Association Between Housing Affordability and Mental Health: A Longitudinal Analysis of a Nationally Representative Household Survey in Australia

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Evidence about the mental health consequences of unaffordable housing is limited. The authors investigated whether people whose housing costs were more than 30% of their household income experienced a deterioration in their mental health (using the Short Form 36 Mental Component Summary), over and above other forms of financial stress. They hypothesized that associations would be limited to lower income households as high housing costs would reduce their capacity to purchase other essential nonhousing needs (e.g., food). Using fixed-effects longitudinal regression, the authors analyzed 38,610 responses of 10,047 individuals aged 25–64 years who participated in the Household, Income, and Labour Dynamics in Australia (HILDA) Survey (2001–2007). Respondents included those who remained in affordable housing over 2 consecutive waves (reference group) or had moved from affordable to unaffordable housing over 2 waves (comparison group). For individuals living in low-to-moderate income households, entering unaffordable housing was associated with a small decrease in their mental health score independent of changes in equivalized household income or having moved house (mean change = −1.19, 95% confidence interval: −1.97, −0.41). The authors did not find evidence to support an association for higher income households. They found that entering unaffordable housing is detrimental to the mental health of individuals residing in low-to-moderate income households.

Australia; housing; longitudinal studies; mental health

Abbreviations: CI, confidence interval; HILDA, Household, Income, and Labour Dynamics in Australia; MCS, Mental Component Summary; SD, standard deviation; SF-36, Short Form 36.

Housing is the place where we spend the majority of our lives and one of the main settings that affect human health (1). Although a relation between housing and health is well established and housing is widely regarded as a key determinant of health (2), gaps remain in our understanding of the multiple potential pathways between housing and health (3–5). Existing evidence has focused mainly on more direct “pathways” (3) between physical dwelling characteristics, such as exposure to toxins (2), poor insulation (4), or dampness (6), and physical health outcomes, such as asthma (4, 7), skin infections (8), or cardiovascular disease (9). Less is known about how the social and economic aspects of housing relate to health, particularly mental health, a finding highlighted in recent reviews (10, 11).

The relation between housing affordability and mental health has been established in a number of studies (6, 7, 12–14); affordability may influence health via the quality (12, 13), location (15), and tenure (14, 16, 17) of dwellings that households can access. Furthermore, in extreme cases, poor housing affordability can result in homelessness that is likely to be both a consequence and a determinant of poor mental health (18). Importantly for this current study, recent work in the United Kingdom (19) that builds on earlier work (10) has indicated that the experience of poor housing affordability appears to influence mental health directly, over and above general financial hardship. The current analysis adds to this body of work to improve understanding of the influence of housing affordability on mental health.

In a great majority of countries, including Australia (20), the United States (3), and the United Kingdom (21), housing is a principal means for households to create and store wealth. For many households, housing costs (mortgage, rent,
and insurance) are their largest category of expenditure, on average accounting for just under 20% of all consumption expenditure in Australia and New Zealand, 18% in the United Kingdom and the United States, and almost 24% in Canada (22). The cost of housing, therefore, has a significant effect on a household's ability to access nonshelter requirements, such as food, transport, and medical care. This is especially the case for low income households as they are likely to pay a greater proportion of their income in housing costs (23).

A number of recent studies and reviews have highlighted the potential of longitudinal studies (10, 22, 24) to explore the relation between housing and health. Longitudinal approaches are able to address a number of key limitations of cross-sectional studies, such as the direction of causation (3, 6, 25, 26) and the role of subjective influences on health, such as the sense of well-being (10, 24). In addition, previous studies have insufficiently separated housing affordability from income, meaning that the effects of housing affordability cannot be distinguished from broader financial stress. This final point is critical because, if housing affordability has an effect on mental health that is distinct from the effects of financial stress, then policy interventions to reduce housing costs may be effective health interventions.

Our research uses a longitudinal approach that considers changes within people over time (comparing individual housing affordability and mental health at 2 time points). We account as much as possible for underlying financial stress driving observed associations by both stratifying and adjusting for income. In Australia, housing affordability has most typically been examined by using a ratio approach, which focuses on households in the bottom 40% of the income distribution paying more than 30% of their income for housing costs (the “30/40 rule”) (27–30). The usefulness of this ratio has been recently reinforced in the analysis by Nepal et al. (31), who analyzed the sensitivity of the 30/40 rule most robustly allowed housing affordability to be examined over time. The structure of the Australian housing system means that affordability is a means by which housing acts as a social determinant of health, leading to housing being regarded as a “health promoting resource accessed through income” (32, p. 25). The research and policy focus on housing affordability among lower income Australians is grounded in the premise that the costs of housing among those with lower incomes result in reduced ability to meet other nonhousing basic needs (e.g., food or medical). Correspondingly, people from higher income households are more likely to have social and material resources that would buffer their health from the negative consequences associated with having high housing costs relative to income (33). Consequently, we hypothesized that the effects of poor housing affordability on mental health would be limited to lower income households.

In this article, we therefore address 2 research questions:

1. Does self-perceived mental health worsen for people whose housing becomes unaffordable?
2. Do observed effects differ between low to moderate and high income households?

### MATERIALS AND METHODS

#### Data

The Household, Income, and Labour Dynamics in Australia (HILDA) longitudinal study follows Australian households and individuals over time. The HILDA data set is based upon a nation-wide probability sample of households and individuals, focused on income, employment, health, and well-being. Information is collected from household members aged 15 or more years by using face-to-face interviews and self-completion questionnaires. All annual waves between 2001 and 2007 were included in these analyses. The initial household response rate at wave 1 was 66%. Retention of responding individuals at subsequent waves was 87% at wave 2 and >90% thereafter (34).

The analysis described in this paper is based upon the 38,610 responses of 10,047 HILDA participants aged 25–64 years who met the following criteria:

- Had at least 2 consecutive waves of data on housing affordability, mental health, and income, and
- Had spent 2 consecutive waves in affordable housing (reference group) or 1 wave in affordable housing followed by 1 wave in unaffordable housing (comparison group).

#### Outcome variable

The Mental Component Summary (MCS) of the Short Form 36 (SF-36) measure was used as the primary outcome measure for these analyses. The SF-36 is one of the most widely used self-completion measures of health status (35), and it has been validated for use in the Australian population (36) and to detect within-person change over time (37). The MCS relates most directly to 4 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 well-being.

#### Predictor variable

“Unaffordable housing” was defined as occurring when a household paid more than 30% of gross household income in rent or mortgage costs (33, 38, 39). Rent, mortgage, and household income were self-reported and refer to the time at which the survey was conducted.

#### Confounders

Potential confounders were identified from existing literature and consideration of the likely relation between each and change in housing affordability and change in mental health. Models were adjusted for age (centered at the mean), change in residence between waves, and equivalized disposable household income. Disposable income was based on income, investments, and expenditure for the financial year and equivalized for each household. Equivalization adjusts for the size and composition of the household by using the modified equivalence method of the Organisation for Economic Co-operation and Development.
and Development (40). The analytical sample was restricted to individuals whose housing was affordable in 1 survey wave but unaffordable in the next wave and to those who remained in affordable housing over 2 consecutive survey waves (reference category).

Missing data

Of the 64,937 data points recorded in the HILDA data set between waves 1 and 7 for people aged 25–64 years, 59.46% are included in these analyses. Cases could not be included where the MCS score was not available or where there was missing information on covariates (reducing the sample to 43,642). The analysis was restricted to people who had spent 2 consecutive survey waves in affordable housing or had 1 wave in affordable housing followed by a wave in unaffordable housing (38,610 observations).

Analysis

We calculated summary statistics of the outcome (MCS) by age group, sex, if moved house between waves, and equivalized disposable income, for both categories of the affordable housing predictor variable (remained in affordable housing/housing became unaffordable). Household income and changes in household income between waves are likely to be strong confounders of the association between housing affordability and mental health. To examine the association between household income and housing affordability, we used 2007 data to plot the relation between quintiles of equivalized income and the proportion of people spending more than 30% of income on housing costs, excluding individuals who did not have any housing costs.

We used longitudinal linear regression models with fixed-effects estimators to estimate the association between unaffordable housing and mental health. Analyses were performed by using STATA, version 11.0, software (StataCorp LP, College Station, Texas). Taking account of repeat observation of individuals, we used the following models (where $i =$ individuals within the sample, and $t =$ time periods):

\[
MCS_i = a + bX + v_i + e_{it}.
\]

MCS was modeled as a function of a constant term ($a$) 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 $e_{it}$ is an error term that varies across individuals and over time. Because we want to control for omitted variables that differ between individuals but are constant over time (including family background, education), we used a fixed-effects rather than a random-effects estimator in the models. Fixed-effects models remove variability between people that is equivalent to including each person in the model as a covariate (i.e., a fixed effect). This approach removes unobserved heterogeneity (between people). The coefficients generated from these models describe changes within individuals only and therefore provide an estimate of associations that are not confounded by differences between people that cannot be accounted for in the models.

The sampling design of HILDA resulted in more than 1 individual per household being included in the analysis. Therefore, robust standard errors were calculated to account for clustering of individuals within households.

We estimated the association between change in housing affordability and change in mental health, initially adjusted for age (referred to as “unadjusted models”), and then further adjusted for equivalized disposable household income. Because the fixed-effects approach measures within-person change over time, by adjusting for an equivalized (by household structure) measure of income, we capture change in both disposable income (which might arise from a change in job or labor force participation) and household structure (an increase or decrease in people in the household).

We also tested the hypothesis that effects would be restricted to lower income households by including in the model an interaction term between housing affordability and level of household income (dichotomized into the lowest 40% and the highest 60% of the national income distribution) (41). We then stratified models according to household income.

Finally, to test the sensitivity of our findings to the outcome measure used, we repeated our primary analysis using each subscale of the MCS (mental health, role-emotional, social functioning, and vitality) as outcomes, stratifying the analysis by household income.

RESULTS

Overall, people who had not experienced unaffordable housing had an average MCS of 49.0 (standard deviation (SD) = 9.9), whereas those whose housing had become unaffordable had an average MCS of 46.5 (SD = 11.3) (Table 1). Across each age, sex, and income group, people whose housing had become unaffordable had worse mental health than people whose housing had remained affordable. People who had moved from one house to another had a lower average MCS score than people who had not moved between waves, and if their housing had also become unaffordable, their average MCS score was the lowest observed at 44 (SD = 12.3) points (Table 1).

Housing becoming unaffordable was more likely for people in the lowest 40% of the income distribution and those who had moved. The majority of occurrences of housing becoming unaffordable were not related to moving from one house to another, implying that changes in household structure, housing costs, or household income were the main reasons for housing becoming unaffordable.

Housing affordability was strongly associated with income. In the lowest income quintile, 43% of individuals spent more than 30% of their income on housing compared with only 3% in the highest income group (Figure 1).

On average, the MCS of people whose housing became unaffordable decreased by 0.54 points after age, equivalized disposable income, and moving from one house to another had been accounted for (95% confidence interval (CI): −0.95, −0.14) (Table 2). Fitting an interaction term in the model showed evidence of effect modification by level of household income ($P = 0.008$). Stratification of models by household income shows that the associations of poor housing affordability with mental health appear to be restricted to
individuals living in low-to-moderate income households (mean change $= -1.19$, 95% CI: $-1.97, -0.41$).

Mental health and social functioning worsened in low-to-moderate income households when housing became unaffordable (mean change $= -1.49$, 95% CI: $-2.75, -0.22$ and mean change $= -4.33$, 95% CI: $-6.19, -2.47$, respectively) (Table 3). No significant relation with housing affordability was observed for the role-emotional or vitality subscales of the SF-36. Again, there was no evidence of an effect of housing affordability for people in the upper 60% of the income distribution.

**DISCUSSION**

We find evidence to support our hypothesis that poor housing affordability is associated with deterioration in mental health in Australia, a finding that is consistent with research in other resource-rich countries, including the United Kingdom (19). Our findings also suggest that decreases in mental health associated with poor housing affordability appear to be limited to individuals living in households in the bottom 40% of the income distribution. We suggest that the concentration of the effect in low-to-moderate income

![](https://example.com/image.png)

**Figure 1.** Percentage of adults aged 25–64 years spending more than 30% of their equivalized household income on housing payments, by income quintile, Australia, 2007.
Table 2. Mental Health Effect of Moving Into Unaffordable Housing, Stratified by Household Income, for Adults Aged 25–64 Years, Australia, 2001–2007

<table>
<thead>
<tr>
<th>Income Distribution</th>
<th>Mean Change in MCS Scoreb</th>
<th>95% CI</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowest 40% of income</td>
<td>Unadjusted</td>
<td>-0.59</td>
<td>-0.99, -0.19</td>
</tr>
<tr>
<td></td>
<td>Adjusted</td>
<td>-0.54</td>
<td>-0.95, -0.14</td>
</tr>
<tr>
<td>Upper 60% of income</td>
<td>Unadjusted</td>
<td>-0.15</td>
<td>-0.69, 0.38</td>
</tr>
<tr>
<td></td>
<td>Adjusted</td>
<td>-0.11</td>
<td>-0.65, 0.43</td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval; MCS, Mental Component Summary; SF-36, Short Form 36.

a Regression coefficients representing the mean change in SF-36 score in individuals whose housing became unaffordable compared with those who remained in affordable housing.

b Unadjusted models were adjusted for age only.

c Adjusted models were adjusted for age, residential change, and equivalized disposable household income.

Table 3. Effect on Mental Health, Role-Emotional, Social Functioning, and Vitality of Moving Into Unaffordable Housing, Stratified by Household Income, for Adults Aged 25–64 Years, Australia, 2001–2007

<table>
<thead>
<tr>
<th>Income Distribution</th>
<th>Mean Change in MCS Scoreb</th>
<th>95% CI</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowest 40% of income</td>
<td>Mental health</td>
<td>-1.49</td>
<td>-2.75, -0.22</td>
</tr>
<tr>
<td></td>
<td>Role-emotional</td>
<td>-2.56</td>
<td>-5.43, 0.31</td>
</tr>
<tr>
<td></td>
<td>Social functioning</td>
<td>-4.33</td>
<td>-6.19, -2.47</td>
</tr>
<tr>
<td></td>
<td>Vitality</td>
<td>-1.01</td>
<td>-2.24, 0.22</td>
</tr>
<tr>
<td>Upper 60% of income</td>
<td>Mental health</td>
<td>0.15</td>
<td>-0.71, 1.01</td>
</tr>
<tr>
<td></td>
<td>Role-emotional</td>
<td>-0.23</td>
<td>-2.04, 1.58</td>
</tr>
<tr>
<td></td>
<td>Social functioning</td>
<td>-0.29</td>
<td>-1.48, 0.89</td>
</tr>
<tr>
<td></td>
<td>Vitality</td>
<td>-0.20</td>
<td>-1.13, 0.73</td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval; MCS, Mental Component Summary; SF-36, Short Form 36.

a Regression coefficients representing the mean change in SF-36 score in individuals whose housing became unaffordable compared with those who remained in affordable housing, adjusted for age, having moved residence since last wave, and equivalized disposable household income.

The effect sizes estimated in these analyses are modest, partly attributable to the conservative modeling approach used (fixed effects and adjustment for income). Generally in population groups, a change of 2–3 points on this scale is considered to be of clinical importance (47); however, as argued by Testa (48), determining the magnitude at which a within-person change becomes meaningful is not straightforward and may vary across different people and in different contexts. For example, Hopman et al. (49) found an age-related, within-person natural progression in MCS over time that equated to an average increase of 1.3 over 5 years for women aged 45–54 years and of 2.0 for men of the same age. Nonsystematic measurement error of income and housing costs that combine to form our exposure variable may have also attenuated our estimates toward the null. Nonetheless, we argue that small effects are still of public health importance when experienced by a large proportion of the population. For example, in Australia in 2004, there were 1.1 million low income households in unaffordable housing (50) and, therefore, poor housing affordability has a role in both the creation and maintenance of health inequalities.

This study has several important strengths. We have used a large and high quality national longitudinal data set, and this has allowed us to model change in mental health predicted by change in housing affordability and to mount stronger causal arguments. The use of fixed-effects regression analysis, allowing us to look at individual change in response to unaffordable housing, negates the bias generated from unmeasured differences between people. Finally, we were able to address the limitations of previous research that have not
taken into account the association between household income and housing affordability. As shown in Figure 1, housing affordability is closely related to income. Therefore, it is necessary to adopt an analytical approach that reduces the possibility that observed associations between housing affordability and health are the result of residual confounding by low income. The analytical approach used in this article does so by focusing on changes within people over time, while adjusting for household income. Our income-adjusted observations using within-person regression analysis allow us to identify a relation between housing affordability and mental health that appears to operate above and beyond the mental health effect of financial difficulties.

The study also has a number of limitations. First, information was not available on the number of times between annual survey waves that participants had changed housing affordability. Additionally, our understanding of the relation between unaffordable housing and health might be sharpened with more comprehensive measures of poor housing affordability (e.g., indicators which take into account mortgage or rent arrears, generational wealth, tenure, transport costs associated with location of housing, and the costs of heating and cooling housing). We also note that our analysis is based upon a dichotomous exposure measure. Although we are mindful of the importance of assessing exposure by using a policy-relevant measure, we also note its limitation in revealing variation on either side of the 30% cutoff. On the basis of our analysis, we do not know the form of the association between housing affordability and health, and this could be a focus of future research.

We have necessarily made some key assumptions in this paper. The first relates to potential reverse causation occurring between survey waves. In some cases, a decline in a person’s mental health may cause his/her housing to become unaffordable, perhaps through job loss or a relationship breakdown. If this were to occur between data collection waves of HILDA, we have no way of knowing if change in mental health preceded a change in housing affordability. We have assumed that the strongest pathway is likely to be from housing unaffordability to poorer mental health. Second, although the first survey wave was, on the whole, highly representative of the Australian population and subsequent retention has been high (>90% for all but 1 wave), there is a documented attrition bias toward people who are of non-English-speaking backgrounds, unemployed, less educated, indigenous, and in lower status occupations (51). Over time, the sample has therefore become less representative of the population and biased toward higher socioeconomic status population groups. In addition to this potential attrition bias, missing data on key variables led to the exclusion of a large number of survey participants from our analytical sample. The large majority of excluded records were missing the MSC score at 1 or both years. Individuals missing these data were slightly more likely to be in unaffordable housing and slightly more likely to be in low/moderate income households (data not shown). It is possible that attrition and selection biases may have affected the estimates of the strength and significance of the relation between unaffordable housing and health that we have obtained in these analyses. If the housing affordability-mental health relation is stronger in very low income groups who also did not report their income, it is likely that we have underestimated the association.

Using data from a national household longitudinal survey, we contribute to the emerging evidence on housing and mental health. The analysis provides strong evidence to support a relation between housing affordability and mental health in low income groups. Further, our findings suggest that interventions to improve housing affordability in low income groups are likely to reduce inequalities in mental health.

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