



## Article

## Does employment security modify the effect of housing affordability on mental health?



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### A B S T R A C T

This paper uses longitudinal data to examine the interrelationship between two central social determinants of mental health – employment security and housing affordability.

Data from ten annual waves of the longitudinal Household, Income and Labour Dynamics in Australia (HILDA) survey (which commenced in 2000/1 and is ongoing) were analysed using fixed-effects longitudinal linear regression. Change in the SF-36 Mental Component Summary (MCS) score of working age individuals (25–64 years) (51,885 observations of 10,776 people), associated with changes in housing affordability was examined. Models were adjusted for income, age, survey year, experience of serious injury/illness and separation/divorce. We tested for an additive interaction between the security of a household's employment arrangements and housing affordability.

People in insecurely employed households appear more vulnerable than people in securely employed households to negative mental health effects of housing becoming unaffordable. In adjusted models, people in insecurely employed households whose housing became unaffordable experienced a decline in mental health ( $B = -1.06$ , 95% CI  $-1.75$  to  $-0.38$ ) while people in securely employed households experienced no difference on average.

To progress our understanding of the Social Determinants of Health this analysis provides evidence of the need to bridge the (largely artificial) separation of social determinants, and understand how they are related.

### Introduction

It is universally acknowledged that the Social Determinants of Health framework is critical to understanding how population health is shaped and inequalities created. Though the framework is well developed and forms a valuable basis for policy interventions internationally, in many cases its application (and the subsequent evidence produced) has been limited by an artificial separation of determinants. Much, for example, is known of the role of employment conditions and their effect on mental and physical health (Butterworth et al., 2011). Similarly there is a substantial evidence base on the role of housing conditions in producing physical health outcomes. We know little, however, about the intersection between employment and housing. In order to progress our understanding of the Social Determinants of

Health we need to bridge the separation of social determinants, and understand how they are related, and more specifically, if groups defined by key social categories might be targeted to reduce the negative impacts of known relationships. This paper explores two of the central social determinants of health that have emerged as critically important to household inequality in neo-liberal economies – employment security and housing affordability.

Housing affordability is an increasing concern around the world. Australia for example, is a nation ranked among the most internationally unaffordable housing markets, and this problem is specifically concentrated in the major capital cities (Australian Bureau of Statistics, 2013; Cox & Pavletich, 2010). Not only is housing affordability an economic concern for governments, but it is also a growing health concern. Alongside increasing housing affordability problems, the

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structure of employment is changing in many cities. Flexible working conditions have given rise to a group of precariously employed workers with non-standard temporary or casual working arrangements (LaMontagne et al., 2014). Precarious employment is characterised by instability, insecurity and economic or social vulnerability (Facey & Eakin, 2010). There is growing evidence of the importance of employment and security of employment to health and wellbeing (Kim, Kim, Park & Kawachi, 2008; Lewchuk, Clarke & De Wolff, 2008; Marmot, Ferrie, Newman & Stansfeld, 2001).

Within a Social Determinants of Health framework, much is known about the separate roles of housing affordability and employment security. There is a growing international evidence base linking (directly and indirectly) unaffordable housing with negative effects on health, especially mental health (Bentley, Kavanagh, Krnjacki & LaMontagne, 2015; Pevalin, 2009). Poor housing affordability has been shown to cause stress and anxiety related to difficulty in honouring rental or mortgage payments (Taylor, Pevalin & Todd, 2007). Because housing is, for many people, their major expenditure and largest ongoing household cost (Baker, Mason & Bentley, 2015), it represents an overarching influence on the quality of life that individuals can lead, affecting not only their health, but also their well-being, employment opportunities and vulnerability to poverty. In this way, unaffordable housing may also impact on health by limiting expenditure for other essential living costs such as food, transport, medical care, and recreation (Bentley, Kavanagh et al., 2015).

Insecure employment has been shown to be associated with a range of repercussions including heightened rates of depression and anxiety (D'Souza, Strazdins, Lim, Broom & Rodgers, 2003), suicide (Milner, Page & LaMontagne, 2013), family breakdown and homelessness. There is also evidence, however, to suggest that precarious or insecure employment may not necessarily have a negative short run impact on mental health and wellbeing (LaMontagne et al., 2014). While being precariously employed may not, by itself, lead to poorer mental health (LaMontagne et al., 2014), the extent to which employment status interacts with other key domains of life to shape health and wellbeing has not been fully explored. As both housing and employment are cornerstones of economic security, the stress of meeting housing costs may be compounded by unemployment or insecure work.

Critically, labour force participation and housing are closely related. People's capacity to afford housing that is suitable and secure is dependant on their labour force status and resultant income. People's labour force participation may be contingent on the location of their housing and its proximity to amenities such as transport and education. Changes in labour force participation may precipitate changes in people's housing situations. For example, people who lose their job may be forced to change their housing either by reducing its cost or moving to a place where their likelihood of finding employment is maximised. More broadly, housing and labour force markets are related economically (see for example Glaeser, Gyourko & Saks, 2006).

There is a need to better understand how housing and employment act together to influence people's mental health and wellbeing. If household employment security is an important factor in generating the negative effect of financial stress associated with high housing costs on mental health, then the security of household employment might also be considered as a way of targeting assistance to households. Our conceptual model (Fig. 1) describes how household employment security may modify the effect of unaffordable housing on mental health in the short term. It identifies key confounders, mediators and effect modifiers in relation to the exposure of interest (housing affordability) and the outcome (self-reported mental health). Household income, age, and experience of a health shock or divorce/separation in the past year are identified as a potential confounders, and household location and quality as potential mediators of the relationship between housing affordability and mental health. As we focussed on the question of more targeted solutions to addressing housing affordability's impact on health by testing effect modification

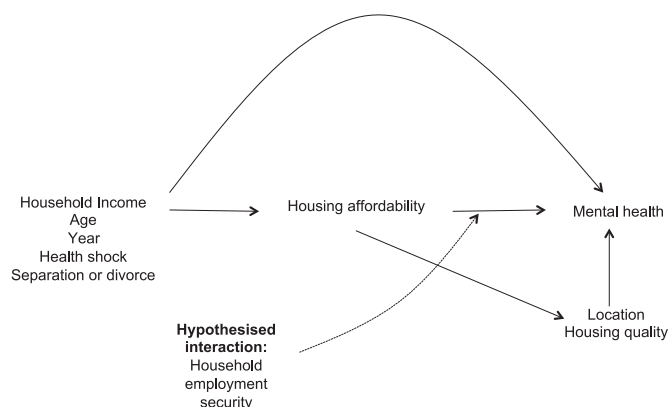


Fig. 1. Conceptual model of the pathway between housing affordability and mental health.

of employment security on the housing affordability and mental health relationship we have not included confounders of the employment security and mental health relationship (VanderWeele & Knol, 2014).

Based on this conceptual model and using the analytical strategy developed in previous work on housing affordability (Mason, Baker, Blakely & Bentley, 2013), we investigate whether the mental health effect of housing becoming unaffordable is modified by security of household employment. Using a population-based panel study of 10,776 Australians over ten years, we examine whether the negative effect of housing unaffordability on mental health differs according to household employment security. We hypothesize that people in insecurely employed households are more vulnerable to the negative mental health effects of unaffordable housing than are people in securely employed households.

## Methods

### Data

This study uses data from the Household, Income and Labour Dynamics in Australia (HILDA) survey (Summerfield, Freidin et al., 2011; Summerfield, Dunn 2011). HILDA is an ongoing panel survey of Australian households and individuals, based upon a nation-wide probability sample and focused on income, employment, health and wellbeing. HILDA has been conducted annually since 2001. Information is collected from household members aged 15 years and over using face-to-face interviews and self-completion questionnaires. All annual waves from 2001 to 2010 were included in these analyses.

Households were initially selected for the HILDA study using a multi-staged approach: 488 Census Collection Districts (CCDs – the smallest geographic area that was defined in the Australian Standard Geographical Classification comprising an average of about 225 dwellings) across Australia were selected; within each of these districts 22–34 dwellings were sampled; and within each dwelling up to three households were included (Watson, 2008). At baseline, interviews were initiated with 19,914 people. Of these, 15,127 were deemed eligible for inclusion and 13,969 were interviewed. The retention rate between wave one and two was 87% and more than 90% in subsequent waves (Wilkins & Warren, 2013).

The analyses described in this paper are based upon responses of HILDA participants aged between 25 and 64 years who experienced both affordable and unaffordable housing at some time during the study period. We excluded younger adults, as many may still be living with parents and therefore not directly responsible for housing costs.

### Predictor variable

In Australia, households spending in excess of 30% of income on

their housing are commonly defined as being in unaffordable housing, depending on their position in the income distribution (Commonwealth of Australia, 2008). Acknowledging this, the predictor variable in this analysis classified households with rent or mortgage payments in excess of 30% of household income as being in unaffordable housing. While affordability is dependent on the proportion of income spent on housing, the majority of research and policy work acknowledges that the income level of the household is also important – for example, high income households may have sufficient financial resources to spend in excess of 30%, and low income households may be unable to secure adequate housing for less than 30% of their income.

Annual gross household income and monthly rent or mortgage costs (collected as continuous variables in Australian dollars) were rescaled to weekly values. Household incomes were equivalised using the modified OECD scale taking into account household size and structure (Haagenars, de Vos & Zaidi, 1994).

### Outcome variable

The Mental Component Summary (MCS) score of the Short Form 36 measure (SF-36) was used as the outcome measure for these analyses. The SF-36 is self-completed, and is a widely used measure of health status (Coons, Rao, Keininger & Hays, 2000) that has been validated for use in the Australian population (Butterworth & Crosier, 2004) and to detect within-person change over time (Hemingway, Stafford, Stansfeld, Shipley & Marmot, 1997). The MCS score relates most directly to four subscales generated from the 36 items that comprise the SF-36: Vitality, Social Functioning, Role Limitations due to emotional problems (Role – Emotional) and Mental Health. A higher score on this 0–100 scale reflects better mental health and wellbeing.

### Effect modifier

Household-level employment status was modelled as a categorical variable with the following categories: securely employed, insecurely employed or unemployed. If at least one adult in a household had a permanent or fixed-term job, then the whole household was classified as securely employed. If no adults were employed the household was classified as unemployed. If no one was securely employed but at least one person was insecurely employed (casual or labour hire), then the whole household was classified as insecurely employed. Households were classified as not in the labour force (NILF) if all the adults in the household were either carers, students, sick or disabled, and had not sought employment in the past month. Households classified as NILF were excluded from the analysis for that wave.

### Potential confounders

Based on the literature (Bentley, Baker, Mason, Subramanian & Kavanagh, 2011; Mason et al., 2013; Pevalin, 2009; Taylor et al., 2007), and our suppositions of the likely relationships between housing affordability and mental health, models were adjusted for two life-stage, working-age categories (25–44 years; 45–64 years), survey year, experience of a serious injury/illness in the past year (i.e. a health shock) (categorised as yes or no), experience of divorce or separation in the past year (categorised as yes or no) and equivalised household income centred at year-specific mean, and scaled by \$100.

As we were concerned with household employment security's role as an effect modifier of the housing affordability and mental health relationship, it was not necessary to adjust for confounders of employment security with the outcome. Consequently, it is important to note that we are testing effect modification (i.e. the extent to which households could be a policy-target) and not a causal interaction (VanderWeele & Knol, 2014).

### Statistical analysis

All analyses were performed using Stata 14.0. Summary statistics of each of the key exposure and outcome variables and confounders were estimated using the *xttab* or *xtsum* commands. Longitudinal linear regression models with fixed-effect estimators were used to examine affordable housing change in relation to mental health. Taking account of repeat observation of individuals at each year of the survey (that is, there was follow-up each year over a ten year period), the following models were used (where  $i$ =individuals within the sample,  $t$ =time periods):

$$MCS_{it} = \alpha + \beta X_{it} + v_i + \varepsilon_{it}$$

MCS was modelled as a function of a constant term ( $\alpha$ ) and a set of covariates ( $X$ ) with associated vector of coefficients ( $\beta$ ) while  $v_i$  is an individual-specific error term that controls for unobserved individual fixed effects (effects that are constant over time) and  $\varepsilon_{it}$  is an error term that varies across individuals and over time.

An interaction term between housing affordability and employment security was included in each model to test for an additive interaction of housing and employment on mental health.

$$MCS_{it} = \alpha + \beta_1 housing + \beta_2 employment + \beta_3 (housing * employment) + v_i + \varepsilon_{it}$$

These models compared the mental health of people at times when they were in unaffordable housing with times when they were not. Furthermore, the use of fixed-effect models enabled us to control for confounding by omitted variables that vary across individuals, but are constant over time (such as ethnicity, or family background).

To test if the cutoff of 30% of income on housing costs was meaningful in the context of the relationship between housing affordability and mental health, we estimated four additional regression models with a 10%, 20%, 40% and 50% cutoff of housing cost as a proportion of income.

The association between housing affordability and mental health, and the statistical significance (at 5%) of the additive interaction with employment security, was estimated. Stata 14.0 post-estimation command (*lincom*) was used to combine coefficients and generate 95% confidence intervals.

Complete case analysis was conducted. There were no missing data for year, sex or age. Of 130,211 total observations between 2001 and 2010, 67,749 observations were for respondents aged 25–64 years who were in the labour force and therefore eligible for inclusion in the analytical sample. Of these observations, 1.8% of observations were missing for housing affordability or insecure employment, a further 11.5% for self-reported mental health and a further 11.9% for remaining confounders (equivalised income and experience of a health shock or separation/divorce in the past 12 months). In total, 78% of the eligible sample of observations was available for inclusion in the analysis.

### Results

Across the pooled sample of observations, when people resided in securely employed households they reported higher mental health scores on average, and when people had unaffordable housing they reported lower mental health scores (1.2 points difference on average) (Table 1). A relatively small proportion (8%) of people residing in securely employed households had unaffordable housing costs. This compared to 11% of people residing in insecurely employed households and 18% in unemployed households.

The income distribution reflects the characteristics of the working age sample, one that is further restricted to households with active participation in the labour force. Consequently just less than 8% of the sample is classified in the lowest 30% of the income distribution, and

**Table 1**  
Description of analytic sample, adults aged 25–64 years by household (51,855 observations of 10,776 individuals).

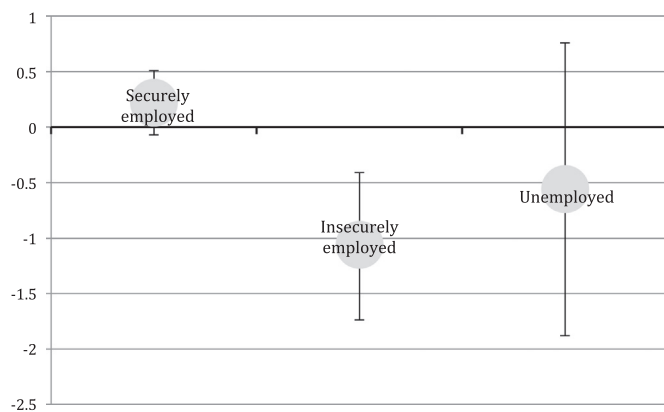
	Total obs	Percent of all obs	Affordable housing		Unaffordable housing	
			N obs	Mean SF-36 MCS score (SD)	N obs	Mean SF-36 MCS score (SD)
<b>Age (years)</b>						
25–44	29,426	56.7	26,236	48.64 (09.54)	3190	47.53 (10.29)
45–64	22,459	43.3	20,980	50.63 (08.96)	1479	48.81 (10.18)
<b>Sex</b>						
Male	26,948	52.0	24,655	50.08 (08.97)	2293	48.67 (09.93)
Female	24,937	48.1	22,561	48.91 (09.70)	2376	47.23 (10.51)
<b>Household employment security</b>						
Secure	43,519	83.9	39,922	49.81 (09.10)	3597	48.53 (09.89)
Insecure	6686	12.9	5923	48.64 (09.91)	763	46.56 (10.62)
Unemployed	1680	3.2	1371	44.79 (11.83)	309	44.35 (12.26)
<b>Income cohort (of national distribution)</b>						
Low (1st–29th percentile)	3662	7.1	2867	47.81 (10.24)	795	45.68 (11.54)
Middle (30th–49th percentile)	8867	18.4	7733	48.62 (09.86)	1134	47.50 (09.86)
High (50th percentile and above)	39,356	75.9	36,616	49.84 (09.13)	2740	48.76 (09.57)
<b>Serious illness or injury in past year</b>						
No	48,461	93.4	44,121	49.66 (9.19)	4340	47.01 (11.03)
Yes	3424	6.6	3095	45.36 (11.70)	329	40.83 (13.00)
<b>Divorce or separation in past year</b>						
No	49,829	96.0	45,560	49.39 (9.88)	4269	49.62 (9.21)
Yes	2056	4.0	1656	42.51 (12.59)	400	43.49 (12.42)

76% in the top half (Table 1). Most observations in the sample (84%) were for people residing in securely employed households (Table 1). Only 3% of the sample was from households classified as unemployed.

The majority of observations in the sample were for people spending more than 10% of their income on housing costs (around 54% of observations) (Table 2). When we considered alternative cut points for housing cost as a proportion of income in relation to mental health (Table 2), we found that moving from spending less than 30%, 40% or 50% of household income on housing costs to spending above

**Table 2**  
Beta coefficients and 95% confidence intervals for fixed effect regression analyses for models with different proportions of income in housing cost adjusted for age, year, income, employment security, health shock and separation or divorce in past 12 months.

Housing costs as a proportion of household income	Percent of sample	Beta	95% LCI	95% UCI
Model 1: > 10%	54.02	0.096	-0.096	0.288
Model 2: > 20%	24.70	-0.120	-0.317	0.078
Model 3: > 30%	9.00	<b>-0.276</b>	<b>-0.532</b>	<b>-0.003</b>
Model 4: > 40%	3.50	<b>-0.226</b>	<b>-0.942</b>	<b>-0.055</b>
Model 5: > 50%	1.72	<b>-0.923</b>	<b>-1.560</b>	<b>-0.284</b>



**Fig. 2.** Estimated change in mental health component summary score associated with housing becoming unaffordable.

these cut point was significantly associated with poorer mental health whereas moving from below to above spending more than 10% or 20% was not.

Across the three levels of employment security, the only change in mental health associated with housing becoming unaffordable where the interval did not include the null was observed for households classified as insecurely employed (B=-1.06, 95% CI -1.75 to -0.38) (Fig. 2). Model fit improved with the inclusion of an interaction term between housing affordability and employment security (p=0.004) providing evidence of effect modification. Results for the models estimated with and without the additive interaction term are presented in Table 3. It should also be noted that the number of unemployed households (at just 3.2% of household observations) is likely too small to detect a significant difference compared to the reference group of people residing in securely employed households.

**Discussion**

Social and economic determinants of health intersect in complex and poorly understood ways to shape population health, yet they are often conceptualised and analysed separately (Bauer, 2014; Krieger & Higgins, 2002; Libman, Fields & Saegert, 2012; World Health Organization, 2008). Given limitations in resources to tackle public health problems, it is important to assess whether interventions aimed at social and economic determinants (such as payments to reduce the burden of unaffordable housing) should be targeted in their delivery. Our finding of employment-related effect modification in the relationship between housing affordability and mental health implies that interventions aimed at insecurely employed households might be more efficient. Further, while there are mixed findings on the effect of insecure employment arrangements on mental health (LaMontagne et al., 2014), we find evidence that they may shape the relationship between mental health and other key determinants of health. This confirms the importance of considering intersections between social determinants of health (Bauer, 2014) as a means of targeting policies and interventions (Vanderweele, 2015).

This study has important strengths. It utilises a large and robust dataset representative of the Australian population to examine the interaction between housing and employment in relation to mental health for the first time. By employing longitudinal analytical methods that make comparisons within people over time we have been better able to estimate potential causal relationships acting over the short term, and identify evidence of effect modification. Through model adjustment, we have reduced the risk of time-varying confounding by observed changes within individuals over time. The use of a fixed-effects model has reduced the risk of time-invariant confounding by unobserved differences between individuals. Using a cut point of 30%, above which housing costs as a proportion of household income are

**Table 3**  
Beta co-efficient with 95% confidence intervals from a fixed-effects regression model with and without an **additive interaction between housing affordability and employment security** (adjusted for age, year, serious personal injury or illness, divorce or separation and household income).

	Model 1			Model 2			P-value for improved model fit with inclusion of the interaction term
	Co-efficient	Lower 95% CI	Upper 95% CI	Co-efficient	Lower 95% CI	Upper 95% CI	
<b>Affordable housing</b>							
Yes	REF			REF			
No	-0.276	-0.528	-0.023	-0.106	-0.404	0.193	
<b>Household employment security</b>							
Secure	REF			REF			
Insecure	0.109	-0.141	0.359	0.220	-0.074	0.514	
Unemployed	-1.326	-1.772	-0.879	-1.276	-1.867	-0.686	
<b>Interaction terms, unaffordable housing by...</b>							
Securely employed household				REF			0.004
Insecurely employed household				-0.959	-1.693	-0.225	
Unemployed household				-0.455	-1.812	0.902	

considered to constitute ‘unaffordable’ housing, is supported by testing alternative cut points of 10%, 20%, 40% and 50% and finding it is only for people who move from below to above either 30%, 40% or 50% that a negative association with mental health is observed in adjusted models.

In interpreting our findings, we note the following potential limitations and considerations. First, the use of fixed-effects regression represents just one modelling approach, which, whilst free of time-invariant confounding may be vulnerable to statistical imprecision due to small numbers of people transitioning between states. Further, results generalise only to those households in our sample that experience changes in housing affordability. Second, because the analysis focused on housing *becoming* unaffordable, it does not reflect the effects of unaffordable housing among people experiencing chronic long-term affordability problems (Bentley, Kavanagh et al., 2015; Mason et al., 2013). Other studies of chronic disadvantage (Lynch, Kaplan & Shema, 1997) would suggest that sustained housing affordability stress may be more detrimental to mental health than unaffordable housing that is only transient; although, in a previous study (Bentley, Baker & Mason, 2012) we found little evidence to support a causal association between a cumulative experience of unaffordable housing and mental health, and concluded that other characteristics of the population who experience long-term unaffordable housing may be a more important explanation for any observed associations with health. Nonetheless, consideration of chronic versus transient housing affordability stress is another important area for future research, and may reveal more substantial mental health effects of unaffordable housing in relation to employment. To correspond to our measure of housing affordability, our measure of insecure employment is at the household level. While this is justifiable as we are interested in a household effect on individual health, there is some difference in specificity between our exposure, effect modifier and the outcome measure. Additionally, while this measure has the virtue of being an objective indicator of employment insecurity, we acknowledge that perceived (individual-level) job insecurity could also vary within employment arrangement categories.

Attrition bias is a potential limitation of longitudinal studies, but loss to follow-up in HILDA has been low each year (< 10% in most waves) (Summerfield, Freidin et al., 2011; Summerfield, Dunn et al., 2011). Furthermore, to induce bias of our estimates of association, attrition must be related both to future change in affordability and future change in mental health. The attrition that has occurred has resulted in disproportionate loss of people of younger age, born outside Australia, who are unemployed or in low-skilled occupations, but we have no *a priori* reason to suspect the relationship between housing affordability and mental health would vary by household employment

status amongst these groups. Relatedly, only 3.4% of households were classified as unemployed. It is likely that no effect was observed for this group due to the small number of households within it.

The HILDA dataset includes imputed values for household income (using the Little and Su method) (Summerfield, Freidin et al., 2011; Summerfield, Dunn et al., 2011), and we have used these in our analyses as approximately 20% of observations are missing income data. A complete case sensitivity analysis only of observations with income data available (not shown) revealed similar employment-specific results. To guard against any possible selection bias and improve generalisability to the wider Australian population we have used the imputed income data in the main analysis, though we recognise this introduces the possibility of information bias due to measurement error.

We note that the effect of housing affordability (our main exposure measure) on mental health may be underestimated by including all adult household members in our analyses. It is possible that effects on the main income earner(s) in a household may be greater.

Confounding by unmeasured variables associated with the exposure (housing affordability) and the effect modifier (employment security) and the outcome cannot be discounted. This is a potential source of bias to the estimated additive interaction term (VanderWeele & Knol, 2014). Finally, exposure and outcome measures were derived from subjectively reported variables, so dependent misclassification bias (where the extent of misclassification of two variables is dependent on each other) is also possible. The fixed-effects analysis, however, mitigates against this as any time invariant influences (e.g., negative affectivity) would be controlled for (being constant within people over time).

**Conclusion**

This is the first study to consider if household employment security modifies the relationship between housing affordability and mental health and wellbeing in a working aged sample. We found evidence suggestive of a mental health effect of housing becoming unaffordable for insecurely employed households. Our analysis is conservative and our effect sizes are small. Nonetheless, a central implication of our finding is that these two key social determinants of health jointly shape mental health and wellbeing such that interventions to reduce the effect of housing affordability stress on health might efficiently target people residing in insecurely employed households.

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### Conflict of interest

None to declare.

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