# The home environment: influences on the health of young-old and old-old adults in Australia

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## Abstract
The physical and societal characteristics of home have been established as important in influencing the health and wellbeing of older adults, yet these have rarely been explored together. There is also limited research into variation across age groups, with older adults often examined as a homogenous group of those 65 years and over. This study advances the knowledge base by using the concept of person–environment (P-E) fit to analyse differences in personal and home environment (physical and societal) characteristics between young-old (65–74 years) and old-old (75 and above) age groups, and to assess how these characteristics influence their self-perceived health. This cross-sectional study draws upon survey data from 1,999 older adult participants from the Australian Housing Conditions Dataset. Descriptive statistics and inferential analysis were used to assess for significant differences between age groups and a binomial logistic regression was utilised to examine influences on health. The analysis found that the factors which influence health varies appreciably between age groups. For the young-old financial strain, being on the fixed-income pension and hypertension were important contributing factors, in contrast for the old-old gender (being male), having depression and the home being modified for disability were key influences. For both age groups heart disease was a contributing factor to perceived health. The results indicate the important contribution to knowledge of incorporating a wide range of person and environment characteristics when exploring P-E fit for older adults. The inclusion of societal aspects, such as financial strain, fixed-income pension, tenure and access to community aged care services when exploring influences on health, arises as a key conclusion of the study. In terms of impact, this research is significant given rising inequalities globally and specifically in the Australian context, the need for policy measures to address income inequality, and its health and social implications for older households.

## Introduction

Older adults, commonly defined as 65 years and above (Orimo *et al.*, 2006), are not a homogeneous group, with variations in health, activity participation, employment and living situation found between older age groups (Spalt *et al.*, 2016; Yang *et al.*, 2018). Categorisation of the old-old varies across the literature, including above 75, 80 and 85 years (Mehta *et al.*, 2008; Yoshimura *et al.*, 2013; Etxeberria *et al.*, 2019). This paper, which utilised data from the Australian Housing Conditions Dataset (Baker *et al.*, 2018) defines young-old as 65–74 years and those aged 75 and above as old-old. Previous research has established that the old-old are more likely to have decreased physical health, experience malnutrition, have reduced participation in activities of daily living, be retired and live alone (Australian Bureau of Statistics (ABS), 2013, 2015, 2016; Yoshimura *et al.*, 2013; Etxeberria *et al.*, 2019). In line with these circumstances, the significance of the home environment for older people increases in the later years of ageing, with the old-old spending more time at home and at increased vulnerability to the physical home environment's barriers (Oswald *et al.*, 2007; Spalt *et al.*, 2016). While these differences exist across the older age groups, research has yet to explore variations in the influence of the home environment across age groups.

International research has established the home environment as critical in supporting the health and wellbeing of older adults (Baker *et al.*, 2014; Garin *et al.*, 2014; Morris, 2018; Trecartin and Cummings, 2018). However, this research has largely focused on the influence of the physical environment on the health and wellbeing of older adults, with less attention paid to the societal characteristics of housing such as tenure. Rarely have both the physical home environment and broader societal environmental factors, such as tenure, been evaluated together to understand their contribution to older adult's health. This, along with the limited understanding of variations across age groups in older age, presents a gap in the literature. This study, using the concept of person–environment (P-E) fit, sought to address this gap, by addressing two research questions:

- What differences, if any, exist between the young-old and old-old age groups' personal characteristics and the physical and societal characteristics of the home environment?
- How do personal characteristics and the physical and societal characteristics of the home environment influence the health of the young-old and old-old?

The paper initially discusses the theoretical framework of P-E fit. Following this, the influence of older adults' personal factors influencing health and wellbeing are briefly presented followed by a more in-depth review of the literature on home environment factors influencing health. The methodology and data underpinning the empirical analysis are discussed prior to the presentation of the results. The analysis section initially presents descriptive and inferential statistics followed by logistic regression modelling to identify and explain what personal characteristics and physical and societal characteristics of home contribute most to the health

of young-old and old-old adults. The penultimate section of the paper is a detailed discussion of key findings in relation to current research followed by conclusions.

## Conceptual framework

This paper is informed by the concept of P-E fit drawn from the Ecological Theory of Aging of Lawton and Nahemow (1973). The ecological theory of ageing is concerned with the interaction between the person and the environment, where the person is described as having competence and the environment as 'press'. The competence of the person includes biological health, sensory and perceptual skills, motor skills, cognitive function and an acknowledgement of psychological strength (Lawton, 1982). The environment is broadly described to include the physical environment; the social environment, which includes norms, values and institutional influences operating in the group, society or culture of the person; the personal environment which refers to the close social relationships of the individual, *e.g.* family and friends; and the supra-personal environment, which is the modal characteristics of the person's close social environment, such as their neighbourhood (Lawton, 1982).

Environmental press is understood to be both demanding and supportive of individuals, where positive or negative quality is defined by the individual. For example, internal stairs to bedrooms may present negative press for one older adult, leading to a fear of falling and non-use of upstairs bedrooms, while for another it may be positive in providing an opportunity for daily exercise and increased health. The interaction of the person and environment influences behaviour (Lawton, 1982) and is reflective of the 'fit' between the person and their environment. This study uses a measure of self-perceived health collected in the Housing Condition Dataset as a measure of the outcome of the P-E interaction. Previous research from Iwarsson *et al.* (2007) used a similar measure along with life satisfaction to explore P-E fit for older adults. The Housing Condition Dataset, however, did not include a life satisfaction or similar measure for use in this study.

The concept of P-E fit has been widely used to explore housing for older adults (Garin *et al.*, 2014), including the large ENABLE-AGE study in Europe exploring relationships between housing and health (Oswald *et al.*, 2007), ageing in place for vulnerable older adults (Park *et al.*, 2017), differences in aged care settings (Pomeroy *et al.*, 2011) and adaptive strategies used by older adults as they age in place (Lien *et al.*, 2015). Much of this work has focused on and progressed understanding of P-E fit with regards to the physical environment (Iwarsson, 2005; Oswald *et al.*, 2007; Pomeroy *et al.*, 2011; Garin *et al.*, 2014; Lien *et al.*, 2015), with limited attention paid to wider aspects of the environment. Lawton (1982) cautioned against this simplified approach to understanding P-E fit, explaining that the person and environment are not a unitary concept, where one aspect of the environment can be used to understand the influence of environment as a whole. Lawton (1982), however, also acknowledged the difficulty in measuring the wide aspects of the person and environment.

This study seeks to broaden the evidence base in understanding P-E fit for older adults by incorporating wider aspects of the environment in our exploration of how the environment influences the perceived health of older adults. In doing so, this

study explores two environmental factors: the physical and societal environment. The term societal environment refers to the structures and systems in society that influence the resources and control that people have over their homes (Aplin and Tanner, 2019). This includes socio-economic and institutional factors such as housing affordability, tenure, social class, welfare and financial strain, aged and disability care service structures and funding, along with housing policy and legislation.

## Literature review

Personal characteristics which influence the self-perceived health and wellbeing of older adults are well explored in the literature. These include a range of health conditions and functional abilities, including chronic health conditions, poor nutrition, depression, memory problems, lower physical activity levels and frailty (Acree *et al.*, 2006; Baernholdt *et al.*, 2012; Ha and Kim, 2019; Shim *et al.*, 2021). Much of this existing literature on the influence of the personal characteristics along with literature exploring physical characteristics of home has focused on older adults as a homogeneous group of over 60, 65 or 70 years (Baernholdt *et al.*, 2012; Garin *et al.*, 2014; Trecartin and Cummings, 2018) or on occasion focused on a specific age group, *e.g.* 75 to 84 or 89 years (Iwarsson, 2005; Oswald *et al.*, 2007; Werngren-Elgström *et al.*, 2009).

Considering the physical environment, literature on understanding home and its influences on health and wellbeing for older adults draws from a range of fields including gerontology, psychology, sociology, social work and occupational therapy (Wahl and Oswald, 2010). The diversity of disciplines and theoretical approaches researching home for older adults has resulted in a complex understanding of home and while different theoretical viewpoints have been adopted, researchers agree that home is an important place which influences the health and wellbeing of older adults.

The high degree of focus on the physical home environments of older adults demonstrates its important role in supporting independence and completion of daily activities at home for older adults (Oswald *et al.*, 2007; Garin *et al.*, 2014). In this context, several studies have shown that those living in more-accessible homes or having fewer barriers in the home are more independent and have a greater ability to participate in day-to-day activities (Iwarsson, 2005; Oswald *et al.*, 2007; Werngren-Elgström *et al.*, 2009; Garin *et al.*, 2014). The relationship between the quality of the physical home environment and the physical health of older adults has also been demonstrated in the literature (Garin *et al.*, 2014). For example, evidence shows feeling cold at home is associated with increased mortality (Zuluaga *et al.*, 2011) and increased falls are associated with homes in need of repair (Gill *et al.*, 2005). Furthermore, a large body of research demonstrates the positive impact of home modifications, or alterations to the physical home environment, where modifications support independence in daily living activities, reduce injuries and falls, and contribute to improved wellbeing for older adults (Wahl *et al.*, 2009; Stark *et al.*, 2017; Trecartin and Cummings, 2018; Carnemolla and Bridge, 2020).

The impact of the physical home environment on psychological wellbeing and mental health, although less established, has also been demonstrated in the literature. For example, increased housing accessibility has been found to be associated with enhanced life satisfaction and wellbeing, along with fewer depressive symptoms (Iwarsson *et al.*, 2007; Oswald *et al.*, 2007; Werngren-Elgström *et al.*, 2009; Trecartin and Cummings, 2018). Subjective factors such as attachment to home, social support and perceived control over the home environment have been found to be mediating factors for wellbeing outcomes such as depression and positive affect (Evans *et al.*, 2003; Oswald *et al.*, 2007; Brown *et al.*, 2009).

Considering wider environmental factors, beyond the physical, the ENABLE-AGE study (Oswald *et al.*, 2007) made a significant contribution to understanding home for older adults. It was a large cross-sectional project in Europe with people aged 75–89, designed to explore the home environment's relationship to healthy ageing and evaluate both objective (housing accessibility) and subjective (meaning of home, housing satisfaction, usability and housing related control-beliefs) aspects of housing (Oswald *et al.*, 2007). The ENABLE-AGE study was theoretically based on the concept of P-E fit from environmental gerontology with a focus on the physical environment and therefore did not incorporate aspects of the societal environment into the model of what contributes to healthy ageing. Sociological research, however, highlights the important role of understanding the experience of home including the influence of housing affordability, tenure, social class and disability in influencing the experience of home and health of individuals (Waters, 2001; Imrie, 2004; Hulse and Saugeres, 2008; Mallett *et al.*, 2011; Keene and Ruel, 2013; Filandri and Olagnero, 2014; Morris, 2018; Aitken *et al.*, 2019; Aplin *et al.*, 2019; Baker *et al.*, 2020; Viljoen *et al.*, 2020). While these societal influences have been well researched with adults, there has been limited research on older adults specifically.

In the Australian context, the influence of tenure has been highlighted in a small number of studies as an important societal factor for older adults (Mallett *et al.*, 2011; Morris, 2018; Petersen and Aplin, in press). In particular, older private renters, 65 years and older, have been identified as a vulnerable group (Morris, 2018; Petersen and Aplin, 2021). Indeed, the study of Morris (2018), with adults 65 years and older in Australia, described the inequality experienced by older adult private renters, where insecurity in tenure and the costs of accommodation impacted psychological health. However, there is a need to examine the home environment more holistically, considering both physical and societal environmental factors in older adult's experience of home to provide a more comprehensive picture of the relationships between home and health.

In seeking to extend the knowledge base, the current paper examines a large national dataset of housing conditions for older Australians to understand how personal characteristics and the physical and societal characteristics of the home environment influence the perceived health of older adults. Further, given the significant size of the dataset, the paper analyses differences between the young-old and old-old age groups. This addresses an important research gap for understanding home and its influence on health for older people, where much of the research to date internationally has focused on older adults as a single age group, those 65 years and older, or a specific age group, the very old in the ENABLE-AGE study, whereas

other authors (Field and Gueldner, 2001; Mehta *et al.*, 2008) have demonstrated differences between age groups. This research, while situated in the Australian context, contributes broadly to understanding P-E fit for older adults in countries with developed economies, where ageing populations place emphasis on the need to support ageing in place.

## Methodology

A cross-sectional study was performed using data from the Australian Housing Conditions Dataset and Technical Report (Baker *et al.*, 2018, 2019). The dataset is based on a large-scale survey, funded by the Australian Research Council to gather robust information on the housing conditions of Australians. The dataset was necessitated as Australian evidence on housing conditions was outdated, with the last survey conducted 21 years ago (ABS, 1999). The data were collected by conducting a total of 4,501 surveys across three Australian states, South Australia, Victoria and New South Wales, using a random stratified sampling method. Dual-frame sampling was developed including both mobile phones (randomly generated) and landlines, sourced from the 2015 Electronic White Pages. The survey was structured across seven topics: (a) dwelling tenure and costs; (b) construction and maintenance; (c) energy, indoor environment and safety; (d) quality and satisfaction; (e) housing costs and financial strain; (f) health status; and (g) demographics (Baker *et al.*, 2018). The draft survey tool was based on items taken from previous and current surveys including the ABS Social Standards, ABS Census 2016, ABS Survey of Income and Housing, ABS Australian Housing Survey, HILDA (Household, Income and Labour Dynamics in Australia) survey, English Housing Survey, Scottish Housing Survey and the BRANZ Housing Condition survey. The items were kept in their original format as much as possible, except for where modification was needed to increase the understanding or relevance of the question.

The data used in this study were weighted using iterative proportional fitting (raking) according to the probability of selection within the household and by age group, gender and area (metropolitan/country) for each selected state. To reflect the structure of the state and in accordance with Dal Grande *et al.* (2015), benchmarks were derived using the ABS Estimated Residential Population (ABS, 2015).

The analysis is in two stages. First, descriptive and inferential statistics are used in the analysis of the distribution of responses across a series of variables derived from specific questions in the survey and structured on a thematic basis. More specifically, variables were structured into categories reflecting personal, societal and physical characteristics. Variables assigned to personal characteristics included questions referring to sex; coronary heart disease or angina; hypertension; mental health issues; and depression. Societal characteristics included variables reflecting tenure and renting; and financial strain and income source; whilst physical characteristics included variables in three broad categories: building problems; repairs and maintenance; and dwelling modifications. The descriptive statistics are supported by inferential tests (chi-square, *t*-test) to assess for significant differences in response by age group: those aged 65–74 (young-old) and those aged 75 and above (old-old). Second, those variables shown to be significantly significant are

then considered as candidate independent variables in the modelling of the health of respondents using a binomial logistic regression. The health of respondents used in the regression was self-assessed, where participants were asked to rate their health on a scale of excellent, very good, fair or poor (Baker *et al.*, 2018). Prior to model development, the candidate variables were assessed using appropriate non-parametric tests of association (phi and Cramer's *V*). The main limitation of the modelling lies in the quality of the data which for most variables is nominal/categorical thereby restricting the scope of the analysis.

## Analysis and results

The results are presented in two parts. First descriptive and inferential analysis of the core dataset and second modelling drawing upon those variables identified as being significant.

### Descriptive and inferential statistics

The first phase of the analysis focuses on responses to questions in the Housing Condition Survey that map to the physical and societal characteristics of the environment discussed earlier in the paper and also those questions that relate to the individual and their personal characteristics. The analysis specifically examines differences that arise between the young-old group (aged 65–74) and the old-old group (75 and above) and tests for statistical significance.

### Personal characteristics

Overall, 1,999 respondents in the survey were aged 65 and over, of whom 54 per cent (N = 1,086) are in the young-old group and 46 per cent in the old-old generation (N = 913). There is a highly significant difference in the distribution of age by gender ($\chi^2$ = 13.81, *p* = 0.001), with females having a higher representation in the sample. Most respondents (82%, N = 1,632) consider their health to be excellent/very good/good, though there is a highly significant difference ($\chi^2$ = 20.11, *p* = 0.001) in perceived state of health based on age, with the old-old more likely to report their health as fair/poor. Importantly, there were significant differences by age in relation to two physical health conditions (Table 1): coronary heart disease or angina ($\chi^2$ = 45.95, *p* = 0.001) and hypertension ($\chi^2$ = 23.83, *p* = 0.001). Older adults were also more likely to have health conditions that restricted daily activities ($\chi^2$ = 10.02, *p* = 0.01). Mental health issues are slightly more prevalent in the young-old age group compared to the old-old group ($\chi^2$ = 3.85, *p* = 0.05), with depression the specific condition showing a significant difference between age groups ($\chi^2$ = 4.54, *p* = 0.03), for which the incidence was greater in the young-old group.

### Societal environment characteristics

Reflecting the age of respondents, owner-occupation is the dominant tenure, with 90 per cent of the sample outright owners or with a mortgage. However, a significant difference in tenure by age group is apparent (Table 2), with 57 per cent (N = 94) of those who rent their home being in the old-old cohort, compared to 43 per cent (N = 70) in the young-old group ($\chi^2$ = 54.35, *p* = 0.001). While reliance

**Table 1.** Personal/health analysis and variables with significant differences between age groups

| Variable | N (%) | $\chi^2$ | p |
|---|---|---|---|
| General health – fair/poor | 363 (18) | 20.11 | 0.001 |
| Coronary heart disease or angina | 334 (17) | 45.95 | 0.001 |
| Hypertension | 859 (43) | 23.83 | 0.001 |
| Long-term health condition | 555 (28) | 10.02 | 0.01 |
| Mental health issues | 246 (12) | 3.85 | 0.05 |
| Depression | 109 (6) | 4.54 | 0.03 |

**Table 2.** Societal analysis and variables with significant differences between age groups

| Variable | N (%) | $\chi^2$ | p |
|---|---|---|---|
| Tenure – renting | 164 (8) | 54.3 | 0.001 |
| Income ≤Aus $20,000 | 310 (16) | 110.69 | 0.001 |
| Financial strain | 115 (6) | 9.20 | 0.03 |

on state/territory housing is more important for the old-old cohort, the difference in rental tenure type was not statistically significant. Regarding housing costs for those renting or paying a mortgage, only 11 participants reported unaffordability. Household income, where stated, varies substantially with some evidence of very low income: 2 per cent (N = 43) indicating a gross annual income of below Aus $12,000. The modal income range was Aus $20,001–40,000 (23%, N = 463) and, reflecting the highly skewed distribution, 61 per cent of respondents have income ranging in bands from Aus $40,000 to over 200,000. A highly significant difference in income occurs between the age groups ($\chi^2 = 110.69$, $p = 0.001$), with the old-old group dominating the lower income bands. Sources of income reveal that this older age cohort is highly reliant on government pension/allowance compared to the young-old group. Indeed, for the latter, superannuation (31%) and income from salary (18%) are collectively more important than that from government sources, differences that are highly significant ($\chi^2 = 197.69$, $p = 0.001$). The incidence of respondents indicating that the members of their household had experienced financial strain over the 12 months prior to the survey is relatively low (6%, N = 115), however, there was a significant difference between age groups ($\chi^2 = 9.20$, $p = 0.03$), with more belonging to the young-old (67%).

## Perception of physical environment characteristics
Overall, a high degree of satisfaction with the quality of dwellings is apparent, with 86 per cent (N = 1,712) self-assessing as excellent/good. Given these high satisfaction levels, those voicing dissatisfaction with particular aspects of their homes is low. Most respondents, across all tenures, indicate their ability to keep warm in winter, with less than 5 per cent experiencing any difficulty. Likewise, the ability to keep cool in the summer is not considered an issue by 96 per cent of

**Table 3.** Physical characteristics analysis and variables with significant differences between age groups

| Variable | N (%) | $\chi^2$ | p |
|---|---|---|---|
| No major building problems | 1,776 (89) | 2.34 | 0.126 |
| No repairs/maintenance in last 12 months | 994 (50) | 9.57 | 0.002 |
| No dwelling modifications | 270 (15) | 6.28 | 0.01 |

respondents; for those who had an issue keeping cool in the summer, a much higher portion belong to those in the young-old age group ($\chi^2 = 8.16$, $p = 0.04$).

A low percentage identify any major building problem with their dwelling, with no significant difference between the young-old and old-old (Table 3). Only one defect, rising damp, arose as being significant between age groups ($\chi^2 = 4.04$, $p = 0.05$). Half of the respondents (N = 1,004) indicate that no repairs or maintenance had been competed in the 12 months prior to the survey, with the old-old less likely to complete repairs ($\chi^2 = 9.57$, $p = 0.002$). Thus, repairs were more often undertaken by the young-old, including painting ($\chi^2 = 10.25$, $p = 0.001$) and roof repairs/maintenance (significant at the 0.05 level, $\chi^2 = 3.76$). Dwelling modifications undertaken by owner-occupiers span a wide range of alterations, with the young-old group again more likely to undertake improvements to their property ($\chi^2 = 6.28$, $p = 0.01$). In contrast, modifications due to disability were more likely to be completed by the old-old group ($\chi^2 = 13.80$, $p = 0.001$).

## Modelling of relationships

The analysis in the previous section shows that respondents are confident about their general health although for the old-old category heart disease or angina and hypertension emerged as more prevalent conditions amongst the old-old. Furthermore, over a quarter of respondents indicate the incidence of other long-term health conditions that restrict daily activities. It is apparent that mental health issues are less prevalent than physical health problems and are more apparent in the young-old cohort primarily due to depression. In exploring further factors relating to the physical and societal environment of home, respondents' perceived state of health is used as the dependent variable in binomial logistic regression which forms the second stage of the analysis.

The independent variables initially selected for model development are those identified from the inferential testing as being significant though strong associations (as assessed by phi coefficient and Cramer's $V$) between variables reduced the number entering the final models. The independent variables for personal, physical and societal characteristics utilised in the analysis are shown in Tables 4 and 5. Data cleaning and recoding of some variables, mainly due to potential violations occurring from small numbers in categorical variables and to allow for non-responses, reduced the overall useable sample size to 1,949 observations. As the paper is concerned with potential differences between the young-old and old-old, two models, one for each cohort, are presented to examine how effects differ between the two age groups in terms of predictivity capabilities and whether

**Table 4.** Binary logistic regression: young-old model

| Variables | B | SE | Wald | p | Exp(B) |
|---|---|---|---|---|---|
| Personal characteristics: | | | | | |
| Sex | 0.050 | 0.198 | 0.063 | 0.803 | 1.051 |
| Coronary heart disease or angina | 1.219 | 0.243 | 25.056 | 0.000 | 3.383 |
| Hypertension | 0.772 | 0.188 | 16.904 | 0.000 | 2.163 |
| Mental health issues | 0.557 | 0.320 | 3.035 | 0.082 | 1.745 |
| Depression | 0.699 | 0.402 | 3.031 | 0.082 | 2.013 |
| Societal characteristics: | | | | | |
| Tenure – renting | 0.021 | 0.411 | 0.003 | 0.958 | 1.022 |
| Financial strain | 0.845 | 0.290 | 8.464 | 0.004 | 2.328 |
| State pension as main income source | 0.764 | 0.196 | 15.225 | 0.000 | 2.147 |
| Physical characteristics: | | | | | |
| Number of bedrooms | −0.015 | 0.250 | 0.004 | 0.952 | 0.985 |
| Repairs/maintenance carried out in last 12 months | 0.059 | 0.187 | 0.099 | 0.753 | 1.061 |
| Major building problems – rising damp | 0.603 | 0.540 | 1.246 | 0.264 | 1.827 |
| Dwelling modifications | −0.140 | 0.280 | 0.249 | 0.618 | 0.870 |
| Modified due to disability | 0.354 | 0.272 | 1.695 | 0.193 | 1.424 |
| Added rooms/extension | −0.288 | 0.244 | 1.395 | 0.238 | 0.750 |
| Constant | −2.869 | 0.378 | 57.740 | 0.000 | 0.057 |

*Note*: SE: standard error.

independent variables have different relative effects. The analysis highlights differences in several aspects. First, that the young-old cohort has a higher predictive capacity in relation to health classification, 85.9 per cent compared to 78.9 per cent accuracy for the old-old category, suggesting that the reliability of statistics is lower as respondents increase in age. Other diagnostics are consistent with expectations from binary logistic models, notably the pseudo $R^2$ (Nagelkerke) for both models are low, 0.19 and 0.17, respectively, but typical of results for logistic regression.

In considering the personal characteristics and physical and societal characteristics of home in their contribution to self-perceived health, a number of variables were shown to be significant for the two age groups. Gender was found to be significant for the old-old model ($p = 0.007$), emphasising the poorer health status of males in the old-old group. For both age cohorts, coronary heart disease is a significant factor impacting on general health, however, the higher Exp(B) for the young-old group (3.383) compared the old-old (2.870) is indicative of slightly higher risk for the former. Indeed, as observed in the inferential analysis, the

**Table 5.** Binary logistic regression: old-old model

| Variables | *B* | SE | Wald | *p* | Exp(*B*) |
|---|---|---|---|---|---|
| Personal characteristics: | | | | | |
| Sex | −0.491 | 0.181 | 7.350 | 0.007 | 0.612 |
| Coronary heart disease or angina | 1.054 | 0.186 | 32.148 | 0.000 | 2.870 |
| Hypertension | 0.120 | 0.176 | 0.470 | 0.493 | 1.128 |
| Mental health issues | 0.537 | 0.329 | 2.665 | 0.103 | 1.710 |
| Depression | 1.508 | 0.477 | 10.011 | 0.002 | 4.517 |
| Societal characteristics: | | | | | |
| Tenure – renting | 0.232 | 0.326 | 0.507 | 0.477 | 1.261 |
| Financial strain | 0.557 | 0.402 | 1.926 | 0.165 | 1.746 |
| State pension as main income source | 0.285 | 0.197 | 2.080 | 0.149 | 1.329 |
| Physical characteristics: | | | | | |
| Number of bedrooms | −0.032 | 0.206 | 0.024 | 0.876 | 0.968 |
| Repairs/maintenance carried out in last 12 months | −0.150 | 0.179 | 0.703 | 0.402 | 0.861 |
| Major building problems – rising damp | −0.100 | 0.847 | 0.014 | 0.907 | 0.905 |
| Dwelling modifications | −0.395 | 0.256 | 2.379 | 0.123 | 0.673 |
| Modified due to disability | 0.564 | 0.216 | 6.809 | 0.009 | 1.758 |
| Added rooms/extension | −0.289 | 0.253 | 1.312 | 0.252 | 0.749 |
| Constant | −1.469 | 0.303 | 23.547 | 0.000 | 0.230 |

*Note*: SE: standard error.

occurrence of hypertension is a greater issue for those in the young-old cohort, being highly significant, with a high odds ratio (2.163), whereas this variable becomes insignificant in the old-old group. Mental health factors also display varying outcomes. For the young-old cohort (although not significant at the 95% level, $p = 0.08$) both general mental health and depression have high odds ratios above 1 (1.745 and 2.013, respectively), whereas for the old-old cohort general mental issues are of lower significance but the incidence of depression is highly significant ($p = 0.002$), with an odds ratio of 4.517 highlighting that depression contributes more to perceived health with increasing age.

Considering the societal characteristics, housing tenure does not arise as a health-related issue, with renting in both models not statistically significant (slightly higher Exp(*B*) for the old-old group), however, renters in this analysis were a combination of social and private given the small sample in each individual renter group. In contrast, financial strain impacts significantly on general health for the young-old cohort ($p = 0.004$) with a high odds ratio (2.328), whereas for the old-old group, financial strain seemingly has an insignificant impact on health.

The same effect is apparent for those households which are reliant on a state pension as the main source of income. As observed, in the inferential analysis, this is more apparent in the young-old group and is highly significant. The odds ratio suggests a health impact of the order of 2.147 for those reliant on state pension compared to those with superannuation benefits or still working. Collectively, these variables suggest that the young-old group appear to be impacted to a much greater extent by money-related concerns.

The analysis demonstrates little impact of the physical characteristics of dwellings on health-related matters, with variables relating to building repairs/dwelling modifications having no significant effect upon perception of respondents' health. However, for the old-old cohort, dwelling modification arising from disability is significant ($p = 0.009$), with an odds ratio of 1.758 indicative of the greater incidence of poorer health in the respondents aged 75 and over, and the corresponding need for dwellings to be adapted to meet circumstances.

## Discussion

This study aimed to examine whether there were any differences in personal characteristics and physical and societal characteristics of the home environment between young-old and old-old age groups from a large Australian dataset. It also sought to understand how these characteristics influenced the two age groups' self-perceived health. In doing so, the study explored P-E fit for older adults where self-perceived health was measured as the outcome of P-E fit, and the environment was conceptualised broadly to incorporate measures of physical and societal characteristics of home. A key finding of the study is that physical home environment characteristics, examined in the binomial logistic regression, appear to make a limited contribution to the perceived health of older Australians. Apart from heart disease, what contributed most to the perceived health of older adults differs between the young-old and old-old cohorts. For the young-old, financial strain, being on the fixed-income pension and hypertension are key factors, while for the old-old gender, (being male), having depression and the home being modified for disability are core influencers. Examining differences in characteristics between the age groups, it was found that the old-old were more likely to have health conditions which restricted their activities of daily living and report their health as fair or poor compared to the young-old group. However, the young old were more likely to report mental health issues and depression, although this was found not to influence their perceived health.

The analysis shows that rather than the physical home environment, it is societal characteristics and the physical and mental health of older adults that are important. However, it should be noted that the logistic regression included limited physical environment characteristics beyond the respondents' homes. Further, previous research which has demonstrated the strong impact of the physical home environment most often includes measures of accessibility or environmental barriers to activity participation, which were not included in this study. Indeed, the closest measure of accessibility in our current study was modifications being completed for disability, which was shown to influence self-perceived health for the old-old cohort. The analysis overall found that older adults lived in well-maintained

homes, with a low percentage reporting any major building problems, a low need for repairs and a third reporting completing renovations to their kitchen and bathrooms. Modifications due to disability also appear to be frequently completed in the sample, with 19 per cent of home-owners/buyers completing modifications to their home. This implies that where the physical environment was posing additional 'press', these respondents had completed modifications to ensure their homes were suitable to their functional needs. It should be noted, however, that the sample was skewed towards higher-income earners, whom would be likely to have higher-quality dwellings and be able to afford repairs or modifications.

In contrast to the physical characteristics of the home environment, the societal environment characteristics of financial strain and fixed-income pension made significant contributions to the perceived health of the young-old. This is also likely related to their increased rates of depression, paralleling the situation in the United States of America, where a large study (Wilkinson, 2016) identified financial strain as a strong predictor of depression and anxiety in older adults. The young-old as a cohort were significantly more likely to be living off superannuation or a salary income compared to the old-old, of whom a large proportion (71%) were living off the fixed-income pension. Financial strain is a subjective measure, a measure of relative deprivation and income inequality, where social comparisons play a large role in perceptions, where if an individual is financially as well off as their peers, even on low income they may be financially satisfied (Stoller and Stoller, 2003; Wilkinson, 2016). For those in the young-old age group and living on a fixed-income pension, it appears that, compared to their peers, their financial situation was difficult, whereas for the old-old cohort their financial situation of the fixed-income pension is common and thus they report less financial strain compared to their younger peers. While this may reflect simply a difference in perception, the power of perception on health is strong, with financial strain and income inequality strongly associated with health outcomes (Kahn and Pearlin, 2006; Wilkinson, 2016).

The income inequality experienced by older Australians on the pension is of particular concern for vulnerable groups, such as those who are renting privately and single women who live in poverty (Smith and Hetherington, 2016; Morris, 2018; Petersen and Aplin, (2021). There have been sustained advocacy movements to increase the aged care pension and in-state policies that reduce income inequality in Australia (Smith and Hetherington, 2016; Housing for the Aged Action Group, nd). For example, National Seniors Australia calls for an independent aged pension tribunal to set a fair age pension rate in line with standards of living and the needs of older Australians and an increase to Commonwealth Rental Assistance (Smith and Hetherington, 2016). The findings of this study add weight to these proposed reforms, indicating that financial strain is contributing to poorer health outcomes for young-old Australians. Further research, particularly longitudinal studies investigating the relationships between societal factors such as financial strain, living on the fixed-income pension, privately renting, and the mental and physical health outcomes would be beneficial in informing policy development in Australia.

The societal environment impacted strongly for the young-old, however, further differences between the two age cohorts are perhaps more reflective of the differing lifestages of the respondents. Gender appears to be important in influencing the

perceived health of the old-old group, with men more likely to report lower self-reported health. This finding overall requires further investigation as it contrasts with previous international research demonstrating women have lower ratings of self-reported health (Arber and Ginn, 1993; Boerma *et al.*, 2016). Further, while men have greater disease burden than women in Australia, this is due to premature death rather than illness (Australian Institute of Health and Welfare, 2019*a*).

Overall, the old-old age group perceived their health to be poorer than the younger age group. Their assessment of health is supported by the more objective ratings of health conditions, with the old-old group reporting greater incidence of heart disease and hypertension, of which the incidence for both increases with age (Australian Institute of Health and Welfare, 2019*b*, 2020). Deteriorating health with age was also reflected in the significant difference between age groups in having health conditions that restrict activities of daily living. However, these physical changes with age, that are somewhat expected in later life, did not translate to decreased mental health, with the group overall reporting limited mental health concerns. In contrast, the higher incidence of depression by the young-old is consistent with national trends (ABS, 2019). The association between depression and increased experience of financial strain for the young-old emerges strongly from the analysis in this paper, though other contributory factors are likely at play. Notably experiences arising from disability influence depression, with research indicating that the incidence of disability is correlated with depression for the young-old (Mehta *et al.*, 2008), yet this changes in advanced age, where disability is not correlated with depression (Mehta *et al.*, 2008).

These trends may indicate that the increased rates of depression in the young-old may be in part related to their non-acceptance of deteriorating health compared to the old-old group. This may also help to explain why those aged 75 years and above had much higher rates of hypertension but did not contribute to their perceived health, as the old-old are likely more accepting of this health condition. While the young-old reported more depression, only for the old-old was depression found to be an important factor in contributing to perceived health. This is likely a result of the functional impact of disability, psychosocial factors such as loneliness and cognitive impairment for the old-old cohort (Pinquart and Sorensen, 2001; van't Veer-Tazelaar *et al.*, 2008; Yang *et al.*, 2018), factors that were beyond the scope of the research underpinning this paper.

On final reflection, while this study provides a rigorous examination of the personal, and physical and societal home environment influences on the perceived health of older adults, a number of limitations should be noted. From an analytical perspective, the young-old cohort had a higher predictive capacity in relation to health classification compared to the old-old category, which suggests that the reliability of statistics may be lower as respondents increase in age. In this context, there was a limited number of physical characteristics that were included in the regression due to their non-significance in the first part of the analysis and the choice of outcomes to examine P-E fit was limited. Future research should explore wider characteristics of the physical environment such as housing accessibility and support from family and community aged care services. Further, it is recommended that research exploring the relationships between home and health should use wider outcomes such as life satisfaction as measured by Iwarsson *et al.* (2007) and

measures of participation in daily life. Likewise, longitudinal studies exploring P-E fit for older adults is required, notably with a growing cohort of older people privately renting or having a mortgage in older age (Ong *et al.*, 2019), in particular such studies should examine those societal environment factors of financial strain and the impact of fixed-income pension, which contributed to the perceived health of the young-old in this research. Concerning tenure, the small percentage of those renting in this survey meant that both social rented housing and private rentals were combined; this limitation meant that undoubted differences between these two groups with regards to housing security and financial strain were not analysed.

## Conclusion

This paper has provided an important contribution to the literature examining the relationships between housing and health for older adults. Differences in personal and home environment characteristics were examined along with the influence of these characteristics on the self-perceived health of young-old and old-old adults. The analysis shows that what influences perceived health in later life differs between the age groups. For the young old, financial strain, being on the fixed-income pension and hypertension were important, while for the old-old gender, (being male), having depression and the home being modified for disability were the key contributors. A shared contributor for both age groups was the incidence of heart disease. Overall, the differing factors influencing health for the two age groups in this study point to the complex nature of the P-E interaction and demonstrate the need for comprehensive frameworks which incorporate broad aspects of personal and environment characteristics when exploring P-E fit for older adults. The variation in findings between the young-old and old-old also highlights the heterogeneous nature of people aged 65 years and above and the need to examine differences in older adult age groups in future research exploring the environmental influences on health. The findings overall point to the importance of incorporating wider aspects of the environment into research exploring the P-E fit of older adults, in particular societal aspects such as financial stain, tenure, access to community aged care services and fixed-income pension, along with social aspects such as support from family and social connections. Indeed, it is apparent from this research that societal characteristics will be increasingly important influences on the health of older adults given rising inequality across many developed economies globally. In the Australian context, the findings add weight to ongoing calls to address income inequality for older Australians.

The limited contribution of the physical home environment on the perceived health of both age groups seemingly reflects the high quality of most Australian homes. However, it is apparent from this research that accessibility of the home environment will be important to include in future research given that 'modifications for disability' impacted the old-old adults' perceived health. Future longitudinal studies are recommended to explore a range of person, and physical, social and societal environment characteristics which contribute to the health, wellbeing and participation of older adults. Such longitudinal data will provide relevant data for policy makers on the influence of the physical and societal home environment characteristics on the health of older adults.

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