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Life course socio-demographic circumstances and the association between housing tenure and disability-free life expectancy in Australia: a longitudinal cohort study

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ABSTRACT

Introduction This study aimed to assess the extent to which the association between housing tenure and disability-free life years is independent of socio-demographic circumstances from earlier in life.

Methods We analysed nationally representative data from the Household Income and Labour Dynamics in Australia survey. Participants were followed up for 14 years (2001–2014). Housing tenure was measured by the question, "Do you (or any other members of this household) own this home, rent it, or do you live here rent-free?" Disability was defined by the SF-36 physical function subscale. We used multistate modelling and inverse probability weighting to estimate the association between housing tenure (home ownership vs renting) and disability-free life expectancy (DFLE), adjusting for a range of socio-demographic indicators.

Results The sample included 6164 participants (52.5% women) aged 45 years and older in 2001. In weighted analyses that adjusted for earlier life circumstances, for men, the estimated total life expectancy (TLE) at age 65 among renters was 16.7 years, 2.3 (95% CI −3.7 to −0.7) years shorter than the TLE of 19.0 years for owner-occupiers. DFLE was 1.8 years shorter for renters than owner-occupiers. For women at age 65, the weighted TLE was estimated to be 20.6 years, 2.3 (95% CI −3.9 to −0.6) years shorter than the 22.9 years estimated for owner-occupiers. Compared with owner-occupiers, DFLE was 3.1 years shorter for women renters.

Conclusions Both men and women renters had shorter disability-free and TLE than owner-occupiers independent of earlier life circumstances. There is a need for policies addressing potential health disparities linked to housing tenure.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Previous research has demonstrated a link between housing tenure and disability-free life expectancy (DFLE) but not accounted for confounding by life course socio-demographic circumstances.

WHAT THIS STUDY ADDS

⇒ In this study, home ownership was independently associated with a longer DFLE, even after adjusting for socio-demographic characteristics from earlier in life.

⇒ Among men at age 65, renters were estimated to have 2.3 years shorter life expectancy and 1.8 years shorter DFLE compared with owner-occupiers.

⇒ Among women at age 65, renters were estimated to have 2.3 years shorter life expectancy and 3.1 years shorter DFLE compared with owner-occupiers.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ These findings support advocacy for policies addressing health disparities linked to housing tenure in countries like Australia.

INTRODUCTION

Housing is an important upstream social determinant of health that provides a strong foundation for ageing well.[1–7] One aspect of housing that may be important for health is housing tenure, which is defined as the legal and financial basis for dwelling occupancy and commonly indicated by home ownership.[8] In many high-income countries, most notably those with liberal welfare regimes such as the USA, the UK, New Zealand and Australia,[9] lack of home ownership in older adulthood has been argued to be a marker of social disadvantage[4 7 10–14] and linked to health disparities.[3 15 16] In these national contexts, home ownership supports wealth accumulation, provides financial security and stability of residence and has also been linked to better housing conditions and enhanced connection to the community.[2 5] All these factors contribute to healthy ageing.[17] However, because housing is acquired during adulthood, health disparities tied to home ownership may partly reflect the long-term impacts

of earlier life exposures. In this study, we examine the extent to which life course socio-economic circumstances contribute to the association between housing tenure and health expectancy.

Disability-free life expectancy (DFLE) is a type of health expectancy that summarises disability and mortality information in a single indicator conveying the cumulative number of years a person of a given age can be expected to live with (and without) disability.[18 19] These indicators are useful for evaluating social determinants of health in later life because they can quantify inequalities in overall life expectancy as well as years of healthy independent living. Several studies have identified home ownership to be an important correlate of DFLE. For example, analysis of general practice data from regional districts in Leicestershire, England, found housing tenure to be a stronger predictor of differences in healthy life years than other socio-economic indicators including deprivation, income, welfare receipt, social class and difficulties managing finances.[20] Similar findings have been reported for Japan[21] and Australia,[15] where older adults who lived in rental accommodation had fewer years lived disability-free and a greater proportion of their life lived with disability compared with owner-occupiers. However, none of these studies accounted for earlier life exposures, such as social disadvantage in childhood or socio-economic position into adulthood, which may contribute to selection into home ownership and partly explain the poorer DFLE of older adults who rent. Early life determinants of housing and health outcomes in older adulthood include place of birth, parental occupation and years of schooling. Attainment of major social milestones and life events such as family formation and workforce participation are also important antecedents of home ownership.[14] For example, marital status is one of the strongest predictors of home ownership in Australia.[22] Adults who do not live with a partner, or have been separated or divorced, are more likely to be renting than married couples.[14] Failure to address selection processes is typical of many studies of health expectancy, particularly when the focus is on mid- or late-life risk factors.[18] However, these considerations are important from both life course and policy perspectives as they provide insight into the origins and development of health inequalities.[23 24]

In our experience, modelling limitations are one of the foremost reasons why many studies of inequalities in DFLE do not adjust for confounding factors. Multistate models underpinning the estimation of DFLE from longitudinal data are complex and often unable to accommodate covariate adjustment for a large number of variables. Previous reviews of the health expectancy literature have identified a need for methodologies that enable adjustment of background characteristics and confounding factors.[18] Inverse probability weights (IPWs) offer a solution to this challenge. IPWs are commonly applied in the analysis of observational data to estimate treatment effects and support causal inference,[25] or more simply to enable unconfounded group comparisons in non-causal descriptive studies.[26] The present study is an example of the latter. Although studies of DFLE regularly incorporate weights to enhance the representativeness of their sample,[27] there are few examples of their use to address confounding. Of note are two recent studies that used IPWs to examine how education and other early life characteristics relate to healthy and working life expectancies independently of gender, birth cohort and ethnicity.[28 29] There is scope to use similar IPW methods to gauge the extent to which the link between home ownership and longer, healthier lives is due to earlier life circumstances.

The aim of this study was to examine differences in DFLE by housing tenure, using IPWs to account for a range of earlier life exposures that contribute to home ownership, and are also likely to be related to late-life disability and mortality. We expect that compared with owner-occupiers, older adults who are renting will have shorter life expectancies and fewer years lived without disability, and that these differences will be attenuated after weighting for housing tenure selection. In our analyses, we account for several life course socio-economic characteristics that contribute to home ownership and may partially explain the association between housing tenure and health expectancy. These include early life factors such as parental occupation and unemployment, birth cohort, country of birth and educational attainment. Factors from earlier adulthood reflecting major milestones such as marital history, occupation, and unemployment history are also included.

METHOD

Data were drawn from the Household Income and Labour Dynamics in Australia (HILDA) survey.[30] HILDA is a nationally representative cohort study which commenced in 2001 and has an annual follow-up. Participating households were selected through multistage random sampling, and survey respondents were all household members aged 15 years and older. The initial household response rate was 66% and the baseline sample comprised 13 969 responding persons from 7682 households. The response rate has been maintained at more than 85% since 2002. Data were collected via a combination of household interviews, personal interviews and self-completion questionnaires. For the present study, we included all HILDA respondents aged 45 years and older in 2001. These respondents were followed to the date of linkage with the National Death Index in February 2014,[31] providing up to 13 waves of longitudinal data (n=6164; total observations=57 957; 47.5% men; 52.5% women). We excluded respondents who entered the sample after 2001. At the date of linkage, there were 1245 persons with a recorded death (average age of death=78.7; SD=10.8; range: 47–104). We follow the STROBE reporting guidelines for cohort studies (see online supplemental material). Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

Measures

Mobility limitations were assessed by the Physical Function subscale of the SF36.[32] Items on this scale capture self-assessed difficulties with everyday activities including walking, climbing stairs, carrying or lifting groceries, dressing and bathing. Consistent with previous research on health expectancies, a threshold of SF36 PF scores ≤40 indicated disability.[15 31] All participants with scores below this threshold reported limitations with at least one of these activities.

All respondents were asked the question "Do you (or any other members of this household) own this home, rent it, or do you live here rent-free?". Housing tenure was coded as a binary variable distinguishing those who were renting from those who lived in their own home or lived rent-free with life tenure. Respondents who reported renting their home were subsequently asked to provide details of the property-owner from whom they were renting.

We included the following covariates reflecting life course characteristics to weight for selection into housing tenure: sex, age, age-squared, country of birth (Australian born; overseas born in a primarily English-speaking country; overseas born in a primarily non-English speaking country), father's career occupation, father's unemployment history, mother's career occupation, age left home, highest qualification attained, number of times married, current marital status, current or most recent occupation and proportion of time unemployed since leaving full-time education. Highest qualification data were coded according to the Australian Standard Classification of Education.[33] Occupation data were coded according to the Australian and New Zealand Standard Classification for Occupations,[34] with a ninth category included to indicate unavailable occupation data. For father's occupation, this ninth category included respondents who did not live with their father or whose father never worked. The same coding scheme was applied to the mother's occupation. Finally, for respondents who reported their father was unemployed for a period of 6 months or longer, we included an indicator of long-term parental unemployment. A separate response coding for each variable is provided with the online supplementary material (online supplemental table S1).

Inverse probability weights

To calculate IPW, we first generated Covariate-Balancing Propensity Scores (CBPSs)[35] with the Stata module 'psweight'.[36] The CBPSs reflect the conditional probability of home ownership given a set of antecedent factors. Briefly, this method uses an empirical likelihood approach to minimise the covariate imbalance among comparison groups in a single-step procedure. This has the benefit of not requiring iterative model fitting to identify an optimal propensity score model. CBPSs have been demonstrated to be robust to model misspecification and have improved performance relative to other methods for estimating propensity scores.[35] Average Treatment Effect IPWs were then calculated from the CBPSs (equation 1 in online supplemental file) and normalised to have a mean of 1 within each group and therefore sum to the original sample size (online supplemental table S3). IPWs were assessed for covariate balance and common support.[37 38] Covariate balance was evaluated by comparing the standardised mean difference and variance ratio for each covariate in the unweighted and weighted sample. A standardised mean difference approaching zero and a variance ratio approaching one in the weighted sample were considered evidence of covariate balance. Common support was evaluated by examining the overlap of the CBPSs by housing tenure. Empirical cumulative distribution functions were also visually inspected to compare covariate distributions in the unweighted and weighted samples.

Health expectancy estimation

We report total life expectancy (TLE) and the average number of years lived with and without disability at age 65 by gender and housing tenure. DFLE was estimated with Interpolated Markov Chain (IMaCh) software V.0.99r19.[39] IMaCh is specialist software used for estimating health expectancies from multistate modelling of longitudinal data. Specifically, IMaCh is a discrete-time Markov model that uses multinomial logistic regression to estimate age-specific transition probabilities between disability states over a given time interval. The multistate model used to estimate DFLEs is depicted in online supplemental figure S1). The method can accommodate irregular intervals between observations (including skipped waves) and missing follow-up data. In the present study, observed time intervals were partitioned into 1 monthly steps to approximate the underlying continuous process. Respondents with no recorded mortality data were censored and assumed to be alive with unknown disability status in March 2014. The resulting transition probabilities were then used to compute a multistate life table.

We first fit unadjusted models (ie, without CBPS IPW) to estimate observed differences in DFLE by housing tenure, we then repeated the analysis with the inclusion of the IPWs to adjust for early life circumstances, thereby obtaining a conditional average controlled difference in DFLE. All models were estimated separately for men and women. A set of supplementary analyses was performed to evaluate whether any differences in DFLE by housing tenure were due to respondents living in public housing. To this end, all models were rerun on a sample excluding 275 persons (4.5%) who reported renting from a government housing authority (ie, living in public or social housing). Finally, in a sensitivity analysis, we repeated the primary analysis but included HILDA responding person sample weights so the estimated reflected the resident population for the year 2001. HILDA sample weights were calculated to account for the probability of household selection (being invited to participate) and the probability of responding (agreeing to participate)

Table 1 Sample characteristics at baseline (2001) and across all waves of follow-up (to 2014)

	Men				Women			
	Baseline		All waves		Baseline		All waves	
	n	%	n	%	n	%	n	%
Age group (years)								
45–54	1158	39.6	11218	42.0	1262	39.0	12834	41.1
55–64	848	29.0	8087	30.3	844	26.1	8712	27.9
65–74	583	19.9	5407	20.2	637	19.7	6233	20.0
75–84	285	9.7	1814	6.8	409	12.6	3091	9.9
80+	52	1.8	196	0.7	86	2.7	365	1.2
Total	2926	100.0	26722	100.0	3238	100.0	31235	100.0
Housing tenure								
Owner-occupier	2536	86.7	23242	87.0	2764	85.4	26660	85.4
Rents home	390	13.3	3480	13.0	474	14.6	4575	14.6
Total	2926	100.0	26722	100.0	3238	100.0	31235	100.0

and calibrated to known population benchmarks (eg, age, sex, marital status, labour force status, geographic location). Complete details on the development of the survey weights are provided elsewhere.[30 40] This sensitivity analysis comprised a smaller sample of 6144 persons due to 20 respondents who had sample weights equal to zero.

RESULTS

Sample characteristics of all 6164 respondents in 2001 are presented in table 1, and transition frequencies are presented in online supplemental table S1a–S1d). Men contributed an average of 9.1 waves of data with an average interval of 15.3 months between observations. Women contributed an average of 9.6 waves of data with an average interval of 15.2 months between observations. At baseline, 390 men (13.3%) and 474women (14.6%) did not live in their own home. Housing tenure was not associated with non-response or attrition.

Estimates of DFLE at age 65 are shown in table 2 for men and table 3 for women. For men at age 65, unadjusted models estimated TLE among renters to be 16.0 years (95% CI 14.6 to 17.4), which was 3.2 years shorter than the TLE of 19.2 years (95% CI 18.5 to 19.9) estimated for owner-occupiers. Similarly, DFLE was 3.2 years shorter for renters than owner-occupiers (table 2). These differences were attenuated in analyses that adjusted for earlier life circumstances with IPWs; however, men who were renting still had shorter life expectancy (mean difference=−2.3 years; 95% CI −3.7 to −0.7) and fewer years lived disability-free (mean difference=−1.8 years; 95% CI −3.1 to −0.5) compared with men who were owner-occupiers. There were no differences in years lived with disability by housing tenure in either the unadjusted or adjusted analyses. Nor were there differences in the proportion of remaining life lived with disability in the adjusted IPW analysis (both 21%).

Table 2 Unadjusted and CBPS IPW adjusted expectancies for men at age 65 by housing tenure

	TLE	DFLE	DLE	DLE/TLE
	Years (95% CI)	Years (95% CI)	Years (95% CI)	%
Unadjusted				
Owner-occupier	19.2 (18.5 to 19.9)	15.3 (14.7 to 15.9)	3.9 (3.6 to 4.3)	20
Rents home	16.0 (14.6 to 17.4)	12.1 (10.9 to 13.2)	3.9 (3.2 to 4.7)	25
Difference	−3.2 (-4.7 to −1.7)	−3.2 (-4.5 to −1.9)	0.0 (-0.8 to 0.8)	
Adjusted				
Owner-occupier	19.0 (18.3 to 19.6)	15.0 (14.4 to 15.6)	3.9 (3.6 to 4.3)	21
Rents home	16.7 (15.4 to 18.1)	13.2 (12.1 to 14.4)	3.5 (2.9 to 4.1)	21
Difference	−2.3 (-3.7 to −0.7)	−1.8 (-3.1 to −0.5)	−0.4 (-1.1 to 0.3)	

CBPS, Covariate-Balancing Propensity Score; DFLE, disability-free life expectancy; DLE, disability life expectancy; IPW, inverse probability weight; TLE, total life expectancy.

Table 3 Unadjusted and CBPS IPW adjusted expectancies for women at age 65 by housing tenure

	TLE	DFLE	DLE	DLE/TLE
	Years (95% CI)	Years (95% CI)	Years (95% CI)	%
Unadjusted				
Owner-occupier	23.0 (22.2 to 23.7)	16.7 (16.1 to 17.3)	6.3 (5.8 to 6.8)	27
Rents home	20.4 (18.8 to 21.9)	11.5 (10.5 to 12.5)	8.9 (7.7 to 10.0)	44
Difference	−2.6 (-4.3 to −0.9)	−5.2 (-6.3 to −4.0)	2.6 (1.3 to 3.8)	
Adjusted				
Owner-occupier	22.9 (22.1 to 23.6)	16.5 (15.9 to 17.1)	6.4 (5.9 to 6.9)	28
Rents home	20.6 (19.2 to 22.1)	13.4 (12.2 to 14.5)	7.3 (6.3 to 8.3)	35
Difference	−2.3 (-3.9 to −0.6)	−3.1 (-4.4 to −1.8)	0.9 (-0.2 to 2.0)	

CBPS, Covariate-Balancing Propensity Score; DFLE, disability-free life expectancy; DLE, disability life expectancy; IPW, inverse probability weight; TLE, total life expectancy.

For women at age 65, unadjusted models estimated TLE among renters to be 20.4 years (95% CI 18.8 to 21.9), which was 2.6 years shorter than the TLE of 23.0 years (95% CI 22.2 to 23.7) estimated for owner-occupiers (table 3). Compared with owner-occupiers, DFLE was 5.2 years shorter (95% CI −6.3 to −4.0), and DLE was 2.6 years longer (95% CI 1.3 to 3.8) for renters. The 2.6-year differences in TLE by housing tenure were not meaningfully reduced in the weighted estimates for women. However, the inclusion of IPWs did reduce differences in DFLE (mean difference=−3.1 years; 95% CI −4.4 to −1.8) and DLE (mean difference=0.9; 95% CI −0.2 to 2.0). Women renters also had a greater proportion of their remaining years of life lived with disability than women owner-occupiers (44% vs 27% for unweighted estimates and 35% vs 28% for weighted estimates) (table 3).

Figure 1 depicts unadjusted and IPW-adjusted DFLE estimates for the age range 45–85. The difference in years lived with disability by housing tenure for women is greater for younger ages than older ages. For example, in weighted analyses that adjusted for earlier life circumstances women who owned their own home at age 50 had an average of 7.3 (95% CI 6.8 to 7.8) years lived with disability, 1.5 years less than the 8.8 (95% CI 7.7 to 10.0) years lived with disability for women who were renting at age 50. In contrast, housing tenure did not differentiate years lived with disability for women at older ages or men at any age.

Results from supplementary analyses that excluded persons living in public housing are presented in online supplemental tables S5 and S6. The pattern of results was consistent with the primary analyses, with one exception: In IPW-adjusted analyses, men who were renting had fewer years lived with disability compared with men who owned their own home (mean difference=−1.0; 95% CI −1.8 to −0.2). Finally, estimates from sensitivity analyses that additionally weighted the sample to the resident population in 2001 were also consistent with the primary analyses reported here (online supplemental figure S4, online supplemental tables S7 and S8).

DISCUSSION

Housing tenure has been proposed as a useful indicator of socio-economic position for older adults,[1] and this claim has been supported by health expectancy studies showing that owner-occupiers are more likely to live for longer in good health than people who do not own their own home.[15 20 21] However, these studies have not accounted for selection into home ownership. This is the first study to demonstrate inequalities in years lived disability-free by housing tenure are independent of socio-economic circumstances experienced earlier in the life course. Home ownership was associated with longer years of healthy life for women and men, even after adjusting for their background characteristics. In contrast, housing tenure did not differentiate years lived with disability, except for women from younger cohorts.

These findings hold implications for analyses of health expectancy by demonstrating the benefits of adjusting for selection effects. Life course and social epidemiological perspectives of healthy ageing emphasise the need to clarify the interconnected pathways linking exposures and experiences across all stages of life.[23 24] The health expectancy literature is large, and several studies have examined differentials in DFLE in relation to housing and other mid-life exposures such as occupation.[15 41 42] However, adjusting for potential confounding is uncommon in these studies. Although unadjusted differences in health expectancies are of value as they reflect the current experience of people in differing situations and can inform the targeting of interventions, in such analyses it is unclear how much of the association between healthy life years and mid-life and/or late-life exposures can be attributed to earlier life circumstances. This has led to calls for health expectancy methods that

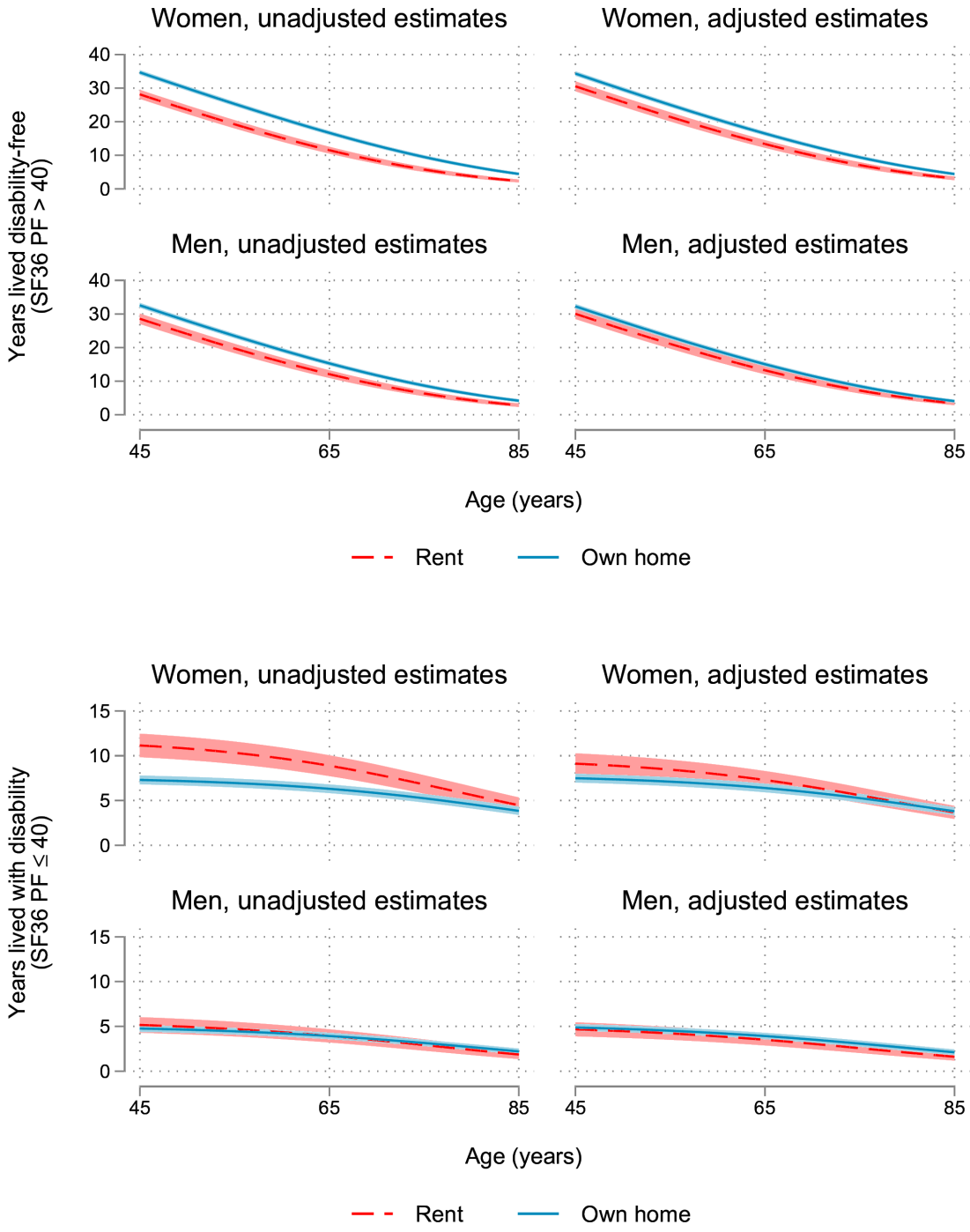

Figure 1 Estimated years lived disability-free (top) and with disability (bottom) by age for women and men. The shaded area indicates 95% CIs. Disability defined by SF36 Physical Function scores (SF36 PF) ≤40. Adjusted expectancies are estimated with Covariate-Balancing Propensity Score inverse probability weights.

support unconfounded group comparisons.[18] The use of IPW in this study enabled us to draw inferences about the association between home ownership and disability life years after accounting for confounding by a range of socio-demographic characteristics. However, we emphasise that it does not make sense to interpret this as a causal association. First, there is potentially omitted variable bias. HILDA lacks data on health in earlier life and adverse childhood experiences such as financial hardship, neglect, abuse or violence. These factors are known to have lasting impacts on future health trajectories, are linked to higher mortality and may contribute to fewer life opportunities for home ownership.[43 44] Our analysis also does not account for income or household wealth as we could not confidently establish a measure of wealth accumulated prior to home ownership. It is likely that accounting for these characteristics would further reduce the association between housing tenure and DFLE reported here. We also did not examine interaction terms between housing tenure and background

covariates. Second, DFLEs (and health expectancies more generally) are not individual health outcomes, they are summary indicators of population health. It is not clear how such summary measures can be conceptualised within a causal framework, particularly when they are derived from a complex episodic state-space of multiple incidence, recovery and mortality transitions.[19] Thus, as with all health expectancy research, we prefer to regard the present findings as a non-causal descriptive epidemiological study.[26] Nevertheless, further research is needed to clarify explanatory factors linking home ownership to healthy ageing.[7]

Our analyses also revealed the link between housing and health expectancy to vary by gender. It is common to observe women have longer years lived with disability than men, and this can be attributed to a variety of biological and social factors.[45] However, it is notable that renting was associated with additional unhealthy life years for women at younger ages (in both relative and absolute terms), including for the adjusted estimates. A trend that was not evident for men. This could reflect greater economic insecurity and financial constraints for women who do not own their own home, many of whom will have experienced fragmented labour force engagement throughout their working years. This finding supports growing concerns for precarious housing arrangements and access to care services for many single women as they age[46] and reinforces the need to account for diverging gender norms and roles when explaining ageing trajectories.

It is important to consider the national context of these findings. Home ownership has become the norm for many Australian households since the 1950s and comprises large portion of household wealth.[11 16] However, there has been a slow but steady decline in home ownership over the past two decades in Australia. In 2001, 70.4% of households were owner-occupied, dropping to 66.2% of households by 2020. The rise in renting has been seen across all age groups but is greater among younger cohorts and predominately comprises private rental rather than social housing.[47] This has implications for the health and well-being of those who live in the private rental market as some welfare policies and programmes supporting older Australians, such as the age pension, assume that most older adults will have acquired home ownership by the end of their working life.[13 16] As a consequence, housing provides an important source of financial security for older Australians and has been described as a fourth pillar of the retirement income system.[12 13]

Asset-based welfare has been used in Australia as a social policy strategy to offset low levels of age pension income support. Australia has a relatively low age pension rate by international standards, predicated on the assumption of home ownership and accumulation of other assets over working lives sufficient to support individuals in their postwork years.[48] Moreover, housing costs as a proportion of income are higher among renters compared with owner-occupiers.[13] Older Australians who do not own their own home are therefore vulnerable to precarious housing and income poverty.[11] Whether similar findings to those reported here are observed for other national populations will likely depend on a constellation of socio-cultural factors and policy settings. Cross-national comparisons have shown housing tenure is more strongly associated with poor health of older adults in the UK and the Netherlands than in other European countries.[4] This would suggest that the link between home ownership and health, and its role as a social determinant is context-dependent.

We acknowledge several limitations of the present study. As with most longitudinal studies, there is selective attrition in HILDA which may bias our estimates. Similarly, HILDA is subject to healthy sample bias, and the original sample frame excluded very remote areas of Australia and non-private dwellings (eg, hostels, prisons and residential aged care homes where meals are provided). This may partly explain why the TLEs estimated with HILDA are slightly higher than national life tables produced by the Australian Bureau of Statistics.[29] Finally, HILDA is a household panel survey, and there is, therefore clustering of respondents at the household level. Currently, it is not possible to include a random intercept in IMaCh (or indeed in other common packages used to estimate health expectancies) to explicitly model this non-independence. However, it is likely that estimating models separately for men and women and inclusion of responding person sample weights in our sensitivity analyses address most (but perhaps not all) of the household clustering for older cohorts.

CONCLUSION

It is widely recognised that many older adults express a desire to live in their own home and local community in their later years for as long as possible. Secure housing in later life provides a major source of financial security, stability and a sense of place.[2 12] In this study, we show that the link between housing tenure and disability-free life years is only partly accounted for by socio-economic circumstances in childhood and earlier adulthood. This finding highlights the importance of housing to age in place and live a healthier longer life and is a further demonstration of why evaluation of mid-life social determinants should consider a life-course perspective.

There is no fundamental reason why home ownership should necessarily be linked to healthy ageing outcomes,[4 8 20 49] and we expect the pathways connecting housing to poor health in later life are amenable to intervention. With declining home ownership rates among younger cohorts in many high-income countries, there is a need for policies addressing potential health disparities linked to housing tenure. This is likely to involve the provision of secure, affordable and safe housing that enables people to remain engaged and connected in their community as they age. This is particularly the case for those countries with retirement income systems that

are currently predicated on the assumption that older adults will own their own homes and therefore have relatively low housing costs in their postwork years.

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Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data may be obtained from a third party and are not publicly available. HILDA data can be accessed by approved users. Data access can be requested from the Australian Department of Social Services National Centre for Longitudinal Data at no cost (https://dataverse.ada.edu.au/dataverse/hilda).

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REFERENCES

1 Avlund K, Holstein BE, Osler M, *et al*. Social position and health in old age: the relevance of different indicators of social position. *Scand J Public Health* 2003;31:126–36.
2 Swope CB, Hernández D. Housing as a determinant of health equity: A conceptual model. *Soc Sci Med* 2019;243:112571.
3 Munford LA, Fichera E, Sutton M. Is owning your home good for your health? Evidence from exogenous variations in subsidies in England. *Econ Hum Biol* 2020;39:100903.
4 Dalstra JAA, Kunst AE, Mackenbach JP. A comparative appraisal of the relationship of education, income and housing tenure with less than good health among the elderly in Europe. *Soc Sci Med* 2006;62:2046–60.
5 Rolfe S, Garnham L, Godwin J, *et al*. Housing as a social determinant of health and wellbeing: developing an empirically-informed realist theoretical framework. *BMC Public Health* 2020;20:1138.
6 Dunn JR. Housing and Health Inequalities: Review and Prospects for Research. *Hous Stud* 2000;15:341–66.
7 Amy C, Emma B, Meena K. Are housing circumstances associated with faster epigenetic ageing. *J Epidemiol Community Health* 2023;78:40–6.
8 Mansour A, Bentley R, Baker E, *et al*. Housing and health: an updated glossary. *J Epidemiol Community Health* 2022;76:833:833–8:.
9 Bambra C. Going beyond The three worlds of welfare capitalism: regime theory and public health research. *J Epidemiol Community Health* 2007;61:1098–102.
10 Khalatbari-Soltani S, Cumming RG, Chomik R, *et al*. The association between home ownership and the health of older men: Cross-sectional analysis of the Australian Concord Health and Ageing in Men Project. *Australas J Ageing* 2021;40:e199–206.
11 Colic-Peisker V, Ong R, Wood G. Asset poverty, precarious housing and ontological security in older age: an Australian case study. *Int J Hous Policy* 2015;15:167–86.
12 Saunders P, Watanabe K, Wong M. Poverty and Housing Among Older People: Comparing Australia and Japan. *Poverty Public Policy* 2015;7:223–39.
13 Yates J, Bradbury B. Home ownership as a (crumbling) fourth pillar of social insurance in Australia. *J Hous Built Environ* 2010;25:193–211.
14 Pledger M, McDonald J, Dunn P, *et al*. The health of older New Zealanders in relation to housing tenure: analysis of pooled data from three consecutive, annual New Zealand Health Surveys. *Aust N Z J Public Health* 2019;43:182–9.
15 Tawiah R, Jagger C, Anstey KJ, *et al*. Lifecourse socioeconomic position and cohort differences in healthy expectancy: New insights into unequal ageing from a longitudinal cohort. *Lancet Public Health* 2022;7:E347–55.
16 Morris A. Housing and Inequality in Australia. *Econ labour relat rev* 2023;34:86–103.
17 Beard JR, Officer A, de Carvalho IA, *et al*. The World report on ageing and health: a policy framework for healthy ageing. *The Lancet* 2016;387:2145–54.
18 Jagger C, Robine JM. Healthy life expectancy. In: Rogers RG, Crimmins EM, eds. *International Handbook of Adult Mortality.2011*.
19 Saito Y, Robine JM, Crimmins EM. The methods and materials of health expectancy. *Stat J IAOS* 2014;30:209–23.
20 Matthews RJ, Jagger C, Hancock RM. Does socio-economic advantage lead to a longer, healthier old age? *Social Science & Medicine* 2006;62:2489–99.
21 Ojima T, Okada E, Saito M, *et al*. Housing Status and Disparities of Healthy Life Expectancy: JAGES Cohort Project. *Int J Epidemiol* 2015;44:i115.
22 Baxter J, McDonald P. Why is the rate of home ownership falling in Australia. *Pol Bull issue* 2005;52.
23 Kuh D, Ben-Shlomo Y, Lynch J, *et al*. Life course epidemiology. *J Epidemiol Community Health* 2003;57:778–83.
24 Liu S, Jones RN, Glymour MM. Implications of Lifecourse Epidemiology for Research on Determinants of Adult Disease. *Public Health Rev* 2010;32:489–511.
25 Chesnaye NC, Stel VS, Tripepi G, *et al*. An introduction to inverse probability of treatment weighting in observational research. *Clin Kidney J* 2022;15:14–20.
26 Li F, Morgan KL, Zaslavsky AM. Balancing Covariates via Propensity Score Weighting. *J Am Stat Assoc* 2018;113:390–400.
27 Bennett HQ, Kingston A, Spiers G, *et al*. Healthy ageing for all? Comparisons of socioeconomic inequalities in health expectancies over two decades in the Cognitive Function and Ageing Studies I and II. *Int J Epidemiol* 2021;50:841–51.
28 Lorenti A, Dudel C, Hale JM, *et al*. Working and disability expectancies at older ages: The role of childhood circumstances and education. *Soc Sci Res* 2020;91:102447.
29 Hambisa MT, Tawiah R, Jagger C, *et al*. Gender, education, and cohort differences in healthy working life expectancy at age 50 years in Australia: a longitudinal analysis. *Lancet Public Health* 2023;8:e610–7.
30 Watson N, Wooden M. The HILDA Survey: A case study in the design and development of a successful household panel survey. *Longit Life Course Stud* 2012;3:369–81.
31 Tawiah R, Jagger C, Anstey KJ, *et al*. Trends in disability-free life expectancy at age 50 years in Australia between 2001 and 2011 by social disadvantage. *J Epidemiol Community Health* 2021;75:1056–62.
32 Ware JE, Gandek B. Overview of the SF-36 Health Survey and the International Quality of Life Assessment (IQOLA) Project. *J Clin Epidemiol* 1998;51:912:903–12:.

33 Australian Bureau of Statistics. Australian standard classification of education (asced). 2001. Available: https://www.abs.gov.au/statistics/classifications/australian-standard-classification-education-asced/2001
34 Australian Bureau of Statistics. ANZSCO - australian and new zealand standard classification of occupations. *Canberra: ABS*; 2006.
35 Imai K, Ratkovic M. Covariate balancing propensity score. Journal of the Royal Statistical Society: Series B (Statistical Methodology). *J R Stat Soc Ser B* 2014;243–63.
36 Kranker K. PSWEIGHT: Stata module to perform IPW- and CBPS-type propensity score reweighting, with various extensions. *Stat Softw Comp* 2019.
37 Garrido MM, Kelley AS, Paris J, *et al*. Methods for constructing and assessing propensity scores. *Health Serv Res* 2014;49:1701–20.
38 Austin PC, Stuart EA. Moving towards best practice when using inverse probability of treatment weighting (IPTW) using the propensity score to estimate causal treatment effects in observational studies. *Stat Med* 2015;34:3661–79.
39 Lièvre A, Brouard N, Heathcote C. THE ESTIMATION OF HEALTH EXPECTANCIES FROM CROSS-LONGITUDINAL SURVEYS. *Math Popul Stud* 2003;10:211–48.
40 Watson N, Fry TRL. *The Household, Income and Labour Dynamics in Australia (HILDA) Survey: Wave 1 Weighting*. Melbourne: The Melbourne Institute, 2002. Available: https://melbourneinstitute.unimelb.edu.au/assets/documents/hilda-bibliography/hilda-technical-papers/htec302.pdf
41 Head J, Chungkham HS, Hyde M, *et al*. Socioeconomic differences in healthy and disease-free life expectancy between ages 50 and 75: a multi-cohort study. *Eur J Public Health* 2019;29:267–72.
42 Cambois E, Laborde C, Romieu I, *et al*. Occupational inequalities in health expectancies in France in the early 2000s: Unequal chances of reaching and living retirement in good health. *Dem Res* 2011;25:407–36.
43 Hughes K, Bellis MA, Hardcastle KA, *et al*. The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis. *Lancet Public Health* 2017;2:e356–66.
44 Grummitt LR, Kreski NT, Kim SG, *et al*. Association of Childhood Adversity With Morbidity and Mortality in US Adults: A Systematic Review. *JAMA Pediatr* 2021;175:1269–78.
45 Oksuzyan A, Brønnum-Hansen H, Jeune B. Gender gap in health expectancy. *Eur J Ageing* 2010;7:213–8.
46 Byles J, Curryer C, Vo K, *et al*. Changes in housing among older women: Latent class analysis of housing patterns in older Australian women. *Urban Stud* 2018;55:917–34.
47 Australian Institute of Health Welfare. Home ownership and housing tenure. 2023. Available: https://www.aihw.gov.au/reports/australias-welfare/home-ownership-and-housing-tenure
48 Australian Government The Department of Veterans' Affairs. How owning a home can affect pensions and payments. 2022. Available: https://www.dva.gov.au/financial-support/income-support/what-changes-your-payments/your-property-or-accommodation/how#:~:text=Your%20home%20is%20not%20counted,does%20not%20own%20their%20residence
49 Lux M, Sunega P. The impact of housing tenure in supporting ageing in place: exploring the links between housing systems and housing options for the elderly. *Int J Hous Policy* 2014;14:30–55.