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The predictors of depression in a longitudinal cohort of community dwelling rural adults in Australia

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Abstract

Purpose Many major studies of depression in Australia are under-representative of rural and remote residents, limiting the generalizability of their findings. This study explores the contributions of a range of individual, social, and community factors to the trajectory of depressive symptoms among a cohort of rural and remote residents.

Methods Data from four waves of the Australian Rural Mental Health Study (baseline $n = 2639$), a 5 year longitudinal study of rural community residents, were examined within generalized linear mixed models to predict depressive symptoms. Depression was measured using the PHQ-9, with key correlates including social support, employment status, financial wellbeing, neuroticism, and rural community factors.

Results Moderate-to-severe depression was reported by 6.3% of the baseline sample. Being permanently unable to work resulted in over a threefold increase in the odds of depression at the following survey wave. Self-rated financial hardship was associated with a fourfold increase in the odds of future depression, as was a high level of community concerns. Neuroticism and tobacco use also made a significant independent contribution to future depressive symptoms. Interpersonal support was a protective factor, reducing the odds of next-wave depression by 64%.

Conclusion Financial and employment-related difficulties appear to be important risk factors for depression, and targeting individuals experiencing such difficulties may be an effective means of reducing depression among certain sub-groups. Strategies to prevent depression in rural and remote Australia may benefit from a focus on interpersonal and community-level support, as the effects of this support are lasting and contribute to a reduced likelihood of depressive episodes in future years.

Keywords Rural · Depression · Social support · Employment · Financial stress

Introduction

Depression is a common illness globally and is the leading cause of disability worldwide, with the World Health Organisation estimating that 350 million people of all ages suffer from depression [1]. In Australia, it is estimated that about 14% of people will experience a major depressive episode at some stage in their lives, and 6% will experience it during any 12-month period [2]. Depression has adverse effects on both mental and physical health, and is thought to increase the risk of comorbid chronic health conditions [3, 4]. The social and economic costs of depression in Australia are overwhelming. Beyondblue, the National Depression Initiative, estimates this cost at AUDS$12.5 billion and 6 million lost days of productivity per year [5]. Internationally, mental illness is the leading cause of disability adjusted life years worldwide, with depression alone accounting for one-third of this disability [6]. The global cost of mental illness was estimated at almost US$2.5 trillion in 2010, with this expected to more than double by 2030 [7]. Additional societal and personal costs often include family conflict [8], risky lifestyle behaviours such as smoking and high alcohol use [9, 10], as well as increased rates of suicide. Consequently, addressing depression is of high importance to the economy and to the health of the global community.

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The relationships between age, socio-economic status, life events, and health behaviours suggest that the pathways into and out of depression can be complex, and there is scant research on particular sub-groups within the population. For example, little is known about the predictors of depression and the mediating factors for those living in rural areas, despite the acknowledged disparities in general health indices, health service availability, and suicide rates between rural and urban populations internationally [11, 12]. A recent study of older adults in China found that higher rates of rural depression were moderated by socio-economic factors at an individual, household, and community level [13]. Research from Canada reported that higher social support and a stronger sense of belonging to their community acted as protective factors against depression for rural residents [14]. Similarly, a study of older adults in Korea reported that deficits in social support were most strongly associated with depression among people who were lifelong rural residents [15]. A recent analysis of data from the 2007 Australian National Survey of Mental Health and Wellbeing highlights the critical role social support plays in mental health, with high-quality social support, particularly from friends and family, associated with reduced likelihood of depression in the preceding year [16]. It is also noteworthy that most major studies of depression in Australia, including the National Survey of Mental Health and Wellbeing, acknowledge that they are under-representative of rural and remote residents, limiting the generalisability of their findings [2]. With approximately 40% of the Australian population living outside of major cities, evaluating and promoting the mental health and wellbeing of this group is important [17]. Consequently, the current paper seeks to further understand the role of social support for rural Australians.

This paper addresses these gaps in knowledge about the predictors of depression for rural populations. Specifically, it uses cross-sectional and longitudinal models to explore the contribution of a range of individual, social, and community factors to the likelihood of depressive symptoms among a sample of rural and remote residents. Based on earlier findings from cross-sectional components of the current study [18–22], we have confirmed significant links between social, economic, and personal factors and markers of mental illness among rural residents. To explore the predictive role of these factors and possible contributions to the course of depressive symptoms, our aim here was to examine these associations within the longitudinal data from this cohort study. Based on the previous international research, we hypothesised that markers of social support, social connection and socio-economic factors would demonstrate a significant independent effect on the longitudinal course of depressive symptoms, given that these factors feature as characteristics within rural communities and may contribute to the varying patterns of mental health problems observed.

Methods

Participants

This analysis uses data from the Australian Rural Mental Health Study (ARMHS), a population-based longitudinal cohort of men and women, designed to investigate the determinants and outcomes of common mental disorders in rural and remote communities [23]. The ARMHS cohort was recruited from rural communities using a household sampling framework based on the Australian Bureau of Statistics (ABS) geographic classification, specifically the Accessibility/Remoteness Index of Australia Plus (ARIA+), with over-sampling of remote and very remote regions of New South Wales (NSW). The sample comprised residents aged 18 years or older living in private dwellings in rural communities in NSW. ARMHS was approved by the Human Research Ethics Committees of the participating institutions in accordance with the Helsinki Declaration, with all participants giving written informed consent. From an initial 9681 invitations, a total of 2639 participants enrolled in the study and completed baseline postal surveys between 2007 and 2008 (27.3% response rate). Compared to the Australian Bureau of Statistics Census population data, the final sample was under-representative of people aged 18–47 years; aside from this, the baseline sample was generally representative of the Australian population [22]. Follow-up postal surveys were administered at 1 year ($n = 1702$), 3 years ($n = 1266$), and 5 years ($n = 1165$) after baseline.

Measures

Demographic data, including age, gender, employment status, and marital status, were self-reported, as was smoking status and any unintentional injuries during the previous 12 months. Perceived financial status was measured by a single item taken from the Household, Income and Labour Dynamics in Australia (HILDA) survey [24]: "Given your current needs and financial responsibilities, would you say that you and your family are: prosperous, very comfortable, reasonably comfortable, just getting along, poor, very poor?"

Three measures of social integration and support were included in this analysis. Involvement in social activities and groups was measured by the Berkman Syme Social Network Index [25], which asks about participation in community organisations such as charity groups, labour unions, or church groups. The perceived availability of interpersonal support was measured by the Interview Schedule for Social Interaction—availability

of Attachment Scale [26]. This scale measures the level of individual social support participants report from their peers (e.g., having someone they can talk to when upset, having someone to confide in). Perceived sense of belonging in the local community was measured by the Sense of Community Index [27]. Items in this scale include "I feel at home in this district" and "I care about what other residents in the district think of my actions".

The level of concern about specific rural community characteristics was measured by a scale specifically designed for ARMHS. Participants were asked to rate stress or worries experienced about eight items on a 5-point scale from "not at all" to "a lot". Items included fuel prices, access to services, and people moving in or out of the district [18]. Recent personal adverse life events were measured by the List of Threatening Experiences [28], a list of 12 events such as arguing with family members or being downgraded at work. Respondents were asked to indicate each event that had occurred during the previous 12 months.

Current alcohol use was measured by the Alcohol Use Disorders Identification Test [29]. This is a ten-item scale of alcohol consumption and related problems. Scores range from 0 to 40 and can be categorised as 0–7 = low risk, 8–15 = risky or hazardous, 16–19 = high risk, and 20 + = harmful. Neuroticism was measured using a seven item subset of the Eysenck Scale—brief form neuroticism items [30], selected to reduce the confounding effects of state factors such as current distress [18]. As neuroticism was considered a trait measure, this scale was only completed at baseline.

Depression was measured using the 9-item Patient Health Questionnaire (PHQ-9) [31], a well-validated instrument [32, 33] which presents a list of common symptoms associated with depression, including loss of interest in activities, feelings of sadness or depression, and loss of energy. Participants are asked to rate the frequency of symptoms during the past 2 weeks on a 4-point scale from "not at all" to "nearly every day." Total scores (using the linear scoring method) range from 0 to 27, and are typically classified as 0–4 = no depression, 5–9 = mild depression, 10–14 = moderate depression, 15–19 = moderately severe depression, 20–27 = severe depression. For the present analysis, a binary outcome measure was used, with scores of 10+ (i.e., moderate-to-severe depression) considered indicative of recent depression, as suggested by the previous research [31–33].

Statistical analysis

Data were analysed using Stata (Release 11; College Station, TX: StataCorp LP). To account for the fact that the same individuals contributed data to multiple ARMHS survey waves, the primary method of analysis was multivariate Generalized Linear Mixed Modelling (GLMM). Analyses were conducted in three stages. First, a baseline-only binary logistic regression analysis was used to explore the independent relationship between baseline characteristics and concurrent depression status. Second, data from all time-points were entered into a GLMM to explore the independent relationship between participant characteristics and concurrent depression across the whole study, while statistically controlling for the fact that the same participants contributed to multiple waves. However, while this analysis used data from four waves, it did not explicitly examine differential associations between the predictors and outcome over time, or changes in model fit by wave; consequently, it is labelled simply as an 'integrated cross-sectional analysis'. Finally, a time-lagged GLMM was conducted, whereby independent variables collected at each wave were used to predict depression at the following study wave. Within the time-lagged analysis, two models were assessed, excluding concurrent depression (Model 1) and with concurrent depression as an additional independent variable (Model 2). The threshold for statistical significance was set at $p < .01$.

Results

In total, 2639 participants completed at least one component of the baseline survey, with 2312 completing the baseline PHQ-9 depression measure. On average, each participant completed 2.7 surveys out of the total set of four surveys distributed throughout the ARMHS project, resulting in a total of 6303 PHQ-9 depression data points. Missing data across waves are examined in Table S1. Those who were lost to follow-up were younger and of a lower perceived financial position (26.7% loss among 18–44 years vs. 19.8% for older age groups; 27.6% loss among those with a lower perceived financial position vs. 18.3% for other groups). No other baseline characteristics distinguished between participants who were retained and those lost to follow-up. Complete data for all measures were provided by 1969 participants at baseline, 1356 participants at 1 year, 1130 participants at 3 years, and 976 participants at 5 years. No factors consistently distinguished missing data within waves; at the 1-year follow-up, participants with incomplete data were more likely to be smokers and reported poorer social networks, while at the 5-year follow-up, those with incomplete data were more likely to report poorer social networks and poorer perceived financial status. No other factors were associated with within-wave missing data. Participant characteristics at baseline, and integrated across all timepoints, are shown in Table 1.

The sample was predominantly middle-aged (45–64 years), employed, married, and self-rated as being reasonably comfortable financially (Table 1). These

Table 1 Participant characteristics, % (n)

Characteristic	Baseline (n = 2312)	Integrated cross-sectional (n = 6303)
Demographics		
Gender (female)	60.0 (1374)	60.5 (3816)
Age		
18–44	21.4 (490)	17.0 (1074)
45–64	50.3 (1153)	50.1 (3160)
65+	28.4 (651)	32.8 (2069)
Employment		
Employed	55.5 (1266)	53.6 (3363)
Unemployed	1.7 (39)	1.6 (102)
Studying/home duties/caring	5.4 (123)	4.5 (282)
Permanently unable to work	5.6 (128)	4.3 (269)
Retired	31.8 (724)	36.0 (2257)
Marital status		
Married/de facto	75.0 (1705)	75.9 (4755)
Divorced/separated	10.0 (228)	10.2 (640)
Widowed	7.4 (169)	7.5 (467)
Never married	7.5 (170)	6.4 (403)
Financial position		
Prosperous/very comfortable	17.3 (392)	16.4 (1025)
Reasonably comfortable	51.3 (1163)	53.8 (3362)
Just getting along/poor/very poor	31.5 (714)	29.8 (1860)
Social factors		
Social networks		
Low	11.0 (242)	10.0 (609)
Medium	34.1 (748)	33.0 (2000)
Medium high	31.6 (692)	33.8 (2050)
High	23.3 (510)	23.2 (1404)
Interpersonal support (high)	81.6 (1827)	82.4 (5125)
Sense of community (high)	33.0 (732)	32.8 (2021)
Concerns about rural community		
Low	30.3 (676)	48.1 (2991)
Medium	42.3 (945)	34.7 (2157)
High	27.4 (612)	17.2 (1066)
Adverse life events		
0–2	79.6 (1790)	83.8 (5240)
3–5	18.2 (409)	14.6 (914)
6 or more	2.3 (51)	1.6 (98)
Physical health		
Current smoker	12.1 (271)	10.8 (664)
Recent injury	16.2 (358)	15.2 (927)
Alcohol use		
Low risk	85.8 (1944)	86.2 (5371)
Risky or hazardous	11.5 (260)	11.2 (699)
High risk or harmful	1.6 (36)	1.4 (87)
Harmful	1.2 (26)	1.1 (71)
Personality factors		
Neuroticism (0–7), mean (SD)	3.4 (3.0)	3.4 (3.0)
Remoteness		
Inner regional	39.4 (902)	40.2 (2530)

Table 1 (continued)	Characteristic	Baseline (*n* = 2312)	Integrated cross-sectional (*n* = 6303)
	Outer regional	35.5 (812)	35.9 (2259)
	Remote/very remote	25.1 (575)	24.0 (1512)
	Current depression	6.3 (145)	6.1 (383)

characteristics were comparable in the baseline sample and the integrated sample over the four waves of the study.

Depression (i.e., total PHQ-9 score of ≥ 10) was reported by 6.3% of the sample at baseline, with 11.1% reporting depression at least once during the five years of data collection. In total, there were 257 depressive episodes across the four waves [171 single episodes (66.5%) and 86 multiple episodes (33.5%)]. Respondents who reported depression at each wave tended to be less likely to complete the survey at the next wave (see Table S2) (typical next-wave attrition: one quarter of those without depression vs. one-third of those with depression). Consequently, the current findings likely underestimate the prevalence of depression in rural residents. However, due to the relatively modest size of this differential, and the multivariate statistical methods used in the primary analyses, we do not feel that this would impact on the accuracy of results, particularly with respect to exploring correlation patterns and predictors of depression.

The baseline regression model (Table 2) showed that, in relative terms, depression was three times more likely among participants who were permanently unable to work (adjusted odds ratio, AOR = 3.34). It was also more likely among participants with a greater number of adverse life events (AOR = 2.75–3.87), and among those with higher levels of neuroticism (e.g., 1.46-fold increase per one-unit change). Conversely, those reporting high perceived interpersonal support were 62% less likely to report depression at baseline (AOR = 0.38). These results were largely similar in the integrated cross-sectional analysis, with the addition of several other factors. Depression was less likely among those with medium high (AOR = 0.23) or high (AOR = 0.35) social networks, as well as being more common among those with higher community concerns (AOR = 2.41–4.34).

In the time-lagged model (Table 3), being permanently unable to work resulted in a threefold increase in the relative odds of reporting depression at the next survey wave (AOR = 3.77). A self-rating of financial status as just getting along or poor resulted in a fourfold increase in the odds of future depression (AOR = 4.20), as did higher levels of community concerns (AOR = 4.19). Cigarette smoking tripled the relative odds of future depression (AOR = 3.15), while each additional point on the neuroticism scale increased the relative odds of depression by 70% (AOR = 1.70). Interpersonal support was again a protective factor, reducing the odds of next-wave depression by 64%

(AOR = 0.36). After controlling for concurrent depression (Model 2, AOR = 10.14), only four factors were predictive of next-wave depression; interpersonal support remained a marginally significant protective factor (AOR = 0.56), while cigarette smoking (AOR = 2.19), high community concerns (AOR = 2.64), and higher neuroticism (AOR = 1.37) increased the odds of depression.

Discussion

This paper provides a valuable contribution to existing depression literature by identifying longitudinal predictors for those residing in rural and remote areas. The baseline-only model found that the odds of depression were increased for those who were permanently unable to work, had low perceived availability of interpersonal support, had a greater number of recent adverse life events, and had higher levels of neuroticism. This largely aligns with the previous research conducted internationally, which has reported a considerable protective effect for social support and socio-economic factors in moderating depression symptoms among rural residents [13–15].

Compared to the baseline-only model, the integrated cross-sectional model identified two additional correlates of depression; depression was more common among those with poor social networks, and those with higher community concerns (including specific rural concerns such as fuel prices, service accessibility, and out-migration). This demonstrates the advantage of utilising multiple waves of data to explore research questions, as this methodology enabled us to identify a larger number of correlates than the baseline data alone, and hence to more accurately recognise those who may be vulnerable to a depressive episode. Taken together, these findings suggest that people with depressive symptoms are likely to be experiencing a complex combination of factors, particularly related to low social integration and support, greater impact of community changes or concerns, and other adverse life events (including interpersonal conflict, issues at work/financial problems). However, it is not clear from the cross-sectional findings what the exact nature of these relationships is, and whether they are a cause or a consequence of depression. This was further explored in the time-lagged analysis.

Table 2 Cross-sectional regression models

Predictor	Baseline ($n=1970$)		Integrated cross-sectional ($n=5457$)	
	% with depression	AOR (99% CI)	% with depression	AOR (99% CI)
Demographics				
Gender				
Male	6.4	–	5.8	–
Female	6.3	0.86 (0.47–1.57)	6.3	0.91 (0.48–1.71)
Age				
18–44	7.6	–	7.4	–
45–64	6.8	0.69 (0.33–1.46)	6.8	0.84 (0.40–1.79)
65+	4.6	1.67 (0.43–6.51)	4.3	1.19 (0.37–3.88)
Employment				
Employed	4.9	–	5.0	–
Unemployed	20.5	1.32 (0.31–5.74)	21.6	1.07 (0.27–4.24)
Studying/home duties/caring	8.1	1.28 (0.40–4.16)	9.2	2.02 (0.72–5.67)
Permanently unable to work	25.0	**3.34 (1.40–7.93)****	24.2	**3.61 (1.39–9.37)***
Retired	4.6	0.94 (0.28–3.09)	4.5	0.98 (0.38–2.53)
Marital status				
Married/de facto	5.3	–	4.7	–
Divorced/separated	14.7	0.47 (0.11–2.00)	13.6	0.87 (0.26–2.91)
Widowed	4.7	0.94 (0.43–2.04)	6.4	1.15 (0.52–2.55)
Never married	6.5	0.47 (0.14–1.53)	9.9	0.84 (0.30–2.41)
Financial position				
Prosperous/very comfortable	2.0	–	2.2	–
Reasonably comfortable	4.3	1.19 (0.38–3.73)	3.6	0.90 (0.36–2.23)
Just getting along/poor/very poor	12.0	1.69 (0.53–5.43)	12.5	2.37 (0.90–6.26)
Social factors				
Social networks				
Low	14.5	–	15.8	–
Medium	9.6	1.35 (0.60–3.03)	9.3	0.86 (0.43–1.72)
Medium high	2.6	0.44 (0.15–1.29)	2.6	**0.23 (0.09–0.59)****
High	2.4	0.65 (0.19–2.21)	2.3	**0.35 (0.12–1.02)***
Interpersonal support				
Low	16.7	–	16.1	–
High	3.9	**0.38 (0.20–0.71)****	3.8	**0.35 (0.20–0.63)****
Sense of community (high)				
Low	7.5	–	7.4	–
High	3.4	0.84 (0.42–1.69)	3.2	0.70 (0.37–1.31)
Concerns about rural community				
Low	1.9	–	2.1	–
Medium	4.8	1.25 (0.47–3.29)	6.7	**2.27 (1.16–4.46)***
High	13.7	1.90 (0.69–5.22)	15.9	**4.32 (1.91–9.73)****
Adverse life events				
0–2	3.7	–	4.0	–
3–5	14.9	**2.75 (1.48–5.11)****	15.1	**2.41 (1.37–4.27)****
6 or more	31.4	**3.87 (1.18–12.90)***	34.7	**4.34 (1.30–14.55)***
Physical health				
Current smoker				
No	5.2	–	5.2	–
Yes	13.3	1.50 (0.72–3.12)	12.3	1.30 (0.60–2.79)
Recent injury				

Table 2 (continued)

Predictor	Baseline (n = 1970)		Integrated cross-sectional (n = 5457)	
	% with depression	AOR (99% CI)	% with depression	AOR (99% CI)
No	5.5	–	5.3	–
Yes	10.1	1.47 (0.74–2.91)	9.5	1.00 (0.54–1.84)
Alcohol use				
Low risk	6.0	–	5.7	–
Risky or hazardous	5.0	0.51 (0.19–1.40)	6.3	0.74 (0.33–1.64)
High risk or harmful	19.4	1.43 (0.31–6.69)	16.1	2.50 (0.53–11.64)
Harmful	23.1	1.77 (0.28–11.20)	18.3	2.34 (0.45–12.34)
Personality factors				
Neuroticism (0–7)		**1.46 (1.26–1.69)****		**1.62 (1.38–1.91)****
Remoteness				
Inner regional	7.4	–	6.4	–
Outer regional	5.8	0.64 (0.33–1.23)	5.9	0.72 (0.37–1.42)
Remote/very remote	5.4	0.74 (0.35–1.55)	5.9	0.82 (0.38–1.77)

AOR adjusted odds ratio

*$p < .01$, **$p < .001$

The predictors of depression identified in the time-lagged analyses were largely similar to the cross-sectional models, with several exceptions. Most notably, adverse life events were not a predictor of next-wave depression, while both cigarette smoking and poor financial position were significant in the time-lagged model only. An inverse relationship between annual income and PHQ-9 depression severity has been reported elsewhere [32]. It is also possible that the relationships observed here represent an interplay between factors associated with future depression. For example, a recent study of mental health in Australia identified financial issues as the leading cause of stress for both men and women, while 18% of Australians reported smoking cigarettes as a method of dealing with stress [34]. Similarly, a study of over 3000 women in Germany presented participants with a list of 13 sources of stress; financial stress was one of only two sources of stress to be associated with an increased likelihood of cigarette smoking [35]. In this context, it is possible that our findings reflect the lasting impact of financial or related stressors; while current financial stress may not be associated with concurrent depression, the enduring effects of financial hardship over time may make depression more likely to occur in the future, and smoking may be a mechanism of coping with this stress. Similarly, there may be a mixture of common antecedent stressors (including financial hardship) that impact both on smoking and depression. While public health campaigns exist to encourage individuals to quit smoking, a more direct approach may also be beneficial, and could be explored in future research. For example, encouraging general practitioners to be particularly aware of mental health and depression symptoms when assisting their patients with smoking cessation. In addition, smoking cessation programs and campaigns could make a targeted effort to include mental health awareness. Further research could explore whether such interventions could be feasible and effective in reducing depression (or smoking).

These findings suggest that numerous heterogeneous approaches to the prevention and treatment of depression are necessary to target the various sub-groups identified by our analyses. An important aspect of our findings is that they indicate that many individuals who are vulnerable for depressive symptoms have fewer direct supports (i.e., have low social support, are not able to enter the workforce). Therefore, they may be less likely to benefit from community-based prevention strategies or experience exposure to public health-level initiatives. Alternative pathways for reaching this group may need to be explored, particularly since our cross-sectional findings show they are less likely to be engaged with, and seek support themselves from, their community. Depression prevention approaches for these individuals may necessitate a more directive approach through avenues such as disability support agencies, volunteer groups (men's sheds networks/rural financial or agri-business counsellors), or other bodies that may have contact with these individuals. It is also likely that online evidenced-based mental health tools may be suited to this group, particularly in cases, where depression symptoms are mild to moderate, where face–face community engagement is not required [36, 37].

For individuals in this sample with milder depressive symptoms, low-intensity strategies may be beneficial to maintaining their mental health. Community-based programs

Table 3 Time-lagged regression models predicting depression at the following survey wave

Predictor	% with next-wave depression	Model 1 (n = 3340) AOR (99% CI)	Model 2 (n = 3308) AOR (99% CI)
Demographics			
Gender			
Male	5.0	–	–
Female	6.0	1.12 (0.49–2.56)	1.24 (0.69–2.22)
Age			
18–44	7.6	–	–
45–64	5.9	0.75 (0.27–2.04)	0.89 (0.44–1.80)
65+	4.1	0.91 (0.18–4.66)	1.07 (0.32–3.61)
Employment			
Employed	5.0	–	–
Unemployed	19.4	0.96 (0.14–6.64)	1.04 (0.27–4.02)
Studying/home duties/caring	5.4	0.66 (0.14–3.17)	0.77 (0.23–2.59)
Permanently unable to work	20.2	**3.77 (1.04–13.64)***	2.13 (0.85–5.36)
Retired	4.1	0.93 (0.25–3.44)	0.87 (0.32–2.39)
Marital status			
Married/de facto	4.4	–	–
Divorced/separated	10.5	1.59 (0.31–8.12)	1.30 (0.40–4.27)
Widowed	7.1	0.77 (0.24–2.47)	0.75 (0.33–1.73)
Never married	11.5	1.44 (0.37–5.58)	1.27 (0.48–3.32)
Financial position			
Prosperous/very comfortable	2.1	–	–
Reasonably comfortable	3.9	2.13 (0.59–7.69)	1.63 (0.60–4.42)
Just getting along/poor/very poor	10.9	**4.20 (1.07–16.50)***	2.24 (0.78–6.37)
Social factors			
Social networks			
Low	13.8	–	–
Medium	8.2	0.79 (0.29–2.11)	0.86 (0.40–1.83)
Medium high	3.1	0.42 (0.12–1.45)	0.57 (0.22–1.47)
High	2.8	0.73 (0.18–3.00)	0.92 (0.32–2.62)
Interpersonal support			
Low	14.3	–	–
High	3.8	**0.36 (0.16–0.79)****	**0.56 (0.31–1.03)***
Sense of community (high)			
Low	6.9	–	–
High	2.9	0.49 (0.20–1.16)	0.56 (0.29–1.09)
Concerns about rural community			
Low	2.2	–	–
Medium	6.0	2.26 (0.90–5.66)	1.84 (0.87–3.87)
High	13.0	**4.19 (1.45–12.14)****	**2.64 (1.13–6.16)***
Adverse life events			
0–2	4.0	–	–
3–5	12.8	1.73 (0.79–3.78)	1.45 (0.78–2.69)
6 or more	29.4	4.52 (0.79–25.72)	2.92 (0.75–11.35)
Physical health			
Current smoker			
No	4.7	–	–
Yes	12.6	**3.15 (1.14–8.66)***	**2.19 (1.09–4.40)***
Recent injury			
No	4.6	–	–
Yes	9.5	1.78 (0.80–3.93)	1.63 (0.88–3.02)

Table 3 (continued)

Predictor	% with next-wave depression	Model 1 ($n=3340$) AOR (99% CI)	Model 2 ($n=3308$) AOR (99% CI)
Alcohol use			
Low risk	5.3	–	–
Risky or hazardous	5.5	1.02 (0.36–2.85)	1.03 (0.47–2.25)
High risk or harmful	15.3	1.60 (0.21–11.88)	1.28 (0.26–6.22)
Harmful	12.5	0.52 (0.04–7.11)	0.42 (0.05–3.48)
Personality factors			
Neuroticism (0–7)		**1.70 (1.37–2.13)****	**1.37 (1.18–1.58)****
Remoteness			
Inner regional	5.4	–	–
Outer regional	5.8	1.27 (0.54–3.03)	1.31 (0.72–2.40)
Remote/very remote	5.7	1.01 (0.37–2.77)	1.14 (0.56–2.30)
Current wave depression			
No	3.2		
Yes	50.8	N/A	**10.14 (5.14–20.03)****

Model 1 ignores concurrent depression

AOR adjusted odds ratio

*p < .01,**p < .001

such as Act-Belong-Commit (http://www.actbelongcommit.org.au/) are becoming more common in regional and rural areas, encouraging community members to become involved in local activities. Evaluation of this program is ongoing. For individuals with higher scores, indicative of moderate or severe depression, clinical treatment may be required. This may be challenging in rural areas, where mental health services are generally less available than in major cities, and attitudinal barriers often prevent their use even where services are present. A limitation of the present study is that help-seeking and service use patterns were not included in the analyses, and it was, therefore, not possible to determine the effects that these factors may have had on the occurrence and persistence of depressive symptoms. Other limitations of this study include a low initial response rate, and the under-representation of younger people initially recruited, which may limit the generalisability of our findings. In addition, there was some evidence of differential loss to follow-up across the phases of the study, with higher attrition among those with depression, younger age groups, and those with a lower perceived financial position, which again may restrict the generalisability of the findings. There was also some missing data within waves which, while mostly missing at random, may have influenced the outcomes of the models.

This paper has considerable strengths, replicating and validating cross-sectional findings from the previous international studies to establish key determinants of depression among rural residents. Importantly, the role of social support and community involvement was again emphasised in our findings, indicating the central role that rural communities may play in maintaining the wellbeing of their residents. The development and dissemination of strategies to assist rural communities to achieve this goal will be important steps for future research.

Compliance with ethical standards

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