whether in the past 12 months they had: experienced the death of someone close, a new job, moved house, a marriage/relationship break-down, robbery or burglary, serious illness, discrimination, serious injury, unplanned loss of job, family or domestic violence or other major event. Selected major stressful event questions were derived from a previous South Australian mental health survey²⁰.

Statistical analysis

Data were weighted by geographic region (metropolitan, rural and remote) age, sex and probability of selection in the household using the ABS 1999 census total ERP of adults aged 18 years or more²¹. As each region involved a discrete sample, these were weighted separately. The study had 92% power (at the 5% level) to detect a 50% difference in prevalence of self-reported mental illness between remote/very remote areas and elsewhere.

Data were analysed using SPSS vers 12.01 (SPSS Inc; Chicago IL, USA) and Stata vers 8 (StataCorp; College station, TX, USA). Bi-variate analyses (using univariate logistic regression models) were undertaken initially to examine associations between ARIA, socio-demographic characteristics, stressful life events, perceived control of life events and lifestyle behaviours, and mental illness. Next, a multivariate logistic model was developed (and included all variables with a *p*-value <0.25 at the bi-variate level) to determine the variables that best predicted mental illness. The model was fitted using backward stepwise elimination of non-significant variables, based on log likelihood ratio tests and a *p*-value of 0.05. Logistic regression analysis generates a coefficient for each variable that is equal to the natural logarithms of the odds ratio for predictors²². Odds ratios for categorical variables represent the odds of having a self-reported mental illness relative to the reference category.

Receiver-Operator-Characteristic (ROC) curve statistics and model goodness-of-fit tests were conducted to examine the performance of the model in predicting presence or absence of disease.

Finally, a series of multivariate logistic regression models was developed (and included all variables used in the previous model) to examine the relationship between stressful life events and mental illness, while adjusting for the sequential inclusion of potential confounders (joint stressful life events, ARIA, perceived control of an event and lifestyle behaviours). Crude and adjusted odds ratios are reported, together with 95% confidence intervals.

Results

Sample population

Of 3989 eligible respondents, 1446 proved ineligible due to no contact after six attempts (*n* = 542), refusals (*n* = 737), being incapacitated (*n* = 98), unable to speak English, Italian, Greek, Croatian, Chinese or Vietnamese (*n* = 41), hearing impaired (*n* = 14) or because of terminated interviews (*n* = 12). In all, 2545 respondents participated in the survey. A response rate of 64% is in keeping with surveys of this type. Aboriginal people represented 1% of the sample which is similar to the proportion for Australia as a whole.

Remoteness and mental illness

The unadjusted odds of mental illness were statistically significantly lower among residents of accessible and remote/very remote areas, compared with highly accessible areas (OR 0.67, 95% CI 0.50-0.91; and OR 0.73, 0.54-1.00) (Table 1).



Table 1: Crude odds ratios and 95% confidence intervals for likelihood of mental illness by ARIA and socio-demographic factors

Socio-demographic characteristic	Mental illness n = 328 n	No mental illness n = 2217 n	OR (95% CI)	P value
ARIA [†]				
Highly accessible	130	832	1.00 (ref)	-
Accessible	62	512	0.67 (0.50-0.91)	0.01
Moderately accessible	26	251	0.67 (0.44-1.01)	0.50
Remote/very remote	70	662	0.73 (0.54-1.00)	0.03
Age (years)				
≥ 55	116	912	1.00 (ref)	-
35-54	158	857	1.45 (1.12-1.90)	0.005
18-34	54	448	0.94 (0.67-1.33)	0.80
Sex				
Female	234	1223	1.00 (ref)	-
Male	94	994	0.50 (0.40-0.63)	<0.001
Marital status				
Married	184	1469	1.00 (ref)	-
Separated/divorced/widowed	100	413	1.05 (0.74-1.48)	0.80
Never married	44	335	1.93 (1.48-2.52)	<0.001
Work status				
Manager	59	380	1.00 (ref)	-
Clerk/sales	115	762	0.97 (0.70-1.40)	0.90
Labourer	67	557	0.77 (0.53-1.12)	0.20
Home duties/never worked	45	261	1.11 (0.73-1.70)	0.62
Other	42	257	1.05 (0.70-1.61)	0.81
Employment status				
Employed	157	1237	1.00 (ref)	-
Unemployed	15	54	2.20 (1.21-4.00)	0.01
Home duties/retired/student	156	926	1.33 (1.05-1.70)	0.02
Combined annual household income				
\$80,000	18	250	1.00 (ref)	-
\$20,000-\$80,000	133	1011	1.83 (1.10-3.05)	0.02
≤ \$20,000	141	665	2.94 (1.76-4.91)	<0.001
Not stated	36	291	1.72 (0.95-3.10)	0.07

OR, Odds ratio; CI, confidence interval.

†Accessibility and Remoteness Index of Australia categories¹⁵.

The odds of mental illness did not vary by ARIA and were no longer significantly associated with mental illness after adjusting for the effects of stressful life events, perceived control of life events, socio-demographic characteristics and lifestyle behaviors (highly accessible [reference category]; accessible OR 0.90, 95% CI 0.60-1.31; moderately accessible OR 0.80, 95% CI 0.45-1.43; remote/very remote

OR 0.70, 95% CI 0.44-1.03) (Table 2). The ROC curve statistic indicated that the final set of variables correctly predicted the presence of mental illness in 80% of cases (0.8030) and the Hosmer-Lemeshow goodness of fit test indicated a good fitting model (χ^2 5.67 (df_8) [degrees of freedom], $p = 0.6847$).



Table 2: Adjusted odds ratios and 95% confidence intervals for best predictors of mental illness

Independent variables	OR (95% CI)	p value
Sex		
Female	1.00 (ref)	-
Male	0.40 (0.25-0.62)	<0.001
Smoking status		
Non-smoker	1.00 (ref)	-
Ex-smoker	1.44 (0.93-2.25)	0.11
Smoker	2.50 (1.50-4.14)	0.001
Vegetable consumption		
None/don't eat/don't know	1.00 (ref)	-
1 serve or less	1.64 (1.04-2.60)	0.03
2-5 serves	1.45 (0.81-2.60)	0.20
≥ 6 serves	2.10 (0.33-12.60)	0.43
Low exercise		
No	1.00 (ref)	-
Yes	1.40 (0.93-2.09)	0.03
Physical condition (SF-12 PCS)		
No	1.00 (ref)	-
Yes	1.90 (1.20-3.00)	0.005
Lack of control with life in general		
Never	1.00 (ref)	-
Rarely	1.60 (1.00-2.80)	0.10
Sometimes	2.11 (1.25-3.60)	0.005
Often	2.42 (0.90-6.70)	0.08
Always	5.0 (1.40-17.80)	0.01
Lack of control with personal life		
Never	1.00 (ref)	-
Rarely	1.10 (0.61-2.00)	0.80
Sometimes	2.0 (1.12-3.12)	0.02
Often	1.30 (0.50-3.60)	0.62
Always	5.10 (1.22-21.05)	0.03
Lack of control with job security		
Never	1.00 (ref)	-
Rarely/sometimes	0.73 (0.40-1.40)	0.34
Often/always	4.11 (1.74-9.70)	0.001
Lack of control with health		
Never	1.00 (ref)	-
Rarely	2.20 (1.20-4.05)	0.01
Sometimes	3.00 (1.80-5.00)	<0.001
Often	2.60 (1.11-6.00)	0.03
Always	1.34 (0.50-3.72)	0.60
Stressful life events		
No	1.00 (ref)	
Family or domestic violence	3.0 (1.10-7.70)	0.03
No	1.00 (ref)	
Death of someone close	2.11 (1.40-3.30)	0.001

OR, Odds ratio; CI, confidence interval.



Psychosocial determinants and mental illness

Socio-demographic characteristics and lifestyle behaviours: Increased odds of mental illness was associated with being in mid-age; female; never married; the unemployed, home duties, retirement or a student; and on a low to middle income (Table 1). Being a smoker (OR 2.10, 95% CI 1.53-2.81), having a risk level of alcohol (low risk; OR 1.40, 95% CI 1.10-1.77; intermediate to very high risk; OR 2.00, 95% CI 1.20-3.20) being obese (OR 1.50, 95% CI 1.10-2.0) or undertaking vigorous exercise (OR 1.50, 95% CI 1.20-1.90) was also associated with mental illness (Table 3). Respondents who reported a physical condition experienced a greater than two-fold increased risk of mental illness (OR 2.60, 95% CI 1.80-3.77).

Perceived control of life events: There was a strong inverse association between perceived control of life event variables and mental illness (score test for trend of odds, $\chi^2 < 0.001$ for all domains), particularly for control with life in general, personal life and health (Table 4).

Stressful life events: Six of 11 stressful life event domains were significantly associated with the likelihood of mental illness at the crude level; family/domestic violence (OR 7.25, 95% CI 4.15-12.65); death of someone close (OR 1.71, CI 1.32-2.22); discrimination (OR 4.80, CI 3.10-7.44); marriage/ relationship breakdown (OR 4.75, CI 3.30-6.90), serious illness (OR 3.53, CI 2.51-5.00); or other major event (OR 2.04, CI 1.51-2.80) (Table 5). Controlling for the joint affects of stressful life events, resulted in overall weaker associations between stressful life events and mental illness (Table 5, Model 0). Of particular note, these values did not change after adjusting for the effects of ARIA (Table 5, Model 1).

Discussion

Our findings demonstrate that remoteness *per se* is not an independent risk factor for mental illness.

Despite current perceptions that broader psychological determinants of mental illness are magnified by additional stressors related to remoteness and isolation, we found that remoteness as determined by ARIA had little effect on psychosocial/mental illness associations. Psychosocial determinants such as stressful life events, perceived control of life events, socio-demographic characteristics and lifestyle behaviours were more important predictors of mental illness. It is important to stress that in previous work we have shown that the prevalence of mental illness is not very different across ARIA zones¹¹. Here we have been able to demonstrate through multivariate analysis that remoteness *per se* is not an independent factor determining mental illness.

Increasingly findings from Australian and international prevalence studies indicate that levels of mental illness are similar everywhere^{3,11,23-26}. However, prevalence is determined by multiple factors and estimates obtained from aggregated data may not be sensitive enough to separate out specific dimensions of locations, such as services and amenities and aspects of the physical and social environment that are important for mental health and wellbeing^{27,28}. Conversely, living in remote locations may be less important than an individual's socio-economic position, or dealing with the stress of government bureaucracy and regulation, financial worries and family problems^{29,30}. In an attempt to unpack the factors guiding prevalence rates of mental illness, our study found that remoteness (as determined by distance to healthcare services) was not an important independent determinant.



Table 3: Crude odds ratios and 95% confidence intervals for likelihood of mental illness by lifestyle behaviours

Lifestyle behaviours (health risk factors)	Mental illness n = 328 n	No mental illness n = 2217 n	OR (95% CI)	P value
Smoking status				
Non-smoker	98	888	1.00 (ref)	-
Ex-smoker	132	902	1.32 (1.00-1.74)	0.05
Smoker	98	427	2.10 (1.53-2.81)	<0.001
Alcohol consumption				
Non-drinker or no risk	140	1147	1.00 (ref)	-
Low risk	166	977	1.40 (1.10-1.77)	0.01
Intermediate – very high risk	22	93	2.00 (1.20-3.20)	0.01
Body mass index*				
Underweight	12	71	1.17 (0.62-2.23)	0.50
Normal	128	891	1.00 (ref)	-
Overweight	88	758	0.81 (0.60-1.10)	0.15
Obese	72	340	1.50 (1.10-2.01)	0.02
Mild exercise†				
No	11	128	1.00 (ref)	-
Yes	269	1716	1.82 (1.00-3.42)	0.06
Moderate exercise				
No	43	322	1.00 (ref)	-
Yes	285	1895	1.12 (0.80-1.60)	0.50
Vigorous exercise				
No	162	309	1.00 (ref)	-
Yes	166	908	1.50 (1.20-1.90)	0.001
Physical condition (SF-12,PCS)				
No	200	1761	1.00 (ref)	-
Yes	128	456	2.60 (1.80-3.77)	<0.001
Fruit (serves per day) ‡				
1 serve or less	168	1045	1.00 (ref)	-
2-3 serves	120	885	0.84 (0.65-1.10)	0.20
>3 serves	18	139	0.80 (0.50-1.35)	0.41
Vegetables (serves per day)				
1 serve or less	86	650	1.00 (ref)	-
≥ 2 serves	237	1547	1.16 (0.90-1.51)	0.25

OR, Odds ratio; CI, confidence interval.

*BMI = weight(kgs)/height(m)²,classified as underweight(<20), normal(20-25), overweight(>25-30), obese(>30)²⁰.

† low: walked for at least 10 minutes at a time; moderate: activities such as brisk walking, bicycling, vacuuming, gardening or activity that increased breathing or heart rate; vigorous: activities designed to increase muscle strength or tone such as lifting weights, pull-ups or push-ups.

‡ fruit and vegetable daily serves cutoffs according to 2001 National Health survey²²



Table 4: Crude odds ratios and 95% confidence intervals for likelihood of mental illness by perceived control of life events in the previous 4 weeks

Perceived lack of control of a life event in previous 4 weeks	Mental illness n = 328 n	No mental illness n = 2217 n	OR 95% CI	P value
Lack of control with life in general			1.00 (ref)	- *
Never	108	1431		
Never	64	424	2.14 (1.31-3.50)	0.002
Rarely	100	279	4.40 (2.75-7.01)	<0.001
Sometimes	42	57	7.70 (3.91-15.07)	<0.001
Often	14	26	13.00 (4.81-35.15)	<0.001
Always				
Lack of control with financial situation			1.00 (ref)	- *
Never	118	1269		
Never	49	330	1.37 (0.94-2.00)	0.10
Rarely	87	427	2.50 (1.60-4.00)	<0.001
Sometimes	74	191	2.80 (1.66-4.60)	<0.001
Lack of control with personal life			1.00 (ref)	- *
Never	114	1468		
Never	60	396	1.71 (1.04-2.79)	0.03
Rarely	107	294	4.93 (3.12-7.80)	<0.001
Sometimes	28	45	5.81 (2.58-13.10)	<0.001
Often	19	14	16.43 (5.84-46.22)	<0.001
Always				
Lack of control with job security			1.00 (ref)	- *
Never	91	913		
Never	44	285	1.54 (1.05-2.30)	0.02
Rarely/sometimes	30	61	5.00 (3.03-8.03)	<0.001
Often/ always				
Lack of control with work life			1.00 (ref)	- *
Never	106	964		
Never	35	194	1.93 (1.04-3.60)	0.04
Rarely	37	190	1.59 (0.87-2.90)	0.12
Sometimes	19	45	7.76 (3.37-17.84)	<0.001
Often	8	19	6.78 (1.92-23.98)	0.003
Always				
Lack of control with health			1.00 (ref)	- *
Never	92	1389		
Never	60	350	2.32 (1.36-3.95)	0.002
Rarely	108	369	4.85 (3.11-7.54)	<0.001
Sometimes	40	369	5.89 (3.03-11.45)	<0.001
Often	28	46	7.15 (3.25-15.70)	<0.001
Always				

OR, Odds ratio; CI, confidence interval.

² tests for trend: <0.001 for all control domains.



Table 5: Associations between stressful life events and mental illness; crude odds and adjusted for joint stressful life events; ARIA; perceived control of life events; socio-demographic characteristics and lifestyle behaviours

Major stressful life events and mental illness							
	N	Unadjusted OR (95% CI)	Model 0* Joint effect of major life events OR (95% CI)	Model 1† Joint events and ARIA OR (95% CI)	Model 2‡ Joint events, ARIA and perceived control of life events OR (95% CI)	Model 3§ Joint events, ARIA, control of life events and socio-demographic characteristics OR (95% CI)	Model 4¶ Joint events, ARIA, control of life events, socio-demographics and lifestyle behaviours OR (95% CI)
In the last 12 months have you personally been affected by:							
Family or domestic violence							
Yes	26/26	7.25 (4.15-12.65)	3.00 (1.53-5.50)	3.00 (1.50-5.35)	1.53 (0.60-4.0)	1.50 (0.54-3.90)	1.21 (0.33-4.40)
No	302/2191	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Death of somebody close to you							
Yes	100/451	1.71 (1.32-2.22)	1.60 (1.20-2.10)	1.60 (1.21-2.10)	1.60 (1.04-2.41)	1.70 (1.10-2.60)	1.70 (1.00-3.00)
No	228/1766	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Discrimination							
Yes	35/54	4.80 (3.10-7.44)	3.05 (1.90-5.00)	3.00 (1.82-4.90)	3.10 (1.55-6.10)	2.84 (1.40-5.75)	2.51 (1.04-6.05)
No	293/2163	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Marriage or relationship breakdown							
Yes	50/81	4.75 (3.30-6.90)	3.70 (2.43-5.55)	3.70 (2.45-5.60)	4.13 (2.22-7.70)	4.34 (2.23-8.50)	7.00 (3.05-16.10)
No	278/2136	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Serious illness							
Yes	56/122	3.53 (2.51-5.00)	3.20 (2.21-4.52)	3.30 (2.30-4.70)	3.02 (1.65-5.52)	2.81 (1.52-5.20)	2.77 (1.32-6.00)
No	272/2095	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Other major event							
Yes	65/239	2.04 (1.51-2.80)	1.74 (1.30-2.41)	1.74 (1.26-2.40)	1.50 (0.90-2.50)	1.40 (0.81-2.33)	1.50 (0.80-2.94)
No	263/1978	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)

OR, Odds ratio; CI: confidence interval.

*Adjusted for joint effect of life events.

† adjusted for joint effect of life events and ARIA.

‡ Adjusted for joint effect of life events, ARIA and perceived control with: life in general, finances, personal life, job security, work life and health.

§ Adjusted for joint effect of event, ARIA, perceived control and socio-demographic characteristics; age, sex, marital, work, employment and income.

¶ Adjusted for joint effect of events, ARIA, perceived control, socio-demographics and lifestyle behaviours; fruit and vegetable consumption, exercise; alcohol consumption, smoking status, body mass index and physical condition.

Many of the associations between stressful life events and mental illness were explained, wholly or in part, by other stressful life events, perceived control of life events, socio-demographic characteristics and lifestyle behaviors. In common with previous research, our findings indicate that perceptions of control play an important role in reducing stressful life events^{30,31}. The link between socio-demographic characteristics and lifestyle behaviors and health are well established for important chronic diseases such as diabetes and circulatory diseases, and our results indicate that these

factors also contribute to the stressful life event/mental illness associations examined here.

Our study has some important limitations. As with all observational designs, we were not able to infer causation or establish temporal relationships. While combined measures of mental illness have been shown to produce similar estimates to those derived from well validated scales, it is possible that combined measures may mask independent relationships¹¹. Our data were based on self-report which



raises the possibility of contamination of the associations studied. Verbal reports, based on medical advice have good sensitivity and specificity for screening for depression in general practice³² however, self-reported measures are reliant on voluntary self-disclosure and a person's recognition of the need for appropriate psychological assessment³³. Additionally, our results are based on data obtained prior to the introduction of the *Better Outcomes in Mental Health* initiative (and associated GP training programs) which may now lead to greater recognition of mental illness by doctors than at the time of the current study³⁴. We also acknowledge that self-reported, medically confirmed, mental illness measures will not capture individuals in the community with undiagnosed or untreated mental illness.

A serious shortage of trained mental health care personnel (eg psychiatrists and mental health care workers)³⁵, particularly in South Australian country areas, may have resulted in fewer people accessing doctors and unable to confirm a medical diagnosis of mental illness, or indeed, encouraged people to migrate to a larger range and specialisation of health services in major regional or urban centres, resulting in differential misclassification and bias towards the null. Thus, while a geographical index can determine a person's remoteness from their closest service centre, this does not mean that the services are adequate or that they are efficiently accessed by people. In terms of mental illness, this latter point is perhaps the most important and should be a priority for further research.

Our study has shown that remoteness *per se* was not associated with mental illness. Psychosocial factors such as stressful life events, perceived control, socio-demographic status and lifestyle behaviors were more important determinants of mental illness. There is now evidence to suggest that many psychosocial determinants may be beyond an individuals control and shaped by broader contextual factors such as macroeconomic forces, political decisions, legal welfare structures and patterns of migration, history and culture³⁶. In Australia, the shift in government policy away from spatial equity to economic efficiency over the last

few decades, has resulted in dramatic economic, social and demographic change, particularly in rural areas, where the decline of commercial and public services (including health), significant emigration and loss of employment has seriously eroded local infrastructures in many rural communities³⁷. More resources are needed to address the high rates of mental illness in Australia, with particular attention to rural contexts.

Acknowledgements

This work has been supported, in part, by grants from 'beyond blue' the National Depression Initiative, and the Australian Government Department of Health and Aged Care, Australia.

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