



Early onset of care needs in the older population: The protective role of housing conditions

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ABSTRACT

Most older people wish to live in their own homes as they age and to have a choice over their housing and care situation. Housing has the potential to play a key role in promoting independence, delaying and/or preventing the onset of care needs and in influencing the level and type of care provision required. However, many older people live in homes that are not suitable for their comfort and needs. Our study focuses on older people living in non-specialist housing in England and aims to i) explore how housing characteristics cluster; and ii) investigate their association with an early onset of care needs. We used four waves of a large representative longitudinal sample of people aged 50 or over, covering the period 2012 to 2020. We performed Latent Class Analysis and a Cox regression survival model to provide answers to our research questions. We found that people living in poor housing conditions or living in social rented housing are more likely to experience early onset of care needs, which may lead to a higher demand for, and utilisation of, long-term care services. We believe that gaining a better understanding of the relationship between housing-related conditions and care needs is paramount from the preventative and service provision point of view, and is of relevance to policymakers, practitioners, and current and future adult long-term care users.

1. Introduction

In the context of an ageing population, many countries have promoted strategies that encourage older people to remain in their own homes. This is based on the understanding that they wish to maintain their independence, preserve their self-esteem and self-identity, as well as, to stay closer to friends, family, and familiar places (Lewis and Buffel, 2020; Pynoos, Caraviello, and Cicero, 2020; Abramsson and Andersson 2016; Schorr and Khalaila 2018). Older people may also prefer to remain at home as they age, to avoid the stress of relocation (Oswald and Rowles, 2006), and/or for financial reasons, to prevent expensive institutionalisation costs, the latter also being an important concern among policy makers (Means, 2007; WHO, 2007). ‘Ageing in place’ has become, therefore, an underlying principle in current ageing policy design and implementation in many countries (Wiles et al., 2012; Sixsmith, and Sixsmith, 2008; Fernandez-Carro, 2013; Yu and Rosenberg, 2017; Thumala et al., 2017), and has arguably become a central part of policy and advocacy discussions in England, the country on which this study is focused (Government Office for Science, 2016; Select Committee on Public Service and Demographic Change, 2013). However,

Ageing in place faces many challenges, including a higher demand for the provision of support services in the community (Vasunilashorn, 2012; Costa-Font et al., 2009), and a potential lack of availability of quality and safe housing (Webber et al., 2022; Bosch-Farré et al., 2020).

Access to satisfactory housing conditions has been highlighted as an important priority in international spheres (Kephelopoulos et al., 2017). For instance, the World Health Organization (WHO, 2018) have developed guidelines and recommendations to promote a healthy housing environment aiming to inform public policies and regulations at the national, regional, and local level. Recently in England, new legal frameworks have been proposed with regards to quality and safety standards across the private (private landlord) and social/public (publicly subsidised) housing renting sectors (Cromarty and Barton, 2021; Lewis et al., 2021; Cromarty, 2022; Centre for Ageing Better, 2022; APPG, 2019). This is in response to concerns about the lack of regulations and accountability in the housing market. One in ten people aged 55+ in England live in homes with at least one serious hazard, and a majority of homes for this age group do not have key accessibility features such as level access, toilet at entrance level, and sufficiently wide doors and circulation space (Public Health England, 2014). Almost a

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quarter (23%) of privately rented accommodation, 10% of housing in the social rented sector and 13% of owner-occupied fail to meet national Decent Home Standards (Department for Community and Local Government, 2022). The latter refers to the minimum established conditions of housing needed in England, including being in a reasonable state of repair, having reasonably modern facilities and services, providing a reasonable degree of thermal comfort, and without any serious hazards of injury or safety (Department for Community and Local Government, 2006).

The World Health Organisation, back in 2004, acknowledged that deficient housing conditions are associated to poor health, quality of life, and well-being (Ministerial Conference on Environment and Health & WHO, 2004), as well as being an important mechanism through which social inequality translates into health inequalities (WHO, 2018). Thomson's et al. (2009) systematic review shows that housing conditions, such as damp and condensation, can expose people to several health risks, including respiratory related illnesses and deterioration of general self-reported health. Poor housing conditions have also been associated to the development of longstanding illnesses, increased health service use (Evans et al., 2000), the risk of fall and injury (Lee and Ailshire, 2020), and to the deterioration of mental health (Clair and Baker, 2022). Many of these health effects are stronger in older populations (as they experience a decline of physical and cognitive functions), and those with existing and/or complex health conditions who, also spend relative longer periods of time indoors (Howden-Chapman et al., 2011; House of Commons, 2018; Rand Europe, 2022). Consequently, good quality non-specialist (e.g., non-purpose-built) housing, not only has the potential to prevent the development of physical illness, but also to play a key part in promoting independence, delay long-term care needs and care utilisation, and to influence the mix and level of long-term care provision required (Fendt-Newlin, 2016). Our interest, therefore, is to investigate beyond the risks that poor housing conditions present to older people's health and focus on researching whether housing could play a role preventing long-term care needs, where empirical evidence is very scarce. Most of the limited evidence currently available on housing and long-term care does not consider the possibility that housing, and care needs mutually influence each other, and mostly focus on housing adaptations. For instance, a European study of housing quality and risk of accidents for older people suggests that many limitations in daily activities are, to a varying degree, caused, enhanced, or facilitated by disadvantageous housing and environmental conditions (Braubach and Power, 2011). Powell et al. (2017) looked at how aids and adaptations could be important in influencing care need, and Chandola and Rouxel (2022) focused on exploring the potential protective effect of adaptations on disability outcomes among older adults. There is also some evidence on how aids and adaptations can make housing more dementia friendly (Evans et al., 2019). Our study makes use of a large representative longitudinal sample of older people living in England to i) identify typologies of housing conditions as they may not happen in isolation and ii) investigate which housing conditions and/or typologies of housing are associated with an early onset of care needs. Gaining a better understanding of the relationship between housing and long-term care is relevant to policymakers and practitioners from both fields, and to adult long-term care users and potential users.

2. Data

Our study focuses on older people living in mainstream housing in England, which is currently 96% of people aged over 65 in the country (APPG, 2019). For this, we make use of a large and representative longitudinal sample, the English Longitudinal Survey of Ageing, ELSA (Banks et al., 2021; NatCen Social Research, 2021), which includes adults aged 50 or older living in England, and their partners (a total of 8000 individuals). We include the four most recent waves of the survey, Waves 6 (2012/2013) to 9 (2018/2019). ELSA includes information on care needs, formal and informal care services received, and

housing-related information, as well as socio-demographic characteristics of individuals and area deprivation levels.

2.1. Long-term care needs (activities of daily living and instrumental activities of daily living)

Measurement of long-term care needs were based on the following question: "Please tell me if you have any difficulty with these activities because of a physical, mental, emotional or memory problem (exclude any difficulties you expect to last less than three months)". Activities are divided into two groups: 'activities of daily living' (ADLs) and 'instrumental activities of daily living' (IADLs). The first group includes dressing, walking across a room, bathing or showering, eating, getting in or out of bed, and using the toilet. IADLs include using a map to figure out how to get around a strange place, recognising when in physical danger, preparing a hot meal, shopping for groceries, making telephone calls, communication (speech, hearing, or eyesight), taking medications, doing work around the house or garden, and managing money, such as paying bills and keeping track of expenses. The main outcome of analysis for this investigation is the age of onset of care needs (the age at which care needs are first reported by respondents in the survey).

2.2. Housing conditions

These were divided into two main groups: i) housing characteristics including tenure (private/social housing, owner occupied), number of rooms, and household size; and ii) housing problems (e.g., condensation issues, cold, lack of light, pest infestation, roof issues, damp, electrical and plumbing issues, noise, and pollution).

Tenure is not only a proxy for the underlying socio-economic characteristics (Beatty and Wilson, 2010), but it has also been well reported that the private and social housing sectors suffer from worse housing conditions than those owner-occupied homes or those in social renting (Cromarty and Barton, 2021). It is important to mention that private renting corresponds to the lease of a property by a private landlord (an individual or a company) and as such, involves a private agreement between the two parties and a recurrent payment from the tenant. Social/public renting is a government subsidised form of renting, which makes housing more affordable for poorer or vulnerable groups (for example, those in low income, living with a disability or long-term condition). Here, the landlord is a housing association (not-for-profit organisations that own, let, and manage rented housing) for the local council. On the other hand, owner occupied properties are homes owned outright by its occupiers or include those with a mortgage. The latter involves, of course, recurrent payments to a financial institution for a determined number of years.

Household size and number of rooms could indicate an overcrowding situation which may increase exposure to risk factors associated with home injury (WHO, 2018; Delgado et al., 2002; Evans and Saegert, 2000), as well as being a marker of poverty and social deprivation. Condensation and other related housing conditions such as roof issues and damp walls signal the lack of ability to repair and are associated with a wide range of health conditions, including respiratory infections, asthma, lead poisoning, injuries, and mental health (Krieger and Higgins, 2002). Similarly, evidence shows that a cold house may be associated with multiple health risks, including an increase in mortality (Public Health England, 2014). Pest infestation (e.g., rats and insects) has been included as a proxy for sanitation, with respiratory health effects that have been well documented (see, for example, Sheehan et al., 2010). Lack of light affects mood and mental health but also the potential for falls and injuries (Palacios, 2021; Grant et al., 2022; Ranson, 1991). Age of the property, which is associated to housing conditions and particularly to energy efficiency in homes (ONS, 2022) was also available in ELSA, however, it had a large number of missing values, so it was excluded from analysis. We see this as a relatively important limitation of our study.

2.3. Socio-demographic and socioeconomic characteristics

Our analysis also includes information on gender (0/1 for male/female), ethnicity (0/1 for non-White British/White British), highest level of education (0/1 for non-university degree/university degree), marital status (0/1 for single/in partnership), employment (0/1 for not employed/employed), as well as information on self-perceived (subjective) social status (0–10), and individual expectations about their financial resources not being enough in the future to meet needs (0–100). Geographical location (regions), rurality (0/1 urban/rural) and deprivation levels (quintiles of the Index of Multiple Deprivation) were also available.

3. Methodology

The research questions were answered by performing two different methodological approaches. Firstly, housing typologies were identified by using Latent Class Analysis (LCA). The main idea behind the construction of latent housing typologies is based on the understanding that poor housing conditions do not appear in isolation. For instance, roof-related problems may well produce dampness, and/or a cold environment. Therefore, rather than using each housing characteristic or condition independently, latent classes are developed. More specifically, the LCA method enables the identification of different clusters within populations who have common characteristics (Weller et al., 2020). In more technical terms, LCA is used to detect the latent (or unobserved) heterogeneity in samples (Hagenaars and McCutcheon, 2002). This analysis was based on housing problems and housing characteristics, and they include continuous, categorical, and dichotomic variables. The optimal number of classes was identified by using the Akaike Information Criteria (AIC, Akaike, 1974) and the Bayesian information criterion (BIC, Schwarz, 1978) in both cases with lower BIC indicating better model fit (Nylund et al., 2007; Dias, 2006). Marginal probabilities for each class were also estimated, posterior probabilities were estimated for each individual (highest predicted probability was selected as being the predicted class), and the average latent class posterior probability was estimated to measure whether the model accurately predicts class membership for individuals with diagonal values closer to 1.0 being more desirable (Muthén and Muthén, 2000). The entropy statistic was also estimated to measure intra-cluster homogeneity (i.e., class classification) with values closer to 1 being ideal (Celeux and Soromenho, 1996). Twenty sets of starting values assigning initial class probabilities were randomly chosen and each model was run with 10 iterations. Dummy variables were generated, one for each class identified.

In order to identify the housing conditions (including the latent classes previously identified) associated with an earlier/later onset of care needs, we performed survival analysis, in particular, we used Kaplan-Meier (K-M) curves (Kaplan and Meier, 1958) and Cox Proportional Hazards Regression models (Cox, 1972). K-M curves take into consideration that we are not able to observe the point at which all individuals develop care needs (as some of them will develop them after the period available for analysis, or perhaps will never do so). That is, this approach deals with censored observations. Nevertheless, it can only establish a relationship between an early onset of care needs and housing factors one by one. Housing conditions, however, could also be a symptom of a bigger problem, the fact that, the early onset of care needs may also be affected by some other socio-demographic characteristics such as age, gender, location, and deprivation, among other things, all of them being somehow represented by housing factors when looking at them in isolation. Cox Proportional Hazard Regression models deals with censored observation while allowing for controlling for multiple housing conditions and characteristics as well as for other individual and contextual factors. For instance, our models control for gender - which may be associated with differential onset of care needs (Anstey et al., 2021), location, and area level deprivation - as local context matters when developing care needs (Cadar et al., 2018). This is

consistent with conceptual frameworks that include housing as a social determinant of physical and mental health inequalities throughout life (The Marmot Review, 2010). For this approach, we used the sample of all individuals who have not developed care needs yet at wave 6 of ELSA, and we investigated the age at which they first are observed having care needs at wave 7, 8, and 9. We controlled for housing conditions and socio-demographic characteristics at the point where no care needs were present (wave 6). A hazard ratio larger than 1 indicates that the condition of interest has a shorter survival than when the condition is not present. On the other hand, a hazard ratio lower than 1 indicates that the housing condition is associated with a later onset of care needs. The ratio, however, does not quantify the magnitude of the difference. The proportionality assumption has been tested by using the Schoenfeld and scaled Schoenfeld residuals (Schoenfeld, 1982). If the test p-values are over 0.05, then we cannot reject proportionality and we assume that we do not have a violation of the proportionality assumption. Goodness-of-fit has been assessed visually, by looking at the behaviour of Cox-Snell residuals (Cox-Snell, 1968). That is, if the hazard function follows the 45-degree line, then we know that it has an approximately exponential distribution with a hazard rate of one and that the model fits the data well.

We conducted analyses using Stata 17 (StataCorp, 2021).

4. Results

We found three distinctive typologies of housing in our sample, Class 1 (21.4% of the houses analysed) were most likely to be larger houses (i.e., with a larger number of rooms), and in a better condition, with relatively fewer issues than other houses. However, noise, pollution, and infestations are some of the most important problems among the houses included in this group. Class 2 (10.4% of the houses analysed) were found to be smaller houses and with several housing issues. That is, in addition to problems with noise, they also present issues with damp, cold, and condensation; they are also dark, and have general rotting. Class 3 (68.2% of the sample analysed) were found to be medium-sized houses, with some housing issues (in particular, problems associated with their roof, as well as damp and cold). Fig. 1 shows the three latent classes identified and its characteristics. Average posterior probabilities were 0.9069 for Class 1, 0.9998 for Class 2, and 0.9524 for Class 3. Entropy statistic measuring intra-cluster homogeneity was equal to 0.94. The classes identified provide an insight into how housing characteristics cluster and do not appear in isolation.

In terms of the characteristics of individuals living in each of the three latent classes identified, houses in Class 2 (relatively worse housing conditions) are more likely to be inhabited by individuals with long-standing illness (83% in Class 2 compared to 55% and 52% in Classes 1 and 3, respectively) and in poor health (57% in Class 2, 22% in Class 1, and 18% in Class 3), but these findings should be taken with a degree of caution as they are only descriptive and therefore it is not possible to interpret them as if housing conditions cause illness, as may well be possible since poor health limits an individual's ability to repair their house. Self-perceived social status was also found to be lower in Class 2 compared to Classes 1 and 3. In addition, one in five houses in Class 2 are in the most deprived quintile of the Index of Multiple Deprivation (IMD). Results also indicate that a larger proportion of houses with worse housing conditions (those in Class 2) are privately rented (7% compared to 2% and 5% in Classes 1 and 3, respectively), but also quite surprisingly, are in social housing (28% of houses in Class 2, compared to less than 10% in the other two classes). On the other hand, but as expected, a higher proportion of Class 1 (better houses) are owned (91%). With regards to care needs, a larger proportion of older individuals living in Class 2 houses have ADLs/IADLs (51%/59%) compared to those living in Class 1 and Class 3 houses (less than 20%). Geographical disparities are not (at least descriptively) evident, except perhaps by the lower proportion of houses in rural areas that belong to Class 2 (20% compared to around 30% in Classes 1 and 3). See Table 1

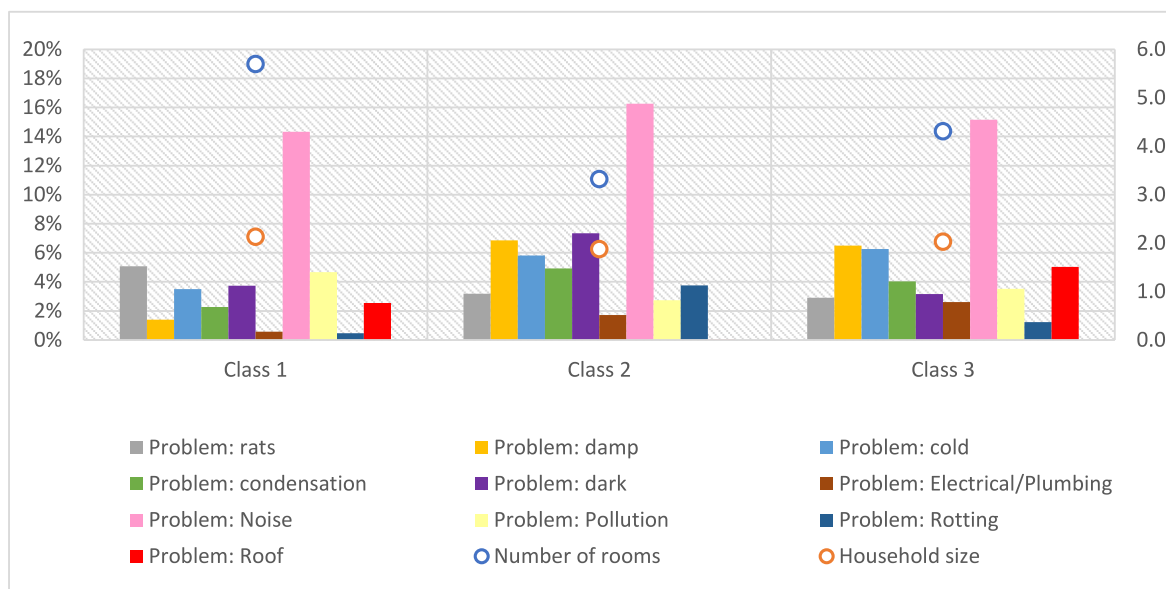


Fig. 1. Latent Classes based on housing conditions.

Table 1 Descriptive Individual characteristics across latent classes.

Wave 9	Class 1 Bigger house & better condition (21.4%)	Class 2 Smaller house & Worse condition (10.4%)	Class 3 Medium size & with some problems (68.2%)
Gender: Female	55.2	61.1	55.3
Ethnicity: White	95.2	95.3	95.0
Age	68.3	73.2	66.4
Marital status: Couple	75.9	62.4	72.4
Employed	31.6	6.7	39.8
Highest education: degree	22.5	12.1	18.3
Poor Health	21.9	57.3	21.7
Long-standing illness	55.4	82.7	51.6
Dementia	1.0	1.5	0.4
Region:			
North East	2.9	9.7	7.0
North West	12.8	10.6	11.2
Yorkshire & Humber	7.7	9.7	11.1
East Midlands	12.0	16.9	9.6
West Midlands	11.2	10.8	10.4
East	12.6	11.4	13.5
London	9.1	8.0	8.2
South East	18.0	11.8	17.7
South West	13.9	11.1	11.3
% Rural	30.5	20.3	27.1
% Believe will not have the financial resources to meet needs in the future	25.8	29.0	28.7
Self-perceived social status (1(Worse off); 10 (Better off))	6.7	5.8	6.4
% Most deprived quintile	7.7	18.6	11.4
% Privately rented	2.2	7.0	4.9
% Social Housing	7.3	27.7	9.3
% Ownership	90.6	65.3	85.8
Any ADL	16.7	51.0	12.4
Any IADL	18.8	59.4	14.7
Number of ADL (if with care needs)	2.2	2.6	2.0
Number of IADL (if with care needs)	2.6	3.0	2.2

for more details.

When descriptively looking at the housing conditions associated with an earlier onset of care needs, we found that, among those living in houses in Class 2 (in worse condition), a median age of 85 years old compared to 90 years old for those in Class 1 and Class 3. Similarly, an earlier onset of care needs was estimated in 81 years old (median age) for those living in houses with three or more housing problems. The median age of onset of care needs is also higher for those living with a larger number of housing problems at 81 years old, compared to 90 years old for those living in houses without problems. Figs. 2 and 3 present Kaplan-Meier curves for ADLs, but similar results were obtained when IADLs were explored (and when only individuals living in the most deprived areas were included in the analysis). Fig. 4 shows that the median age of onset of care needs is also earlier for those living in social housing compared to those living in rented accommodation or those that are homeowners.

Looking at factors simultaneously associated with an early onset of care needs, and using a Cox survival regression model, Table 2 shows two specifications of each set of care needs (ADLs and IADLs). Model 1 presents Hazard Ratios (HR) for the association between housing conditions and characteristics (household size, tenure, total number of

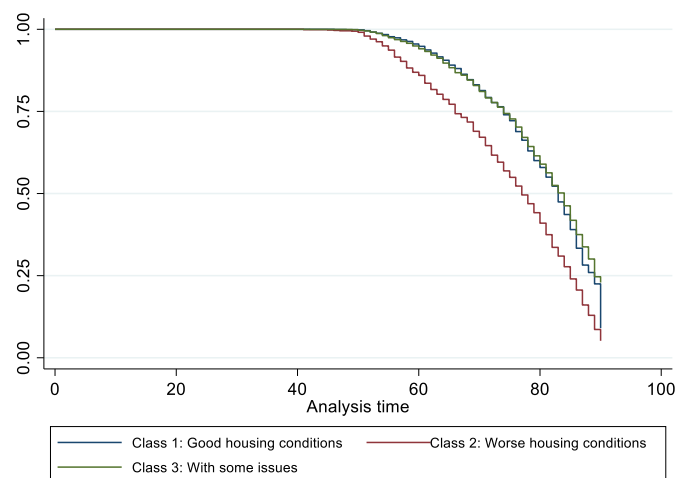


Fig. 2. Housing and onset of care needs (ADLs), Kaplan Meier curves (by latent class).

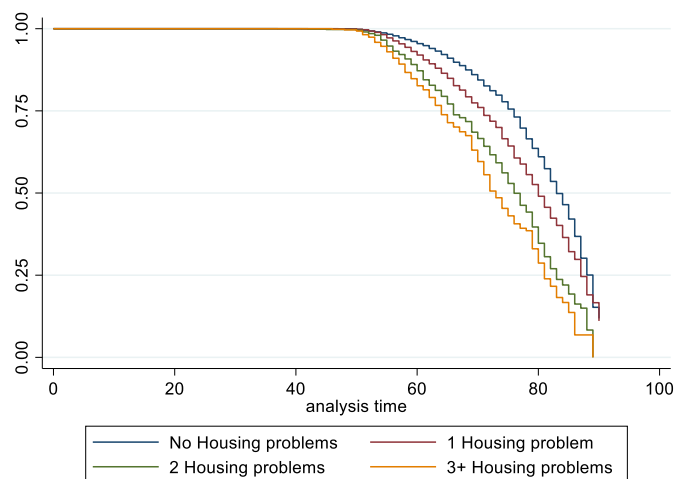


Fig. 3. Housing and onset of care needs (ADLs), Kaplan Meier curves (by number of housing problems).

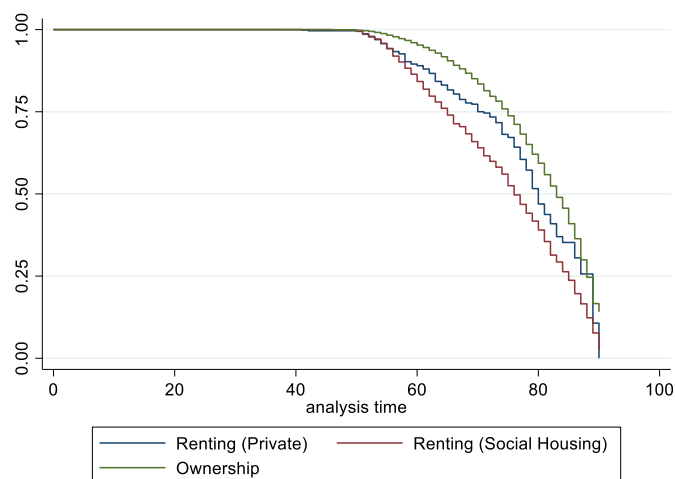


Fig. 4. Housing and onset of care needs, Kaplan Meier curves (by tenure).

housing problems, condensation issues, housing class typology, location, deprivation, and rurality) and an early onset of ADLs, controlling by individual characteristics such as gender, ethnicity, marital status, employment, and educational level). Model 2 includes the same specification as Model 1 but including an additional variable: The expectation that the household will not have sufficient financial resources to meet its needs in the future. Similarly, Models 3 and 4 present Hazard Ratios for the association between housing conditions and characteristics and an early onset of IADLs excluding and including information on the expectation of availability of resources to meet needs in the future, respectively. We found that household size (number of people living in the household), privately rented, and social housing are associated with an earlier onset of care needs (HR>1). More specifically, for those that have not developed ADLs yet (column ADLs (1)), living in privately rented accommodation at wave t have a 1.323 increased chance to develop them at wave t+1 compared to those living in their own house. Similarly, those in social housing have a 1.591 increased chance to develop them compared to those living in their own house. The number of problems in accommodation (e.g., damp, cold, roof issues, etc) was found to be associated with earlier onset of care needs (ADLs and IADLs) as well as specifically having condensation issues. Similarly, houses classified in Class 2 (those in relatively worse housing conditions) are more likely, controlling for other factors, to be inhabited by older people with an early onset of care needs compared to those living in Class 1.

Table 2
Housing and onset of care needs (Cox regression model).

Age of onset care needs: Cox Regression (Hazard Ratios)				
	ADLs Hazard Ratio (model 1)	ADLs Hazard Ratio (model 2)	IADLs Hazard Ratio (model 3)	IADLs Hazard Ratio (model 4)
Individual characteristics				
Household size	1.214***	1.216***	1.205***	1.198***
Tenure: Privately renting	1.323***	1.240**	1.237**	1.156
Tenure: Social housing	1.591***	1.496***	1.514***	1.430***
Total number of housing problems	1.208***	1.210***	1.169***	1.171***
Condensation problems	1.272*	1.223	1.261*	1.204
Class 2	1.322***	1.313***	1.274***	1.264***
Class 3	0.852***	0.847***	0.901*	0.891**
Gender (female)	1.128**	1.112**	1.343***	1.319***
Ethnicity (White British)	0.763*	0.715**	0.670***	0.640***
Married/Partner	1.047	1.050	1.027	1.035
Employed	1.478***	1.436***	1.351***	1.331***
Higher Education	0.936	0.945	0.940	0.948
Self-perceived (subjective) social status (0–10, 10 better off)	0.987***	0.989***	0.988***	0.990***
Not enough financial resources to meet needs: expectations		1.005***		1.005***
Local area characteristics				
North West	1.056	1.045	1.084	1.064
Yorkshire & Humber	0.907	0.895	0.886	0.874
East Midlands	1.093	1.088	1.028	1.007
West Midlands	1.013	1.007	0.879	0.868
East	1.068	1.059	0.895	0.876
London	0.744**	0.745**	0.716***	0.713***
South East	0.979	0.987	0.837	0.837
South West	0.985	0.970	0.923	0.911
Rural	0.972	0.958	0.907*	0.897*
IMD (Quintiles): II Q	1.032	1.030	1.038	1.049
IMD (Quintiles): III Q	1.163**	1.166**	1.132*	1.146*
IMD (Quintiles): IV Q	1.274***	1.292***	1.280***	1.308***
IMD (Quintiles): V Q (most deprived)	1.438***	1.451***	1.345***	1.370***
Number of observations	6111	6048	6104	6041

p-values: *** <0.01; ** <0.05; * <0.1.

Furthermore, results show that those living in a Class 2 house typology have, a 1.322 and a 1.274 increased chance to develop ADLs and IADLs, respectively, at the next wave (t+1), compared to those living in Class 1.

Geographical variation, particularly living in London and quite the opposite of living in a rural area, is associated with a later onset of care needs. Deprivation, as expected, also plays a role when investigating the onset of care needs, individuals living in the most deprived areas are more likely to have an earlier onset of care needs. Similarly, individuals with a higher self-perceived social status are more likely to have a later onset of care needs, and individuals that expect not to have sufficient financial resources to cover their needs in the future are more likely to have an earlier onset of care needs. Additional covariates included in the model are gender, ethnicity, marital status, employment, and education. The proportionality assumption cannot be rejected by looking at the Schoenfeld residuals (p-value>0.1). We generated the Cox-Snell residual, and we checked that the hazard function follows the 45-degree line to conclude that the model fits the data well.

5. Discussion

This study identifies three typologies of housing: bigger houses in a relatively good condition, but with issues related to pest infestation and pollution (Class 1); smaller houses that are in worse condition with multiple housing problems (Class 2), and medium sized houses with a few housing conditions mostly related to problems with the roof, cold, and damp (Class 3). While many housing issues are not well spread, for instance, only 7% of houses in Class 2 (and 1% and 6% of houses in Classes 1 and 3, respectively) present issues with damp, our main interest is not on the absolute size of the problem, but investigating how relative differences on housing typologies may lead to an increasing risk of developing care needs. In this regard, the second class is the one that instinctively generates the most concern, although the proportion of individuals living in this typology is relatively small (10%). Class 3 on the other hand, includes around 68% of older individuals in the sample. This highlights the need for not neglecting any of the groups identified, which themselves may require different strategies to raise their housing standards.

The total number of housing conditions and the identified typologies of housing were both found to be associated with having an earlier onset of care needs when controlling for other housing related factors and socio-demographic characteristics. Houses in Class 2, in worse conditions, were found to be associated with an earlier onset of care needs, showing that not only is the type of problem, but also the combination of housing conditions that could affect when long-term care needs start to develop. This is important as multiple housing problems could highlight that the combination of these risks could be more than the sum of them separately (Baker and Lester, 2017). An example of this exacerbation could be the fact that condensation issues (which we found to be associated with earlier onset of care needs) are usually present in combination with high indoor humidity, damp, low temperatures, poor ventilation and mould, all of these factors being related to upper respiratory tract symptoms (US Institute of Medicine, 2004). To tackle these issues, policy strategies could focus on making funding available for housing improvement. For instance, 'Disabled Facilities Grants' have been made available to those living with a disability or those who have age-related needs in England (Department for Levelling Up Housing and Communities and Department of Health and Social Care, 2022), but they only focus on property adaptations, rather than on housing conditions per se, and it has been reported to involve a cumbersome and slow process (Mackintosh et al., 2018).

We also found that those privately renting or in social housing, are more likely to have an early onset of care needs. This highlights the importance of regulatory frameworks that could help tenants to have a more effective way to improve the property where they live and/or create incentives for landlords to maintain high quality housing standards. The latter findings are also of important concern as there has been a significant increase in the number of older people expected to rent rather than own their own home in later life (Centre for Ageing Better, 2022), and also since a substantial proportion of households (approximately 17% in England) are in the social rented housing sector (Ministry of Housing, Communities and Local Government, 2020; OECD 2020). In this regard, the House of Commons Levelling Up, Housing and Communities Committee in England has reported that "the condition of some social housing in the country has deteriorated so badly as to be unfit for human habitation" and a significant proportion of social housing tenants live with serious damp and mould, which have potentially serious impacts on their mental and physical health (House of Commons, 2022). It seems that, while improved standards have been proposed, for example, the White Paper published by the Department for Levelling Up Housing and Communities (2022b), the social housing sector has not been able to implement many changes. This is perhaps associated with the reduction in funding faced by local authorities in England (House of Commons, 2022).

Homes in which people age may present challenges, and housing

conditions may become a promoter or deterrent to make the policy ideal of ageing in place a reality (Lewis, and Buffel, 2020). In this regard, facilitating ageing in place has meant helping older people to remain in their homes, but it is important to highlight that quality housing cannot be taken for granted. Furthermore, housing is not simply a refuge for older people, but also part of their individual and social wealth (Yang and Fu, 2019; Cristoforetti et al., 2011) and where many of them find their dignity and purpose (Lim and Bowman, 2022). The policy focus should perhaps be on ageing in the 'right' place instead (Golant, 2015). This also includes the promotion of consumer awareness (Costa-Font et al., 2009), that could help to deal with early stages of problems rather than in a point of crisis. In addition, ageing in the right place could prevent costs associated with inadequate housing conditions. For instance, it has been estimated that poor quality housing creates a cost to the NHS of £1.4 billion for first-year treatment costs (Centre for Ageing Better, 2020) and that they cost 195 billion euros yearly to countries in the European Union (Eurofund, 2016). Lack of suitable housing means people are moving to residential care prematurely or staying in hospital unnecessarily rather than recovering in their own homes (Department of Health and Social Care, 2021). The complexity of the problem calls for several approaches that tackle the issue from different angles and acknowledge the potential capacity of housing to play a protective role. Improving housing quality, therefore, offers an opportunity to address potential risk factors, and at the same time, to develop strategies to enhance the protective role that housing could play on the onset of care needs, in particular, among the older population.

Finally, ageing in the 'right' place, not only involves the home and its environment as such, but also surrounding areas, the neighbourhood with its services and potential social connections also could contribute to the development of care needs. 'Ageing in Place' will also be hampered without enough community/home care-based support (Vasunilashorn, 2012; Costa-Font et al., 2009; Campbell et al., 2021). In addition, housing aids adaptations, including telecare services, have recently been seen as a key tool in facilitating ageing in place (Heywood and Turner, 2007). We leave these topics for future research in the area.

6. Conclusions

Our study offers a contribution towards gaining a better understanding of the relationship between housing conditions and care needs. Housing tenure, in particular social housing, and the number and combination of housing problems seems to be associated with earlier development of care needs. While these findings are based on an English data set, they may also be relevant for international policy makers, especially those working on prevention-related areas. Solutions, however, should be tailored to country contexts and challenges (OECD, 2020). Further research could be aimed at identifying housing conditions associated with levels of care needs and the provision of informal and formal care services and exploring the role played by geographical location, neighbourhood characteristics, deprivation, and fuel poverty.



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Declaration of competing interest

We have no conflicts of interest to disclose.

References

- Abramsson, M., Andersson, E., 2016. Changing preferences with ageing – housing choices and housing plans of older people. *Hous. Theor. Soc.* 33 (2) <https://doi.org/10.1080/140336096.2015.1104385>, 217–214.
- Akaike, H., 1974. A new look at statistical model identification. *IEEE Transact. Autom. Contr.* AC-19 716–723.

- All party parliamentary group for healthy homes and buildings, APPG, 2019. Building Our Future Laying the Foundations for Healthy Homes and Buildings. White Paper. Available at: <https://healthyhomesbuildings.org.uk/>, 21/02/20023.
- Anstey, K.J., Peters, R., Morthy, M.E., et al., 2021. Association of sex differences in dementia risk factors with sex differences in memory decline in a population-based cohort spanning 20–76 years. *Sci. Rep.* 11, 7710. <https://doi.org/10.1038/s41598-021-86397-7>.
- Baker, E., Lester, L., 2017. Multiple housing problems: a view through the housing niche lens. *Cities* 62. <https://doi.org/10.1016/j.cities.2016.10.001>, 146–151.
- Banks, J., Batty, G. David, Breedvelt, J., Coughlin, K., Crawford, R., Marmot, M., Nazroo, J., Oldfield, Z., Steel, N., Steptoe, A., Wood, M., Zaninotto, P., 2021. In: English Longitudinal Study of Ageing: Waves 0-9, 1998-2019, 37th Edition. UK Data Service. SN, p. 5050. <https://doi.org/10.5255/UKDA-SN-5050-24> [data collection].
- Beatty, C., Wilson, I., 2010. Tenure and Change in Deprived Areas Evidence from the New Deal for Communities Areas. Centre for Regional Economic and Social Research, Sheffield Hallam University and the Department for Communities and Local Government, February. Available online at: <https://extra.shu.ac.uk/ndc/downloads/reports/Tenure%20and%20Change%20in%20Deprived%20Areas.pdf>, 21/02/20023.
- Bosch-Farré, C., Malagón-Aguilera, M.C., Ballester-Ferrando, D., Bertran-Noguer, C., Bonmatí-Tomás, A., Gelabert-Vilella, S., Juvinyà-Canal, D., 2020. Healthy ageing in place: enablers and barriers from the perspective of the elderly. A qualitative study. *Sep. 4 Int. J. Environ. Res. Publ. Health* 17 (18), 6451. <https://doi.org/10.3390/ijerph17186451>. PMID: 32899744; PMCID: PMC7559318.
- Braubach, M., Power, A., 2011. Housing conditions and risk: reporting on a European study of housing quality and risk of accidents for older people. *J. Hous. Elder.* 25 (3), 288–305. <https://doi.org/10.1080/02763893.2011.595615>.
- Cadar, D., Lassale, C., Davies, H., Llewellyn, D.J., Batty, G.D., Steptoe, A., 2018. Individual and area-based socioeconomic factors associated with dementia incidence in England: evidence from a 12-year follow-up in the English longitudinal study of ageing. *JAMA Psychiatr.* 75 (7), 723–732. <https://doi.org/10.1001/jamapsychiatry.2018.1012>.
- Campbell, M., Stewart, T., Brunkert, T., Campbell-Enns, H., Gruneir, A., Halas, G., Hoben, M., Scott, E., Wagg, A., Doupe, M., 2021. Prioritizing supports and services to help older adults age in place: a Delphi study comparing the perspectives of family/friend care partners and healthcare stakeholders. *PLoS One* 16 (11), e0259387. <https://doi.org/10.1371/journal.pone.0259387>.
- Celeux, G., Soromenho, G., 1996. An entropy criterion for assessing the number of clusters in a mixture model. *J. Classif.* 13 (2), 195–212. <https://doi.org/10.1007/BF01246098>.
- Centre for Ageing Better, 2022. The State of Ageing 2022. March 2022. Available at: https://ageing-better.org.uk/resources/summary-report-state-ageing-2022?gclid=Cj0KCQjw1bqZBhDXARisANTjCPL5r44qCnXq_ddlshOc_8uEmUUNsOGTmcrzpmecs_jz4Efd5SnCBoaAv_VeALw_wcB.
- Centre for Ageing Better, 2020. Home and dry: the need for decent homes in later life. Centre for Ageing Better. Available at: <https://www.ageing-better.org.uk/publications/home-and-dry-need-decent-homes-later-life>.
- Chandola, T., Rouxel, P., 2022. Home modifications and disability outcomes: a longitudinal study of older adults living in England. *The Lancet Regl Health - Eur.* 18. <https://doi.org/10.1016/j.lanreg.2022.100397>.
- Clair, A., Baker, E., 2022. Cold homes and mental health harm: evidence from the UK household longitudinal study. *Soc. Sci. Med.* 314. <https://doi.org/10.1016/j.socscimed.2022.115461>.
- Costa-Font, J., Elvira, D., Mascarilla-Miró, O., 2009. 'Ageing in place'? Exploring elderly people's housing preferences in Spain. *Urban Stud.* 46 (2), 295–316. <https://doi.org/10.1177/0042098008099356>.
- Cox, David R., 1972. Regression models and life-tables. *J. Roy. Stat. Soc. B* 34 (2), 187–220.
- Cox, D.R., Snell, E.J., 1968. A general definition of residuals. *J. Roy. Stat. Soc. B* 30 (2), 248–275.
- Cristoforetti, A., et al., 2011. Home sweet home: the emotional construction of places. *J. Aging Stud.* 25, 225–232. <https://doi.org/10.1016/j.jaging.2011.03.006>.
- Cromarty, H., 2022. Social housing reform in England: what next? House of commons library. Research Briefing. June. Available at: <https://researchbriefings.files.parliament.uk/documents/CBP-9227/CBP-9227.pdf>.
- Cromarty, H., Barton, C., 2021. Housing Conditions in the Private Rented Sector (England). House of Commons Library. June. Available at: <https://researchbriefings.files.parliament.uk/documents/CBP-7328/CBP-7328.pdf>.
- Delgado, J., Ramirez-Cardich, M., Gilman, R.H., Lavarello, R., Dahodwala, N., Bazan, A., et al., 2002. Risk factors for burns in children: crowding, poverty, and poor maternal education. *Inj. Prev.* 8 (1), 38–41.
- Department for Community and Local Government, 2022. National Statistics English Housing Survey 2021 to 2022: Headline Report. December. Available online at: <https://www.gov.uk/government/statistics/english-housing-survey-2021-to-2022-headline-report/english-housing-survey-2021-to-2022-headline-report>, 20/02/2023.
- Department for Community and Local Government, 2006. A decent home: definition and guidance for implementation June 2006 – update. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/7812/138355.pdf, 20/02/2023.
- Department of Health and Social Care, 2021. People at the Heart of Care Adult Social Care Reform. White Paper CP 560 December. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1061870/people-at-the-heart-of-care-asc-reform-accessible-with-correction-slip.pdf, 21/02/20023.
- Department for Levelling Up Housing and Communities and Department of Health and Social Care, 2022. Disabled Facilities Grant (DFG) Delivery: Guidance for Local Authorities in England. March. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1065574/DFG_Guidance.pdf, 21/02/20023.
- Department for Levelling Up Housing and Communities, 2022. Policy Paper (White Paper) A Fairer Private Rented Sector. August. Available online at: <https://www.gov.uk/government/publications/a-fairer-private-rented-sector/a-fairer-private-rented-sector>, 21/02/20023.
- Dias, J.G., 2006. Latent class analysis and model selection. In: Spiliopoulou, M., Kruse, R., Borgelt, C., Nürnberger, A., Gaul, W. (Eds.), From Data and Information Analysis to Knowledge Engineering. Studies in Classification, Data Analysis, and Knowledge Organization. Springer, Berlin, Heidelberg. https://doi.org/10.1007/3-540-31314-1_10.
- Eurofund, 2016. Inadequate Housing in Europe: Costs and Consequences. Publications Office of the European Union, Luxembourg. Available online at: http://publications.europa.eu/resource/cellar/5187e545-78ab-11e6-b076-01aa75ed71a1.0001.02/DOC_1, 21/02/20023.
- Evans, S., Waller, S., Bray, J., Atkinson, T., 2019. Making homes more dementia-friendly through the use of aids and adaptations. *Health Care* 7 (1), 43. <https://doi.org/10.3390/healthcare7010043>.
- Evans, G.W., Saegert, S., 2000. Residential Crowding in the Context of Inner City Poverty. *Theoretical Perspectives in Environment-Behavior Research*, pp. 247–267, 85.
- Evans, J., Hyndman, S., Stewart-Brown, S., et al., 2000. An epidemiological study of the relative importance of damp housing in relation to adult health. *J. Epidemiol. Community Health* 54, 677–686.
- Fendt-Newlin, M., Cornes, M., Manthorpe, J., Moriarty, J., 2016. Living Well in Old Age: the Value of UK Housing Interventions in Supporting Mental Health and Wellbeing in Later Life. King's College London. Social Care Workforce Research Unit. May. Available online at: <https://www.housinglin.org.uk/assets/Resources/Housing/OtherOrganisation/Mental-Health-Living-well-in-old-age.pdf>, 21/02/20023.
- Fernandez-Carro, C., 2013. Ageing in Place' in Europe: A Multidimensional Approach to Independent Living in Later Life. PhD Thesis. Doctoral Programme in Demography. Centre d'Estudis Demogràfics. Universitat Autònoma de Barcelona. September. Available online at: https://www.tdx.cat/bitstream/handle/10803/129081/cf_c1de1.pdf, 20/02/2023.
- Government Office for Science, 2016. Future of an Ageing Population. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/816458/future-of-an-ageing-population.pdf, 16/02/2023.
- Golant, S.M., 2015. *Ageing in the Right Place*. Health Professions Press, Baltimore.
- Grant, L.K., St Hilaire, M.A., Heller, J.P., Heller, R.A., Lockley, S.W., Rahman, S.A., 2022. Impact of upgraded lighting on falls in care home residents. *J. Am. Med. Dir. Assoc.* (22), 471–476. <https://doi.org/10.1016/j.jamda.2022.06.013>. Epub ahead of print. PMID: 35850166.
- Hagenaars, J., McCutcheon, A. (Eds.), 2002. *Applied Latent Class Analysis*. Cambridge University Press, Cambridge. <https://doi.org/10.1017/CBO9780511499531>.
- Heywood, F., Turner, L., 2007. Better Outcomes, Lower Costs. Implications for Health and Social Care Budgets of Investment in Housing Adaptations, Improvements and Equipment: Review of the Evidence. Department of Work and Pensions, London.
- House of Commons, 2018. Housing for Older People Needs National Strategy. Communities and Local Government. Available online at: <https://publications.parliament.uk/pa/cm201719/cmselect/cmcomloc/370/37002.htm>, 21/02/20023.
- House of Commons, 2022. The Regulation of Social Housing. Levelling up, Housing and Communities Committee. First Report of Session 2022–23. July. Available online at: <https://committees.parliament.uk/publications/23116/documents/169311/default/>, 21/02/20023.
- Howden-Chapman, P.L., Chandola, T., Stafford, M., Marmot, M., 2011. The effect of housing on the mental health of older people: the impact of lifetime housing history in Whitehall II. *BMC Publ. Health* 11, 682. <https://doi.org/10.1186/1471-2458-11-682>.
- Kaplan, E.L., Meier, P., 1958. Nonparametric estimation from incomplete observations. *J. Am. Stat. Assoc.* 53 (282), 457–481. <https://doi.org/10.2307/2281868>.
- Kephalopoulos, S., Geiss, O., Barrero, J., D'agostino, D., Paci, D., 2017. Promoting Healthy and Energy Efficient Buildings in the European Union: National Implementation of Related Requirements of the Energy Performance Buildings Directive (2010/31/EU). EUR 27665 EN, Publications Office of the European Union, Luxembourg. <https://doi.org/10.2760/73595>.
- Lee, H., Ailshire, J., 2020. Neighborhood and housing conditions and risk of falls. *Innov. Aging* 4 (Suppl. 1), 651–652. <https://doi.org/10.1093/geroni/igaa057.2245>.
- Lim, W.M., Bowman, C., 2022. Aging in a place of choice. *Dignif. Purpos. Liv. Older Adults* 46 (3), 183–189. <https://doi.org/10.1080/01924788.2022.2097806>.
- Lewis, C., Buffel, T., 2020. Aging in place and the places of aging: a longitudinal study. *J. Aging Stud.* 54. <https://doi.org/10.1016/j.jaging.2020.100870>.
- Lewis, A., Cromarty, H., Barton, C., 2021. Housing an Ageing Population: a Reading List. House of Commons Library. Briefing paper Number 09239. June. Available at: <https://researchbriefings.files.parliament.uk/documents/CBP-9239/CBP-9239.pdf>, 21/02/20023.
- Mackintosh, S., Smith, P., Garrett, H., Davidson, M., Morgan, G., Russell, R., 2018. Disabled facilities grant (DFG) and other adaptations: external review. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/762918/DFG_Review_2018_Summary.pdf, 21/02/20023.
- Marmot, M., Goldblatt, P., Allen, J., et al., 2010. Fair society, healthy lives. The Marmot Review. Available at: <https://www.instituteofhealthequity.org/resources-reports/fair-society-healthy-lives-the-marmot-review>, 21/02/20023.
- Means, R., 2007. *Safe as Houses? Ageing in Place and Vulnerable Older People in the UK Social Policy and Administration*, vol. 41, pp. 65–85, 1.

- Ministerial Conference on Environment and Health (4th : 2004 : Budapest, Hungary), World Health Organization. Regional Office for Europe, 2004. In: Declaration : Fourth Ministerial Conference on Environment and Health. Budapest, Hungary, 23-25 June 2004. Copenhagen : WHO Regional Office for Europe. <https://apps.who.int/iris/handle/10665/107577>, 21/02/20023.
- Ministry of Housing, Communities and Local Government, 2020. Renting social housing. Published 4 February. Available online at: <https://www.ethnicity-facts-figures.service.gov.uk/housing/social-housing/renting-from-a-local-authority-or-housing-association-social-housing/latest>, 21/02/20023.
- Muthén, B.O., Muthén, L.K., 2000. Integrating person-centered and variable-centered analyses: growth mixture modeling with latent trajectory classes. *Alcohol Clin. Exp. Res.* 24 (6), 882–891. <https://doi.org/10.1111/j.1530-0277.2000.tb02070.x>.
- NatCen Social Research, 2021. English Longitudinal Study of Ageing: Waves 1-8, 2002-2017: Quintile Index of Multiple Deprivation Score: Special Licence Access. [data Collection]. UK Data Service. SN, p. 8431. <https://doi.org/10.5255/UKDA-SN-8431-1>.
- Nylund, K., Asparouhov, T., Muthén, B., 2007. Deciding on the number of classes in latent class analysis and growth mixture modeling: a Monte Carlo simulation study. *Struct. Equ. Model: A Multidiscip. J.* 14 (4), 535–569. <https://doi.org/10.1080/10705510701575396>.
- OECD, 2020. Housing and Inclusive Growth. OECD Publishing, Paris. <https://doi.org/10.1787/6ef36f4b-en>.
- Oswald, F., Rowles, G.D., 2006. Beyond the relocation trauma in old age: new trends in today's elders' residential decisions. In: Wahl, H.-W., Hoff, A. (Eds.), *New Dynamics in Old Age: Environmental and Societal Perspectives*. Baywood Publications, Amityville, New York, pp. 127–152.
- Palacios, J., Eichholtz, P., Kok, N., Aydin, E., 2021. The impact of housing conditions on health outcomes. *R. Estate Econ.* 49, 1172–1200.
- Powell, J., Mackintosh, S., Bird, E., Ige, J., Garret, H., Roys, M., 2017. *The Role of Home Adaptations in Improving Later Life*. Centre for Ageing Better. Centre for Ageing Better.
- Public Health England, 2014. Minimum home temperature thresholds for health in winter – a systematic literature review. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/776497/Min_temp_threshold_for_homes_in_winter.pdf, 21/02/20023.
- Pynoos, J., Caraviello, R., Cicero, C., 2009. Lifelong housing: the anchor in aging-friendly communities. *Generations* 33 (2), 26–32.
- Rand Europe, 2022. Poor indoor climate: its impact on health and life satisfaction, as well as its wider socio-economic costs. Available online at: https://www.rand.org/pubs/research_reports/RRA1323-1.html. (Accessed 21 February 2023).
- Ranson, R., 1991. *Healthy Housing: A Practical Guide*. Spon Press and the World Health Organization Regional Office for Europe, London, England.
- Sixsmith, A., Sixsmith, J., 2008. Ageing in place in the United Kingdom. *Ageing Int.* 32, 219–235. <https://doi.org/10.1007/s12126-008-9019-y>.
- Select Committee on Public Service and Demographic Change, 2013. Ready for ageing? Report. Available online at: <https://publications.parliament.uk/pa/ld201213/ldselect/ldpublic/140/14003.htm>. (Accessed 16 February 2023).
- Sheehan, W.J., Rangsthienchai, P.A., Wood, R.A., Rivard, D., Chinratanapit, S., Perzanowski, M.S., Chew, G.L., Seltzer, J.M., Matsui, E.C., Phipatanakul, W., 2010. Pest and allergen exposure and abatement in inner-city asthma: a work group report of the American academy of allergy, asthma & immunology indoor allergy/air pollution committee. *J. Aller. Clin. Immunol.* 125 (3), 575–581. <https://doi.org/10.1016/j.jaci.2010.01.023>. PMID: 20226293; PMCID: PMC2862381.
- Schoenfeld, D., 1982. Partial residuals for the proportional hazards regression model. *Biometrika* 69 (1), 239–241. <https://doi.org/10.1093/biomet/69.1.239>. April.
- Schorr, A.V., Khalaila, R., 2018. Aging in place and quality of life among the elderly in Europe: a moderated mediation model. *Arch. Gerontol. Geriatr.* 77 (1), 196–204. <https://doi.org/10.1016/j.archger.2018.04.009>.
- Schwarz, Gideon E., 1978. Estimating the dimension of a model. *Ann. Stat.* 6 (2), 461–464. <https://doi.org/10.1214/aos/1176344136>.
- StataCorp, 2021. *Stata Statistical Software: Release, vol. 17*. StataCorp LLC, College Station, TX.
- Thomson, H., Thomas, S., Sellstrom, E., Petticrew, M., 2009. The health impacts of housing improvement: a systematic review of intervention studies from 1887 to 2007. *Am. J. Publ. Health* 99, S681–S692. <https://doi.org/10.2105/AJPH.2008.143909>. S3 (November 1, 2009).
- Thumala, D., Kennedy, B.K., Calvo, E., Gonzalez-Billault, C., Zitko, P., Lillo, P., Villagra, R., Ibáñez, A., Assar, R., Andrade, M., Slachevsky, A., 2017. Aging and health policies in Chile: new agendas for research. *Health Syst. Reform* 3 (4), 253–260. <https://doi.org/10.1080/23288604.2017.1353844>.
- US Institute of Medicine, 2004. *Damp indoor spaces and health. Chapter 4, toxic effects of fungi and bacteria*. In: Committee on Damp Indoor Spaces and Health. National Academies Press, Washington (DC).
- Vasunilashorn, S., Steinman, B.A., Liebig, P., Pynoos, P., 2012. Aging in place: evolution of a research topic whose time has come. *J. Aging Res.* 2012 <https://doi.org/10.1155/2012/120952>. Article ID 120952, 6 pages, 2012.
- Webber, R., May, V., Lewis, C., 2022. Ageing in place over time: the making and unmaking of home. *Socio. Res. Online*. <https://doi.org/10.1177/13607804221089351>, 0(0).
- Weller, B.E., Bowen, N.K., Faubert, S.J., 2020. Latent class analysis: a guide to best practice. *J. Black Psychol.* 46 (4), 287–311. <https://doi.org/10.1177/0095798420930932>.
- Who, 2018. *Housing and Health Guidelines*. World Health Organization, Geneva. Available online at: <https://www.who.int/publications/i/item/9789241550376>, 21/02/20023.
- Who, 2007. *Global age-friendly cities project*. Available online at: <https://apps.who.int/iris/handle/10665/43755>. (Accessed 16 February 2023).
- Wiles, J., Leibing, A., Guberman, N., Reeve, J., Allen, R., 2012. The meaning of “aging in place” to older people. *Gerontol.* 52 (3), 357–366. <https://doi.org/10.1093/geront/gnr098>. June 2012.
- Yang, Z., Fu, Y., 2019. Physical attributes of housing and elderly health: a new dynamic perspective. *Int. J. Environ. Res. Publ. Health* 16 (24), 4961. <https://doi.org/10.3390/ijerph16244961>. Dec 6.
- Yu, J., Rosenberg, M.W., 2017. “No place like home”: aging in post-reform Beijing. *Health Place* 46, 192–200. <https://doi.org/10.1016/j.healthplace.2017.05.015>.