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Does living in remote Australia lessen the impact of hardship on psychological distress?

Running head: Impact of hardship on psychological distress

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ABSTRACT

Aims: Rural and remote regions tend to be characterised by poorer socio-economic conditions than urban areas, yet findings regarding differences in mental health between rural and urban areas have been inconsistent. This suggests that other features of these areas may reduce the impact of hardship on mental health. Little research has explored the relationship between financial hardship and deprivation and mental health across geographical areas.

Methods: Data were analysed from a large longitudinal Australian study of the mental health of individuals living in regional and remote communities. Financial hardship was measured using items from previous Australian national population research, along with measures of psychological distress (Kessler-10), social networks/support and community characteristics/locality, including rurality/remoteness (inner regional; outer regional; remote/very remote). Multilevel logistic regression modelling was used to examine the relationship between hardship, locality and distress. Supplementary analysis was undertaken using Australian Household, Income and Labour Dynamics in Australia (HILDA) Survey data.

Results: 2161 respondents from the Australian Rural Mental Health Study (1879 households) completed a baseline survey with 64% from outer regional, remote or very remote regions. A significant association was detected between the number of hardship items and psychological distress in regional areas. Living in a remote location was associated with a *lower* number of hardships, lower risk of any hardship, and lower risk of reporting three of the seven individual hardship items. Increasing hardship was associated with no change in distress for those living in remote areas. Respondents from remote areas were more likely to report *seeking help from welfare organisations* than regional residents. Findings were confirmed with sensitivity tests, including replication with HILDA data, the use of alternative measures of socio-economic circumstances, and the application of different analytic methods.

Conclusions: Using a conventional and nationally used measure of financial hardship, people residing in the most remote regions reported fewer hardships than other rural residents. In contrast to other rural residents, and national population data, there was no association between such hardship and mental health among residents in remote areas. The findings suggest the need to reconsider the experience of financial hardship across localities and possible protective factors within remote regions that may mitigate the psychological impact of such hardship.

Introduction

Australia has a spatially diverse population, with 30% of residents living outside of the major cities in regional and remote communities (Australian Bureau of Statistics, 2013). Rural and remote residents may be exposed to a variety of risk factors for poor mental health tied to their location, including environmental adversity, geographical isolation, restricted access to services, and poorer socio-economic circumstances (Smith et al., 2008). Socio-economic disadvantage has been shown to increase with decreasing population density (Australian Institute of Health and Welfare, 2012), with 39% of those living in remote areas meeting criteria for low socioeconomic status compared to 24% of those living in regional areas and 17% of those in major cities (National Rural Health Alliance, 2013). Financial hardship or deprivation in particular has been identified as a strong and consistent correlate of poor mental health (Butterworth et al., 2009, Lewis et al., 1998, Mirowsky and Ross, 2001, Skapinakis et al., 2006, Weich and Lewis, 1998, Kiely et al., 2015). Measures of financial hardship assess the ability to meet basic individual needs (such as food and shelter), and therefore identify those excluded from minimally accepted standards of living in society (Whelan et al., 2001). Evidence suggests the experience of hardship or deprivation mediates much of the association between other measures of socio-economic status and mental health (Butterworth et al., 2012). Thus hardship/deprivation may be a potentially important target for regional and remote mental health strategies.

In contrast to evidence of the adversity associated with residing in a rural location, a separate body of research has shown protective effects of rural living. For example, living in close proximity to “green” space has been shown to moderate the effects of stressors such as adverse life events, and income inequality, such that the consequence of these stressors on health and mortality is reduced (Astell-Burt et al., 2014, Mitchell and Popham, 2008, van den Berg et al., 2010). In analysis that considered area-based differences in the influence of social capital on psychological distress, Allen et al. (2012) found that low levels of social support (a composite index reflecting perceptions of emotional support and social network size and frequency of contact) were less strongly associated with psychological distress amongst those living in remote locations than those in more urban environments. It may be that other personal or social features of remote communities are protective of mental health, such as sense of community. Our previous research suggested that, for those residing in remote locations, mental health was more closely tied to their family and household circumstances than for those in more urbanized locations (Butterworth et al., 2014). Thus, while people

living in more remote and regional areas may experience greater rates of poverty and hardship, the positive features of living in these areas may reduce the impact of these exposures on their mental health. To date, little research has explored the relationship between financial hardship and mental health across geographical areas, hence it is unclear whether a differential effect exists across regions. In one relevant study, Law and colleagues analysed suicide register data from the Australian state of Queensland. They found the area-based indicators of deprivation (e.g., levels of unemployment, income, public housing), while strongly associated with suicide mortality in urban regions, showed no such association with suicide mortality in rural Queensland (Law et al., 2014).

The aim of this paper is to enhance our understanding of the relationship between hardship (assessed at the individual level) and mental health. We report an analysis of longitudinal data from a large study of the mental health of individuals living in remote and regional communities in the Australian state of New South Wales. On two occasions this study included a module of financial stress/deprivation items previously demonstrated to explain much of the variance in mental health due to other socio-economic measures (Butterworth et al., 2012). Our first aim is to contrast the distribution of hardship and other measures of socioeconomic disadvantage among residents of regional and remote communities to determine if exposure to this key stressor is elevated in the most remote areas of Australia. Secondly, we will explore the relationship between hardship and mental health across geographical regions to assess whether the strength of the association between deprivation and psychological distress varies by remoteness of residence. Subsequent analyses will test the robustness of the findings via a range of sensitivity tests, including replication with a different dataset, the application of different analytic methods, considering the consistency of the association between hardship and alternative markers of socio-economic circumstances, and investigating whether the pattern of results observed can be explained by key individual and community-level characteristics.

Method

Data

Data were from the Australian Rural Mental Health Study (ARMHS), a longitudinal population-based study exploring the determinants of mental health in rural and remote communities. ARMHS commenced in 2007, with respondents randomly selected from non-metropolitan NSW through the Australian Electoral Roll. A household sampling frame was

used whereby a household informant, identified through an initial telephone contact, provided family and household membership information. Postal surveys were then mailed to all adult members of each household. Remote and very remote regions were over-sampled to ensure an adequate sample size from these regions. A full description of the study methodology is available in Kelly et al. (2011, 2010).

This analysis draws on baseline data conducted in 2007 and the wave 4 data collected in 2013. Overall, 2639 survey respondents from 1879 households completed a baseline postal survey (response rate 27%), with 28% of respondents residing in remote or very remote regions. On average, there were 1.4 respondents per household. At baseline the key hardship measures were included in a supplementary questionnaire which was mailed to all participants two weeks after the initial survey, and was returned by 2161 (82%) respondents. These same items were also assessed in the final wave questionnaire, with 1165 of the original respondents participating in this wave (44%). Thus, this analysis is based on a total overall sample of 2161 persons with 3121 observations: 1082 provided data at baseline only, 119 provided data at wave 4 only, and 960 contributed data at both waves.

Measures

Geographical area: Remoteness was assessed using the Australian Standard Geographic Classification (ASGC; Australian Institute of Health and Welfare, 2004). The ASGC classifies geographical areas by the distances that need to be travelled (by road) to reach the nearest urban localities of various sizes. Thus, it provides a measure of accessibility to goods and services (Australian Bureau of Statistics, 2006). The current analyses contrasted respondents identified in regional areas (inner and outer regional; n= 1595) with those residing in remote or very remote locations (n = 566).

Psychological distress: The key outcome measure for this analysis was experience of psychological distress assessed by the Kessler-10 scale (K10; Kessler et al., 2002) using published cut point to classify clinically meaningful distress (i.e. a score of 16 or greater; Slade et al., 2011). The K10 assesses the frequency, during the previous four weeks, of ten psychological symptoms and is commonly used as an indicator of general mental health and wellbeing.

Hardship: The key independent measure was derived from seven items assessing whether people were excluded from minimally accepted standards of living due to insufficient economic resources (Bray, 2001, Butterworth and Crosier, 2005). These items were developed by the Australian Bureau of Statistics for use in income and expenditure surveys (Australian Bureau of Statistics, 2000), and have been used in other Australian surveys (2007 National survey of Mental Health and Wellbeing; Household Income and Labour Dynamics in Australia Survey). The scale assesses whether the following events had occurred in the past 12 months due to a shortage of money:

- Could not pay electricity, gas or telephone bills on time
- Asked for financial help from friends or family
- Could not pay mortgage or rent on time
- Sold something
- Unable to heat or cool home
- Went without meals
- Asked for help from welfare/community organisations.

Exploratory factor analysis and structural equation modelling demonstrated all seven items loaded on a single factor. A summary measure of number of hardships experienced (top-coded at 5) was constructed as a proxy of severity of hardship in the past 12 months.

Individual-level characteristics: A range of demographic variables were included in all models including age, sex, and partner status (married/de facto). Individual-level factors included any reported chronic physical health condition (i.e. contrasting those who reported no health condition (reference category) with those participants who reported any experience of heart disease/attack, high cholesterol, high blood pressure, stroke, cancer or diabetes). Individual-level socio-economic measures included employment status (working in the past week or not) and educational attainment (classified into three categories: those who had completed high school or not, with the status of 6.9% of respondents unable to be determined). Household income was also included. Due to differences in income categories across waves, there was some variability in cut-points, but respondents were classified into 4 categories: low (< approx. \$AUS20,000 per year), medium, high (> approx. \$AUS90,000 per year) and missing/negative income.

Area-level characteristics: The Index of Relative Socio-Economic Disadvantage (IRSD) is a widely used standardised summary measure of area-level socioeconomic circumstances produce by the Australian Bureau of Statistics. The index summarises a range of socio-economic markers of individuals and households within areas (e.g., proportion of respondents with low levels of educational attainment, unemployed or working in unskilled occupations, lack access to a car, single parent families, no internet connection at home, low household income). The present analysis collates data at the postcode level, and categorises scores as quintiles (higher categories representing lower levels of disadvantage; Australian Bureau of Statistics, 2008).

ARMHS measures and other data used in post-hoc analysis

To better understand the current results, a series of post-hoc analyses were conducted. These analyses considered the potential explanatory role of respondents' sense of community (Chipuer and Pretty, 1999), concerns about rural community infrastructure (Kelly et al., 2011), sense of place (the connection individuals have with their local environment and landscape; Higginbotham et al., 2006), perceived social support (Henderson et al., 1980), social networks (Berkman and Syme, 1979), recent adverse life events (Brugha and Cragg, 1990), trait neuroticism (EPQ; Eysenck et al., 1985), the Hunter Opinions and Personal Expectations Scale (HOPES; Nunn et al., 1996) as a measure of dispositional optimism, and single items to assess overall quality of relationships, worry/stress about family relationships (*not at all to a lot*; see Butterworth et al., 2014), and sense of control in life (Allen et al., 2013). *A subjective measure of financial circumstances* was assessed via a single question, with 6 scale responses ranging from prosperous, very comfortable, reasonably comfortable, just getting along, poor or very poor.

Finally, we examined the consistency of key study results through analysis of wave 13 of the Household, Income and Labour Dynamics in Australia (HILDA) Survey. Further detail of the HILDA Survey is available elsewhere (Watson & Wooden, 2012). In brief, the study has a national household sampling frame, and our analysis utilised population weights provided with the dataset to ensure the results better resembled the characteristics of the Australian population. We report analysis of a sample of 15,253 respondents from remote (n=225), regional (n=5359) and major cities (n=9669), using the same measures of psychological distress and financial hardship, and consistent covariates.

Analysis

We initially present descriptive characteristics of the baseline sample, stratified by remoteness. Multilevel generalised linear regression models were used to account for the clustering of observations (over time) within individuals and within households. Negative binomial and logistic multilevel regression models were used to evaluate evidence of regional differences in the distribution of the overall and individual hardship measures, as well as other socio-economic indicators. A further series of multilevel logistic regression models were used to model the association between hardship and psychological distress, and to test whether this association differed according to remoteness of residence via the inclusion of interaction terms.

Sensitivity analyses replicated these multilevel models using a Generalised Estimating Equations (GEE) approach and Bayesian MCMC models, and applying different cut-points on the K10. A final series of exploratory models examined alternative explanations of the reported results and are reported in an online supplement. All results are reported with 95% confidence intervals.

Results

Table 1 presents the key baseline characteristics of the sample, by residential remoteness. Around 60% of respondents were female and were over the age of 55 years, three-quarters were married or in a marriage-like relationship, and just over half reported one or more chronic physical conditions. Around 30% of respondents were identified with significant levels of psychological distress at baseline.

A series of multilevel logistic regression models assessed regional differences in mental health, and the key socio-economic and hardship measures, while controlling for other socio-demographic characteristics (sex, partner status, any physical health conditions and age). These results showed that, compared to those living in regional areas, respondents living in remote locations were more likely to be residing in disadvantaged communities (OR = 2.68, 95% Confidence Interval (CI) = 2.18 – 3.31), and to have not completed high-school (OR = 1.61, 1.3427 – 2.05). However, respondents from remote areas had lower odds of not working compared to those in living in regional areas (OR = 0.51, 0.38 – 0.68). There were no locational differences evident in levels of psychological distress (OR = 1.02, 0.72 – 1.30) or household income (i.e., low income households: OR = 1.12, 0.76 - 1.67).

Table 2 presents the results from a series of multivariate multilevel negative binomial and logistic regression models assessing regional differences in reported hardship. Model A controls for general socio-demographic characteristics, while Model B also incorporates the range of other socio-economic measures. Contrary to expectations, the results suggest living in a remote location was associated with a *lower* overall number of hardships, lower risk of any hardship, and lower risk of reporting three of the seven individual hardship items (missing meals, unable to heat or cool home, and asking for help from family or friends). For example, the final model of overall number of hardships indicates that living in a remote area is associated with 21% fewer hardships than living in a regional location. One individual hardship item showed the opposite pattern of association, with respondents from remote areas more likely to report *seeking help from welfare organisations* than regional residents.

Table 3 presents the results from a series of multilevel logistic regression models to assess whether the experience of hardship was associated with increased risk of psychological distress and, more importantly, whether this association differed by remoteness of residence. Considering the overall number of hardships, the main effect model (see 1st panel of Table 3) shows that each additional hardship reported was associated with an 83% increase in the odds of reporting psychological distress. Location of residence was not significantly associated with psychological distress (result not shown: OR = 1.12, 0.79 – 1.58). When a term representing the interaction between number of hardships and location of residence was added to this model it was statistically significant (OR = 0.55, 0.40 – 0.74), indicating that the association between hardship and psychological distress was weaker for those living in remote areas. The predicted probabilities of psychological distress arising from this model are graphically presented in Figure 1 and, to aid interpretation, models stratified by location are presented in the next two panels of Table 3. These results show that, for residents of regional areas, each additional hardship more than doubled the odds of experiencing psychological distress. In contrast, increasing hardship was not associated with any change in distress for those respondents living in remote areas.

This pattern of results was repeated for the individual hardship measures. The main effect models show that respondents who reported each of the individual hardship items had significantly elevated odds of psychological distress ranging from a two and one half fold increase for those who had sought help from family or friends through to odds 13 times

greater for those who reported that they had missed meals because of financial reasons. The stratified analyses show that all associations between hardship and psychological distress were significant for residents of regional centres, whereas the association was non-significant in all models for those in remote locations. This was not simply a consequence of the reduced power (i.e., the smaller sample) in remote areas as the Odds Ratios in all instances were much smaller (or in the opposite direction).

Sensitivity analyses

Given the unexpected pattern of results, a series of post-hoc sensitivity analyses were conducted to evaluate the robustness of the current results. More comprehensive details of these data and analyses are available as (online) supplementary material.

A first set of analyses examined whether the measures of hardship used, which are specific instances of exclusion or deprivation from minimally accepted standards of living, may have a different meaning for residents in remote locations. That is, whether these specific items represent the same construct for those living in remote and non-remote locations. To test this we assessed the consistency in the association between hardship and a range of other socio-economic indicators across remote and regional locations. A series of multilevel negative binomial models initially regressed number of hardships onto alternative measures of financial circumstances, and then considered whether the inclusion of the interaction between this measures and location improved overall model fit. The results confirmed that reported number of hardships was significantly associated with lower ratings of prosperity (IRR = 6.78, 5.63 – 8.16), with household income (reference = highest income tertile, medium income: 3.17, 2.38 – 4.23; low income: 7.55, 5.23 – 10.89), and increasing deciles of area advantage (1.19, 1.10 – 1.29). More critically, however, there was no evidence that the associations between alternative markers of socioeconomic circumstances and hardship differed for respondents from remote or regional locations. Results were similar for each of the individual hardship items.

Another potential explanation is that those living in remote locations are exposed to a greater range of stressors and, thus, the relative impact of these elements of hardship is reduced in the context of the exposures more specific to remote Australia. To investigate this, we considered three potential proxies for exposure to remote stressors: reported concern about levels of community infrastructure (Kelly et al., 2011), a schedule of recent adverse life events (see

Kelly et al, 2010), and whether respondents reported that they lived on a farm. While the likelihood of experiencing community distress or living on a farm were greater among those living in remote locations, the number of reported life events was (marginally) lower for those in remote compared to regional locations. Further, there was no evidence that any of these factors moderated the association between hardship and distress.

It may be that the characteristics of individuals living in remote locations and aspects of their surrounding environment promote greater resilience or better ways of coping with hardship and, thus, helps to minimise the adverse mental health consequences. The prior analysis of the individual hardship items showed that residents in remote locations were more likely to report seeking financial assistance from community and welfare organisations than those living in regional locations. However, further analysis showed that such help seeking did not moderate the association between hardship (excluding this item) and distress. Similarly, while respondents residing in remote locations reported greater levels of control, optimism, social support, social network size, sense of community, and connection with their local environment than the respondents from regional areas, there was no evidence that any of these personal qualities (sense of control, dispositional optimism), interpersonal characteristics (social support, social network) or community characteristics (sense of place, sense of community) moderated the association between hardship and distress.

Finally, to assess the generalizability of the current results, we replicated key analyses using data from wave 13 of the HILDA Survey. The results confirmed that the average number of hardships for respondents from remote and regional areas was consistent with that observed in the ARMHS data. Again, we found that respondents from remote areas were more likely to report *seeking help from welfare organisations* (4.4%) than those from regional locations (3.7%) or major cities (3.1%). Analysis stratified by area and controlling for all covariates showed that the experience of any hardship was associated with increased risk of psychological distress amongst those in major cities (OR = 2.12, 1.81 – 2.49), and those in regional areas (OR = 2.51, 2.14 – 2.94), but not for those resident in remote Australia (OR = 1.49, 0.66 – 3.37).

Discussion

Addressing the health needs of people in rural and remote regions has been an international focus of health and social policy; particularly driven by the inequities in health outcomes, the

acknowledged barriers to equitable provision of health services, the disparities in socio-economic status and the demographic characteristics of many remote regions, conferring greater health needs and hardships in these regions. Many rural regions are more vulnerable to economic hardship through more limited employment base and volatility of primary industry on which rural communities are often based (Fraser et al., 2005). The association between socioeconomic status and health is well established. Research has also demonstrated the important role of locality socio-economic status on health outcomes (Weich et al, 2001; 2003). Other studies and national population data sets have identified the greater disadvantage in regional and remote areas relative to urban areas (Smith et al., 2008), with lower educational attainment (AIHW, 2012), lower employment and income levels.

This study aimed to examine the relationships between remoteness, financial hardship and levels of psychological distress in a large community-based cohort residing in regional and remote areas in the state of New South Wales, Australia. We hypothesised that financial hardship would increase with levels of community remoteness, and that this hardship would contribute to poorer mental health among remote residents. A significant association was detected between the number of hardship items and psychological distress in regional areas. In contrast, living in a remote location was associated with a *lower* overall number of hardships, lower risk of any hardship, and lower risk of reporting three of the seven individual hardship items. Increasing hardship was associated with no change in distress for those living in remote areas. Nevertheless, respondents from remote areas more likely to report *seeking help from welfare organisations* than regional residents. The findings were confirmed with a range of sensitivity tests, including replication with HILDA data set, the use of alternative measures of socio-economic circumstances, and the application of different analytic methods.

The findings suggest that those residing in remote locations have less exposure to deprivation/hardship, using conventional measures of hardship as applied in other national data sets. Furthermore the findings suggest that hardship was unrelated to mental health in remote locations. This raises important questions, a number of which were explored in confirmatory analysis. Is the measure of hardship inappropriate for remote localities, hence lacking sensitivity to the manifestations of financial hardship for those living in these localities? Is the perception of hardship modified by prevailing community-wide disadvantage? Seeking help from welfare organisations was more frequently reported among

remote residents. A number of assistance programs have been launched to assist remote communities through a series of environmental adversities (such as prolonged drought, floods) and hence may explain this greater use of welfare support, linked to sources of financial hardship not captured in the items used. Broader contextual factors may be relevant and mitigate impact on perceived hardship and wellbeing, such as the relative prosperity of the community, shared aspirations and the shared exposure to hardships within such communities (Weich et al., 2001; Kahneman & Deaton, 2010). Such experience of shared exposure may be underpinned by the smaller community size and greater awareness of this shared adversity (as might be experienced in the impact of severe drought on all sectors of small rural communities that are characteristically more reliant on local primary industries such as farming) (Fraser et al., 2005). Such shared adversity may facilitate attitudes that are more permissive towards help seeking and broader community support. Perhaps adversity is more openly acknowledged and hence people in remote areas are more comfortable seeking assistance, with more support in place. Adversity may be a shared experience that forms part of remote community identity, resulting in a lesser impact on mental health.

A limitation of this analysis is that it may have been affected by sample bias, in that we may have recruited a population that is more resilient and hence represents a unique subsample of remote residents. Remote respondents were more likely to make use of community welfare organisations, and may have been more inclined towards research participation. It is also important to note that ARMHS data was collected from NSW only, while HILDA data was collected nationally, which may limit the comparability of these samples.

These findings may serve to highlight the importance of more detailed exploration of the experience of financial hardship in diverse localities, and the specific markers of such hardship that aren't captured by items that reflect more urbanised concerns (e.g. rent payment, heating or cooling home). Enhanced understanding of the social and personal context of hardship in remote communities is needed.

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Conflict of interest

None

Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

Availability of Data and Materials

Data is available by written request to the ARMHS chief investigator Brian Kelly (brian.kelly@newcastle.edu.au).

References

- Allen J, Inder KJ, Lewin TJ, Attia J, Kelly BJ** (2012). Social support and age influence distress outcomes differentially across urban, regional and remote Australia: an exploratory study. *BMC Psychiatry* **12**.
- Allen J, Inder KJ, Harris ML, Lewin TJ, Attia JR, Kelly BJ** (2013). Quality of life impact of cardiovascular and affective conditions among older residents from urban and rural communities. *Health and Quality of Life Outcomes* **11**.
- Astell-Burt T, Mitchell R, Hartig T** (2014). The association between green space and mental health varies across the lifecourse. A longitudinal study. *Journal of Epidemiology and Community Health* **68**, 578-83.
- Australian Bureau of Statistics** (2000). Household Expenditure Survey Australia, User Guide 1998–99. Canberra: Commonwealth of Australia.
- Australian Bureau of Statistics** (2006). Statistical Geography Volume 1 - Australian Standard Geographical Classification (ASGC), Jul 2006. Canberra: Commonwealth of Australia.
- Australian Bureau of Statistics** (2008). Census of Population and Housing: Socio-Economic Indexes for Area (SEIFA), Australia. Canberra: Commonwealth of Australia.
- Australian Bureau of Statistics** (2013). Estimates of Aboriginal and Torres Strait Islander Australians, Jun 2011. Canberra: Commonwealth of Australia.
- Australian Institute of Health and Welfare** (2012). The health of Australia's males: a focus on five population groups. Cat. no. PHE 160. Canberra: AIHW
- Australian Institute of Health And Welfare** (2004). Rural, regional and remote health: a guide to remote classifications. Canberra: AIHW.
- Berkman LF, Syme SL** (1979). Social networks, host resistance, and mortality: a nine-year follow-up study of Alameda County residents. *American Journal of Epidemiology* **109**, 186-204.
- Bray JR** (2001). Hardship in Australia: an analysis of financial stress indicators in the 1998–99 Australian Bureau of Statistics Household Expenditure Survey. *Occasional Paper*. Canberra: Department of Family and Community Services.
- Brugha TS, Cragg D** (1990). The List of Threatening Experiences: the reliability and validity of a brief life events questionnaire. *Acta Psychiatrica Scandinavica* **82**, 77-81.
- Butterworth P, Crosier T** (2005). Deriving a measure of financial hardship from the HILDA Survey. *Australian Social Policy*, 1-12.
- Butterworth P, Handley TE, Lewin TJ, Reddy P, Kelly BJ** (2014). Psychological distress in rural Australia: regional variation and the role of family functioning and social support. *Journal of Public Health* **22**, 481-488.
- Butterworth P, Olesen SC, Leach LS** (2012). The role of hardship in the association between socio-economic position and depression. *Australian and New Zealand Journal of Psychiatry* **46**, 364-73.
- Butterworth P, Rodgers B, Windsor TD** (2009). Financial hardship, socio-economic position and depression: results from the PATH Through Life Survey. *Social Science and Medicine*, **69**, 229-237.
- Chipuer HM, Pretty GMH** (1999). A review of the sense of community index: Current uses, factor structure, reliability, and further development. *Journal of Community Psychology* **27**, 643-658.
- Eysenck SBG, Eysenck HJ, Barrett P** (1985). A revised version of the psychoticism scale. *Personality and Individual Differences* **6**, 21-29.

- Fraser C, Jackson H, Judd F, Komiti A, Robins G, Murray G, Humphreys J, Pattison P, Hodgins G** (2005). Changing places: the impact of rural restructuring on mental health in Australia. *Health & Place* **11**, 157-171.
- Henderson S, Duncan-Jones P, Byrne D G, Scott R** (1980). Measuring social relationships. The Interview Schedule for Social Interaction. *Psychological Medicine* **10**, 723-34.
- Higginbotham N, Connor L, Albrecht G, Freeman S, Agho K** (2006). Validation of an environmental distress scale. *EcoHealth* **3**, 245-254.
- Kahneman D, Deaton A** (2010). High income improves evaluation of life but not emotional well-being. *Proceedings of the National Academy of Sciences of the United States of America* **107**, 16489–16493.
- Kelly BJ, Lewin TJ, Stain HJ, Coleman C, Fitzgerald M, Perkins D, Carr VJ, Fragar L, Fuller J, Lyle D, Beard JR** (2011). Determinants of mental health and well-being within rural and remote communities. *Social Psychiatry and Psychiatric Epidemiology* **46**, 1331-1342.
- Kelly BJ, Stain HJ, Coleman C, Perkins D, Fragar L, Fuller J, Lewin TJ, Lyle D, Carr VJ, Wilson JM, Beard JR** (2010). Mental health and well-being within rural communities: The Australian Rural Mental Health Study. *Australian Journal of Rural Health* **18**, 16-24.
- Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK, Normand SL, Walters EE, Zaslavsky AM** (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological Medicine* **32**, 959-76.
- Kiely KM, Leach LS, Olesen SC, Butterworth P** (2015). How financial hardship is associated with the onset of mental health problems over time. *Social Psychiatry and Psychiatric Epidemiology* **50**, 909-18.
- Law C, Snider A, De Leo D** (2014). The influence of deprivation on suicide mortality in urban and rural Queensland: an ecological analysis. *Social Psychiatry and Psychiatric Epidemiology* **49**, 1919-1928.
- Lewis G, Bebbington P, Brugha T, Farrell M, Gill B, Jenkins R, Meltzer H** (1998). Socioeconomic status, standard of living, and neurotic disorder. *Lancet* **352**, 605-609.
- Mirowsky J, Ross CE** (2001). Age and the effect of economic hardship on depression. *Journal of Health and Social Behavior* **42**, 132-150.
- Mitchell R, Popham F** (2008). Effect of exposure to natural environment on health inequalities: an observational population study. *Lancet* **372**, 1655-60.
- National Rural Health Alliance** (2013). A snapshot of poverty in rural and regional Australia. Canberra: National Rural Health Alliance.
- Nunn KP, Lewin TJ, Walton JM, Carr VJ** (1996). The construction and characteristics of an instrument to measure personal hopefulness. *Psychological Medicine* **26**, 531-45.
- Skapinakis P, Weich S, Lewis G, Singleton N, Araya R** (2006). Socio-economic position and common mental disorders: longitudinal study in the general population in the UK. *British Journal of Psychiatry* **198**, 109-117.
- Slade T, Grove R, Burgess P** (2011). Kessler Psychological Distress Scale: normative data from the 2007 Australian National Survey of Mental Health and Wellbeing. *Australian and New Zealand Journal of Psychiatry* **45**, 308-16.
- Smith KB, Humphreys JS, Wilson MGA** (2008). Addressing the health disadvantage of rural populations: How does epidemiological evidence inform rural health policies and research? *Australian Journal of Rural Health* **16**, 56-66.
- Van Den Berg AE, Maas J, Verheij RA, Groenewegen PP** (2010). Green space as a buffer between stressful life events and health. *Social Science and Medicine* **70**, 1203-10.

- Watson N, Wooden M** (2012). The HILDA Survey: a case study in the design and development of a successful household panel study. *Longitudinal and Life Course Studies* **3**, 369-381.
- Weich S, Lewis G** (1998). Material standard of living, social class, and the prevalence of the common mental disorders in Great Britain. *Journal of Epidemiology and Community Health* **52**, 8-14.
- Weich S, Lewis G, Jenkins SP** (2001). Income inequality and the prevalence of common mental disorders in Britain. *The British Journal of Psychiatry* **178**, 222-227.
- Weich S, Twigg L, Holt G, Lewis G, Jones K** (2003). Contextual risk factors for the common mental disorders in Britain: a multilevel investigation of the effects of place. *Journal of Epidemiology and Community Health* **57**, 616-621.
- Whelan CT, Layte R, Maitre B, Nolan B** (2001). Income, deprivation, and economic strain: an analysis of the European Community Household Panel. *European Sociological Review* **17**, 357-372.

Table 1: Baseline characteristics of the sample used in analysis

	Regional (inner & outer)		Remote (remote and very remote)		Total	
	No.	Col %	No.	Col %	No.	Col %
	1509	73.9	533	26.1	2042	100
Hardship						
Not pay bills	144	9.6	57	10.7	201	9.9
Not pay mortgage/rent	53	3.6	24	4.6	77	3.8
Sold something	154	10.2	48	9.0	202	9.9
Missed meals	40	2.7	7	1.3	47	2.3
Not heat or cool home	56	3.7	12	2.3	68	3.3
Financial help family /friends	140	9.3	36	6.8	176	8.6
Financial help welfare	37	2.5	29	5.4	66	3.2
Any hardship	329	21.8	112	21.0	441	21.6
No. hardships (mean; sd)	0.40	(1.00)	0.37	(0.97)	0.39	(0.99)
Self-rated prosperity						
Prosperous – comfortable	1032	68.6	361	68.5	1393	68.5
Just getting along	429	28.5	151	28.7	580	28.6
Poor/Very poor	43	2.9	15	2.8	58	2.9
Other socio-economic						
Disadvantaged area (bottom 2 quintiles)	495	32.8	296	55.5	791	38.7
Not working	656	47.3	188	37.5	844	44.7
Low income household	202	13.4	74	13.9	276	13.5
Not complete high school	389	25.8	187	35.1	576	28.2
Live on farm	318	21.4	171	32.5	489	24.3
Demographic						
Female	889	58.9	343	64.4	1232	60.3
No partner	372	24.8	128	24.3	500	24.7
Any chronic health conditions	813	54.3	301	56.8	1114	54.9
Age category (years)						
18-34 years	98	6.5	48	9.0	146	7.2
35-44 years	174	11.6	92	17.3	266	13.1
45-54 years	331	22.1	98	18.5	429	21.1
55-64 years	433	28.9	146	27.5	579	28.5
65+ years	463	30.9	147	22.7	610	30.0
Kessler 10 > 16	423	28.4	151	28.7	574	28.5

Table 2: Incidence Rate Ratios (IRR) from negative binomial multilevel models and Odds Ratios (OR) from logistic regression multilevel models (and 95% Confidence Intervals) assessing regional differences in reported experience of hardship (overall and individual items), controlling for general socio-demographic characteristics (A) and the range of other socio-economic measures (B).

Outcome measure		Model A		Model B	
		Simple		With ses	
		IRR	95% CI	IRR	95% CI
Regional (ref)	No. of hardships				
Remote		0.81	0.66 – 1.01	0.79	0.63 – 0.99
Individual hardships		OR	95% CI	OR	95% CI
Regional (ref)	Not pay bills				
Remote		0.96	0.71 – 1.31	0.94	0.67 – 1.31
Regional (ref)	Not pay mortgage/rent				
Remote		1.10	0.68 – 1.77	1.11	0.66 – 1.85
Regional (ref)	Sold something				
Remote		0.81	0.60 – 1.10	0.74	0.53 – 1.02
Regional (ref)	Missed meals				
Remote		0.47	0.23 – 0.95	0.40	0.19 – 0.85
Regional (ref)	Not heat or cool home				
Remote		0.45	0.26 – 0.79	0.41	0.23 – 0.74
Regional (ref)	Financial help family/friends				
Remote		0.56	0.39 – 0.81	0.62	0.42 – 0.92
Regional (ref)	Financial help from welfare				
Remote		1.81	1.15 – 2.86	1.80	1.09 – 2.96
Regional (ref)	Any hardship				
Remote		0.82	0.65 – 1.04	0.76	0.59 – 0.98

Both models control for gender, partner status, baseline age, wave, and presence of chronic health conditions

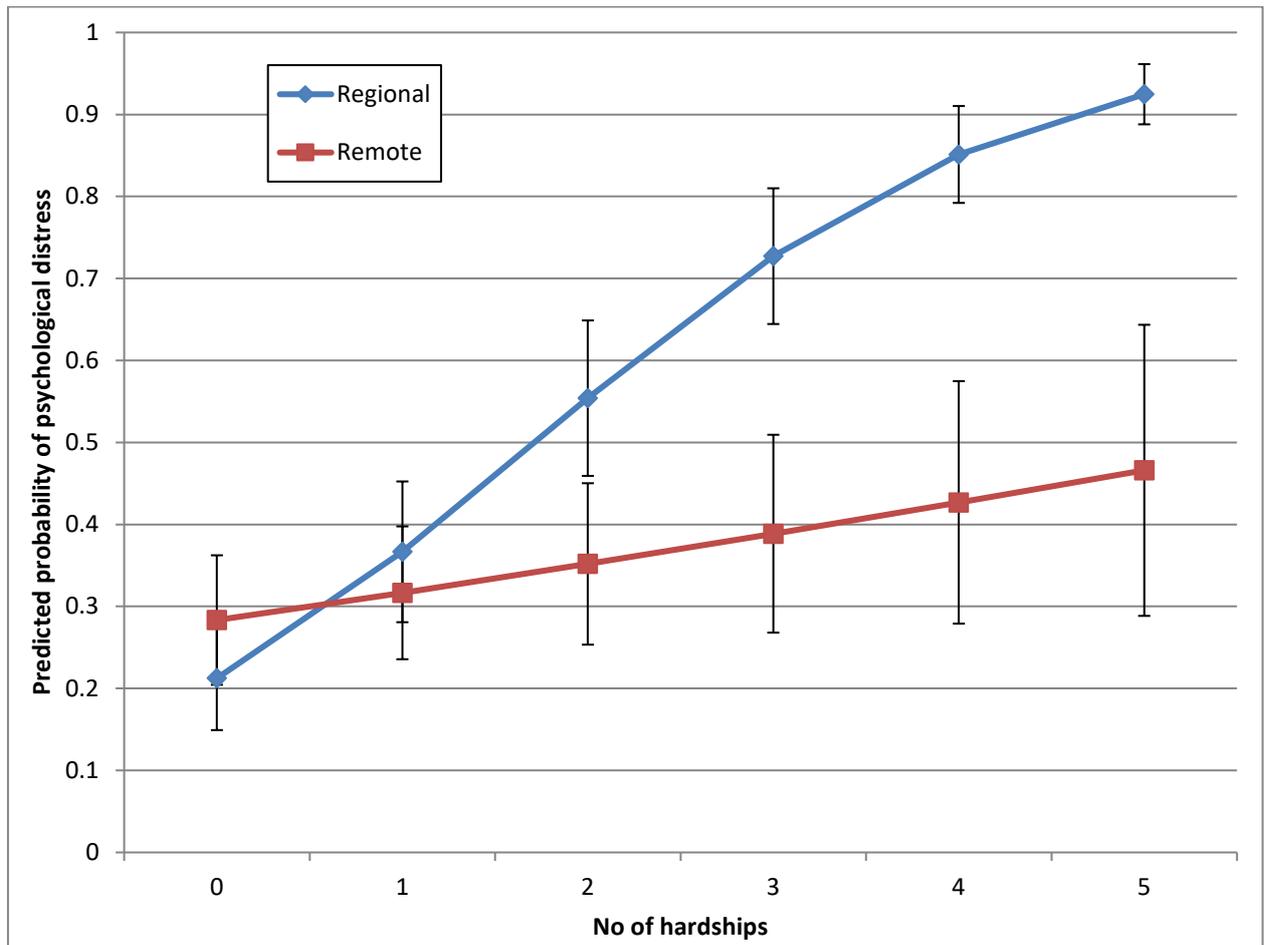
Bold indicates $p < .05$

Table 3: Odds ratio (and 95% Confidence Intervals) from logistic multivariate multilevel models reflecting risk of psychological distress by reported hardship

	Main effects model		Considering interaction between area and hardship					
	Overall		Interaction: hardship x area (ref = regional)		Regional		Remote	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Hardship								
No. of hardships	1.83	1.58 – 2.12	0.55	0.40 – 0.74	2.15	1.80 – 2.57	1.17	0.90 – 1.52
Individual hardships								
Not pay bills	3.29	2.08 – 5.21	0.32	0.12 – 0.84	4.50	2.63 – 7.72	1.42	0.61 – 3.29
Not pay mortgage/rent	3.46	1.75 – 6.86	0.36	0.08 – 1.58	4.64	2.06 – 10.44	1.66	0.47 – 5.85
Sold something	4.20	2.72 – 6.50	0.44	0.17 – 1.15	5.08	3.10 – 8.33	2.22	0.94 – 5.22
Missed meals	13.18	5.59 – 31.08	0.12	0.01 – 1.04	19.23	7.30 – 50.61	2.37	0.34 – 16.28
Not heat or cool home	4.21	2.23 – 7.92	0.07	0.01 – 0.46	6.28	3.11 – 12.66	0.46	0.08 – 2.48
Financial help family/friends	2.57	1.57 – 4.20	0.12	0.03 – 0.44	3.89	2.21 – 6.83	0.48	0.16 – 1.50
Financial help from welfare	5.61	2.69 – 11.70	0.11	0.02 – 0.51	13.13	4.92 – 35.01	1.47	0.46 – 4.74
Any hardship	2.98	2.12 – 4.18	0.43	0.21 – 0.90	3.70	2.49 – 5.49	1.60	0.75 – 3.00

Controlling for gender, partner status, baseline age, wave, presence of chronic health conditions, and other socioeconomic measures

Figure 1: Predicted probability of experiencing psychological distress (with standard errors) by number of hardships reported and remoteness of resident



* holding other covariates constant (male, partnered, aged 45-54 years at baseline, wave 1, no health conditions, not living on farm, currently working, completed high school, in an area at median level of socioeconomic disadvantage, and reporting household income at the medium level).

Poor but not more distressed: greater financial hardship is not associated with increased psychological distress among adults living in remote Australia

Supplementary materials

1. Consistency of the association between hardship and alternative measures

Table Supp1 presents the results from a series of multilevel negative binomial models regressed number of hardships onto alternative measures of socioeconomic position/financial circumstances and considered the interaction of each with locations and assessing whether the inclusion of the interaction between area and measure of socioeconomic position improves model fit and thereby indicates that this association differs between regional and remote areas.

Table Supp1: Incidence Rate Ratios from multilevel negative binomial models (and 95% Confidence Intervals) assessing the association between measures of socio-economic circumstances and number of reported hardships, and improvement in model fit accompanying inclusion of interaction between area and each key covariate

	Model A		Model B	
	IRR	95% CI	Inclusion of interaction with area Likelihood ratio statistic (df)	P value
Self-rated prosperity (ref = not poor)	6.78	5.63 – 8.16	0.74 (1)	0.389
Household income				
Ref = Higher tertile	1.00		1.32 (3)	0.724
Medium income	3.17	2.38 – 4.23		
Low income	7.55	5.23 – 10.89		
Not report income	4.72	3.04 – 7.33		
Area disadvantage (deciles increasing disadvantage)	1.19	1.10– 1.29	0.03 (1)	0.872

Models control for area (remote vs regional), gender, partner status, baseline age, wave, and presence of chronic health conditions

The results suggest the relationship between hardship and alternative measures of socioeconomic position does not differ for individuals residing in regional and remote areas.

2. Influence of salient remote stressors

An alternative explanation for the current results is that people living in remote locations are exposed to a greater range of stressors than those living in more urban centres and, therefore, the impact of hardship may be (relatively) reduced. Table Supp2 initially presents the results from a series of multilevel generalized linear models (based on normal, poisson and logit distributions) for three potential indicators of such stressors (community distress, life events, and living on a farm).

Table Supp2: Coefficient, Incidence Rate Ratio and Odds Ratio (with 95% Confidence Intervals) from Multilevel Generalized Linear Models to assess area differences in the prevalence of potential stressors

Stressor	Model	Result	
Concerns about community infrastructure (scale score)	Linear regression – coefficient	1.22	0.72 – 1.72
Stressful life events (number)	Poisson regression –IRR	0.93	0.85 – 1.02
Living on farm (binary)	Logit regression – OR	5.81	2.84 – 11.85

Models control for area (remote vs regional), gender, partner status, baseline age, wave, and presence of chronic health conditions

Results suggest those respondents living in remote areas were more concerned about community infrastructure and more likely to live on a farm than those living in more urban locations. Therefore Table Supp3 presents the results of a series of multilevel logistic regression models in which psychological distress is regressed upon number of hardship and each of these potential stressors separately (with other covariates also included) and subsequently considering whether the interaction between area and each of these measures improved model fit (indicating that the strength of association between hardship and distress may vary due to this potential confounder).

Table Supp3: Odds Ratios from multilevel logistic regression models (and 95% Confidence Intervals) assessing the association between psychological distress and remote stressors, and improvement in model fit accompanying inclusion of interaction between hardship and each stressor

	Model A		Model B Inclusion of interaction with hardship	
	IRR	95% CI	Likelihood ratio statistic (df)	P value
Hardship (number)	1.41	1.23 – 1.62	0.07 (1)	0.794
Concerns about community infrastructure (scale score)	1.19	1.16 – 1.23		
Hardship (number)	1.82	1.57 – 2.11	0.04 (1)	0.835
Living on farm (binary)	0.84	0.59 – 1.19		

Models control for area (remote vs regional), gender, partner status, baseline age, wave, and presence of chronic health conditions

Although respondents who lived in remote locations were more concerned about community infrastructure and were more likely to live on a farm than those residents living in more urban areas, these factors did not moderate the association between hardship and psychological distress, suggesting these factors could not explain the area-level differences.

3. Seeking help from welfare or community organisations

While the analysis of the individual hardship items presented in the main manuscript (Table 1 and Table 2) showed that respondents from remote locations had similar or lower risk of experiencing most hardships than residents of more urban areas, this was not the case for the item asking whether respondent had ever received financial help from a welfare or community organisation. Respondents from remote areas reported significantly higher likelihood of using such forms of assistance (OR = 1.80, 1.09 – 2.96). It may be, therefore, that the weaker association between hardship and psychological distress for those living in remote areas reflects lower stigma associated with the use of such services and the moderating influence of these forms of assistance on the association between other aspects of hardship and psychological distress.

To test this possibility, Table Supp4 presents the results from a multilevel logistic regression model in which psychological distress is regressed upon the sum of hardship items (excluding receiving financial help from welfare/community organisations) and this item separately (and other relevant covariates), and subsequently assesses whether the interaction between these two measures improved model fit.

Table Supp4: Odds Ratios from multilevel logistic regression models (and 95% Confidence Intervals) assessing the association between psychological distress and remote stressors, and improvement in model fit accompanying inclusion of interaction between hardship and each stressor

	Model A		Model B Inclusion of interaction with hardship	
	IRR	95% CI	Likelihood ratio statistic (df)	P value
Hardship (number – excluding financial help)	1.85	1.56 – 2.21	1.36 (1)	0.244
Financial help from welfare/ community organisations	4.20	1.40 – 12.61		

Models control for area (remote vs regional), gender, partner status, baseline age, wave, and presence of chronic health conditions

The lack of significant interaction provides no support for the hypothesis that those who are more likely to seek financial assistance from welfare or community organisation are less likely to experience psychological distress associated with their experience of other hardships.

4. Potential personal, interpersonal and community risk and protective factors

An initial series of regression models, using robust variance estimators to adjust for the lack of independence amongst observations, regressed each of these measures of interest on location of residence (Table Supp5).

Table Supp5: Coefficients (with 95% Confidence Intervals) from regression models using robust variance estimators to assess area differences in the potential risk and protective factors

Category	Item	Area effect (ref = regional)	
		Coef	95% CI
Personal	Sense of control	0.11	0.05 – 0.17
	Neuroticism	-0.17	-0.35 - 0.01
	Dispositional optimism	0.06	-0.01 – 0.14
Interpersonal	Social support	0.08	-0.04 – 0.20
	Social network strength	0.13	0.05 – 0.21
	Relationship quality	0.07	-0.01 – 0.15
	Relationship stress	0.01	-0.08 – 0.10
Community	Sense of place	0.58	0.14 – 1.01
	Sense of community	0.42	0.21 – 0.52

Models control for area (remote vs regional), gender, partner status, baseline age, wave, and presence of chronic health conditions

Results suggest those respondents living in remote areas reported greater sense of control, social network strength, sense of place and sense of community than those living in more urban locations. The area level differences in neuroticism approached significance ($p = .07$) and was also considered in the next series of analyses.

Table Supp6 presents the results of a series of multilevel logistic regression models in which psychological distress is regressed upon number of hardship and each of these potential proactive factors separately (with other covariates also included) and subsequently considering whether the interaction between area and each of these measures improved model fit.

Table Supp6: Odds Ratios from multilevel logistic regression models (and 95% Confidence Intervals) assessing the association between psychological distress and potential protective factors that differ in prevalence across remote and regional areas, and improvement in model fit accompanying inclusion of interaction.

	Model A		Model B Inclusion of interaction with hardship	
	IRR	95% CI	Likelihood ratio statistic (df)	P value
Hardship (number)	1.50	1.30 – 1.73	0.78 (1)	0.377
Sense of control	0.17	0.13 – 0.23		
Hardship (number)	1.77	1.53 – 2.04	0.36 (1)	0.551
Neuroticism	2.09	1.86 – 2.35		
Hardship (number)	1.56	1.32 – 1.85	0.05 (1)	0.825
Optimism	0.24	0.18 – 0.33		
Hardship (number)	1.76	1.52 – 2.03	0.04 (1)	0.837
Social Network	0.61	0.51 – 0.72		
Hardship (number)	1.88	1.62 – 2.18	0.21 (1)	0.650
Sense of place	0.96	0.93 – 0.99		
Hardship (number)	1.82	1.57 – 2.11	0.92 (1)	0.338
Sense of community	0.82	0.78 – 0.87		

Models control for area (remote vs regional), gender, partner status, baseline age, wave, and presence of chronic health conditions

Although each of these risk or protective factors was significantly associated with levels of psychological distress, these factors did not moderate the association between hardship and psychological distress suggesting these factors could not explain the area-level differences.

5. Assessing generalizability with data from wave 13 of the Household, Income and Labour Dynamics in Australia Survey

The initial analysis considered the mean number of hardships reported by respondents in major city, regional and remote locations (Table Supp7) and assessed with negative binomial regression. The results show the same pattern of results as was observed with the ARMHS data. If anything, the mean number of hardships and IRRs indicate a more extreme difference between regional and remote area in the HILDA Survey data, however the results fail to reach statistical significance. It is interesting that the results from major cities fall midway between the regional and remote results.

Table Supp7: Mean number of hardships and coefficients (with 95% Confidence Intervals) from multivariate negative binomial regression models assessing association between area and number of hardships

	Number of hardships	Negative binomial regression	
		IRR	95% CI
Major city	0.34 (.31 - .36)	0.93	0.84 – 1.02
Regional area (ref)	0.42 (.39 - .45)	1.00	
Remote area	0.32 (.20 - .44)	0.79	0.56 – 1.11

Models control for area (remote vs regional), gender, partner status, baseline age, wave, and socio-economic indicators.

Finally, a set of stratified analysis were conducted to replicate the analysis between number of hardships and psychological distress reported for the main ARMHS results (Table Supp8). The results, again, are broadly consistent with the ARMHS results. While each additional hardship was associated with a (statistically significant) doubling or greater in the odds of psychological distress for respondents from major cities and regional areas, the association was much weaker and non-significant for respondents from remote areas. Again, the magnitude of the Odds Ratio for regional respondents was greater in the HILDA data than was observed in the ARMHS data. For this analysis, so too was the association amongst respondents from remote locations. However, the pattern of results is consistent.

Table Supp3: Odds Ratios from multilevel logistic regression models (and 95% Confidence Intervals) assessing the association between number of hardships and psychological distress across major city, regional and remote areas.

	Major city		Regional area		Remote area	
	OR	95% CI	IRR	95% CI	IRR	95% CI
Hardship (number)	2.12	1.81 – 2.49	2.51	2.14 – 2.94	1.49	0.66 – 3.37