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Granbom, Marianne; Löfqvist, Charlotte; Horstmann, Vibeke; Haak, Maria; Iwarsson, Susanne

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PO Box 117  
221 00 Lund  
+46 46-222 00 00

# **Relocation to Ordinary or Special Housing in Very Old Age: Aspects of Housing and Health**

Granbom, Marianne, Reg. Occupational therapist, PhD Candidate; Löfqvist, Charlotte, Reg. Occupational therapist, PhD; Horstmann, Vibeke, LicSc; Haak, Maria, Reg. Occupational therapist, PhD; Iwarsson, Susanne, Reg. Occupational therapist, PhD, Professor

*Department of Health Sciences, Faculty of Medicine, Lund University, Sweden*

Corresponding author:

Marianne Granbom, PhD Candidate

Department of Health Sciences, Lund University

Box 157, SE-221 00 Lund, Sweden

Phone: +46 (0)46 222 19 81

Fax: +46 (0)46 222 19 59

E-mail: [marianne.granbom@med.lu.se](mailto:marianne.granbom@med.lu.se)

## **Abstract**

Relocation in very old age is considered to be a major life event and a move could be triggered by many different economic, social, health-related or environmental reasons. Based on the notion of person-environment (P-E) fit as expressed in the Ecological Theory of Ageing, the aim of this prospective study over 4 years was to explore which aspects of housing and health predict relocation to ordinary or special housing among very old people. At baseline, the participants (80-89 years old) lived alone in ordinary housing in Sweden (N=384). Data collection at home visits included assessments and observations on aspects of objective and perceived housing as well as on aspects of health. After four years, 18% (n=70) of the participants had moved, either to ordinary housing (n=24) or to special housing (n=46). Cox regression models showed dependence in cleaning, perceived functional independence, and living in a one-family house to predict moves to ordinary housing. Dependence in cooking, cognitive deficits, and accessibility problems predicted moves to special housing. In conclusion, aspects of housing and health are related to relocation in very old age, but in different patterns for relocation to ordinary housing and special housing, respectively. This kind of knowledge has practical implications for relocation counseling and societal planning targeting very old people.

## **Keywords**

Residential mobility, ENABLE-AGE, Activities of daily living, Accessibility, Perceived housing

## Introduction

A move in old age is considered to be a major life event (Sergeant and Ekerdt 2008), and relocation among old and very old people is a hot topic in the public debate across Europe. Still, the knowledge on factors that predict moves to ordinary housing or to institutional settings is insufficient. Even if relocation occurs more seldom in old age than during adolescence and mid adulthood, the occurrence increases somewhat with very old age (Statistics Sweden 2011).<sup>1</sup> A recent Swedish study reported that 50% of the population aged 70-100 years is expected to experience a move to an institutional setting at some point in time during old age (Ernst Bravell et al. 2009). The proportion of very old people living alone is increasing across Europe (Walker 2005), and in Sweden, about half of those aged 75+ live in single households (Statistics Sweden 2011). Since living alone in old age increases the risk of relocation to an institutional setting (Bharucha et al. 2004; Hallberg & Lagergren 2009), very old people living alone constitute an important target group for research on relocation. From an ecological perspective, relocation is suggested to be related to the (in)congruence between the competencies of the individual and the demands of the environment. This study intends to go into detail on aspects of housing (representing the environment) and health (representing the individual competencies) and how these aspects are related to relocation to ordinary housing or institution-like settings among people aged 80+.

Some of the most frequently reported health-related predictors of relocation to an institutional setting are dependence on others for activities of daily living (ADL) (Hallberg and Lagergren 2009; Miller and Weissert 2000), and dementia or cognitive decline (Miller and Weissert 2000; Larsson et al. 2006; Bharucha et al. 2004). Number of prescribed medications (Bharucha et al. 2004), health deterioration (Bloem et al. 2008), frailty (Puts et al. 2005) as well as depression increased the likelihood to move into institutional care (Larsson et al. 2006). Comparing movers to regular dwellings, adapted dwellings, or institutions among people 64-91 years, Bloem and co-workers (2008) showed that among widows and widowers an inaccessible home, lack of housing adaptations, or the presence of stairs predicted a move to ordinary or adapted dwellings. Regarding relocation to ordinary housing in old age, previous research has identified a diversity of influential aspects. That is, older people do not move because of one but many reasons, with aspects of housing and health highly intertwined (Sergeant and Ekerdt 2008; Stimson & McCrea 2004). A retrospective study among people aged 60-89 who were living alone showed that moves made to another ordinary dwelling were more often motivated by aspects of housing than aspects of health (Oswald et al. 2002). In a Danish study with cohabiting couples as well as people living alone (Hansen and Gottschalk 2006), people aged 52-77 were asked about what would make them consider a move. Five years later their considerations were compared with the actual moves undertaken. Predictors of relocation to ordinary housing were living in a large dwelling, recently being alone, living isolated in a rural area, and having lived in the dwelling for at least 10 years. Other frequently reported housing-related reasons for moving within ordinary housing are demanding maintenance of large garden or home (Hansen and Gottschalk 2006; Stimson and McCrea 2004; Sergeant and Ekerdt 2008). Summing up on this review on current literature on relocation in old age, the relation between aspects of health and relocation to institutional settings is well established, but we know less about the influence of aspects of housing. In particular, previous research lacks data on objectively assessed aspects of housing, such as

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<sup>1</sup> In this paper the terms *relocation* and *move* will be used interchangeably and refer to short distance residential moves, in opposite to long distance migration.

environmental barriers and accessibility, and there is also a paucity of studies among very old people.

In Sweden, the municipalities are responsible for providing home care and social services for older people living in *ordinary housing* as well as to provide *special housing* when more extensive care is needed. Special housing is an umbrella term that represents a diversity of settings, providing different levels of care. Special housing is financed by taxes and provided after individual assessment made by a municipality official. The decision based on the needs assessment specifies to which kind of special housing a move is granted as well as type and amount of service provided. Major reductions during the latest decades have led to that only those with a great need of care are being granted a placement in special housing (Larsson et al. 2006). Instead, the availability of *senior housing* within the ordinary housing stock is increasing. Typically, these settings are owned and provided by housing estate companies and target specific resident groups, most commonly defined in terms of a certain minimum age. Overall in senior housing, the apartments have a higher level of accessibility, and in many of these units there are facilities for social activities. As in ordinary housing, home care service can be provided.

Theoretically, relocation in old age is commonly explained from an ecological perspective, predominately based on the ecological theory of ageing (Lawton and Nahemow 1973). Herein, the individual is defined as having a set of competencies (e.g. functional capacity and other aspects of health) and the environment is defined in terms of its demands (e.g. environmental barriers and other aspects of housing), labelled environmental press. When health declines in old age the environmental pressure gets high in relation to the personal capacities, resulting in poor person-environment fit (P-E fit) (Lawton and Nahemow 1973). For older people striving for maintaining independence in everyday life, health decline demands constant adaptation in order to perform activities of daily living (ADL). According to the docility hypothesis, the lower their competence, the more sensitive people are to the demands of the environment (Lawton and Simon 1968). In contrast to the docility hypothesis, criticized for viewing older people as being passive towards their environments (Scheidt and Norris Baker 2004), the proactivity hypothesis suggests that the higher their competence, the easier it is for people to proactively utilize the resources of the environment (Lawton, 1989). Thus relocation, a major form of environmental adaptation, could either be interpreted as an outcome of environmental docility or as environmental proactivity (Oswald et al. 2002; Oswald and Rowles 2007). Linking to the dynamics of proactivity, relocation can also be viewed as a coping strategy, however occurring only if the individual perceives a future move as viable and not too overwhelming. Moreover, an alternative residential environment perceived as a better place to fulfil needs and goals of everyday life than the current one represents an additional motivational factor (Golant 2011).

Focusing on the home environment, exploration of P-E fit (Lawton & Nahemow 1973) in relation to relocation requires data on an array of aspects of health as well as objective and subjective aspects of housing. In previous research, variables representing components of P-E fit have been included, but in most studies without explicit differentiation among the components and seldom using composite variables that capture the P-E interaction. In the majority of studies on relocation, variables representing the personal component (aspects of health) dominate. Commonly, fewer variables represent the environmental component in terms of housing, and the differentiation between objective and perceived aspects of housing is not often spelled out. Objective aspects of housing include for example tenure, type of dwelling, housing standard, and physical environmental barriers. Accessibility represents a

specific facet of P-E fit, namely the relationship between functional limitations of the person and the prevalence of physical environmental barriers (Iwarsson and Ståhl 2003). Equally important is how the individual perceives the situation, and how the home is linked to his/her identity (Haak et al 2011). Perceived aspects of housing have been conceptualized in many different ways, for example as place attachment, meaning of home and housing satisfaction (Oswald et al. 2006). To date, research based on an ecological perspective, taking aspects of health as well as objective and perceived aspects of housing into account in prospective studies, is virtually non-existing. Consequently, the aim of this prospective study over 4 years was to explore what aspects of housing and health that predict relocation to ordinary or special housing among very old, single-living people.

## **Method**

### **Project context**

This study originates from the cross-national and inter-disciplinary ENABLE-AGE Project, with the main aim to examine the home environment as a determinant for autonomy, participation and well-being in very old age among people living alone, i.e. targeting people described as particularly sensitive to environmental stress (Iwarsson et al. 2007; Lawton 1999). The project was conducted in five European countries (Sweden, the United Kingdom, Germany, Latvia and Hungary: N=1,918). For this study, baseline data from the Swedish part of the ENABLE-AGE Project (collected in 2002) were utilized. In Sweden, 965 persons who fulfilled all inclusion criteria were contacted and 41% agreed to participate (N=397). In the ENABLE-AGE Project extensive data on aspects of housing and health were collected at home visits, including interviews, assessments and observations conducted by trained, experienced occupational therapists. For further details see Iwarsson et al. (2007) and Iwarsson et al. (2005). Dates of moves, deaths, and new addresses were obtained from the Public National Registry within four years from baseline.

The Swedish part of the ENABLE AGE Project was approved by the local Ethics Committee at Lund University (LU 324, 2002). Written informed consent was obtained before the data collection, following national ethical guidelines. All data were confidentially treated.

### **Study sample**

From the Swedish sub-sample of the ENABLE AGE Project seven participants with incomplete baseline data were excluded. Another six participants could not be traced in Public National Registry. Thus, the final study sample consisted of 384 persons; 95 men (24.7%) and 289 women (75.3%). Due to inclusion criteria of the ENABLE AGE Project, the participants were 80-89 years old and lived alone in ordinary housing in urban districts. The mean age was 84.9 years (SD=3.0). Approximately half of the participants owned their home. The mean length of stay in the present home was 22 years (SD=17), and on average the participants perceived their economic situation as good: 8 (q1-q3: 6-10, possible range 0-10). After four years 70 participants (18%) had moved either to another ordinary dwelling (n=24), or to special housing (n=46); in all, 314 persons (82%) stayed put. Sixty-nine of the participants (18%) died during the four-year study period without having moved first.

## Measures

Demographic information such as sex, age and perceived economic situation was collected by means of study-specific questions developed for the ENABLE-AGE Project (Iwarsson et al. 2005). Relocation (the dependent variable) was recorded as the first move observed either to ordinary or special housing for an observation period of four years.

### *Aspects of health*

A total *number of symptoms* (range 0-30) was obtained by means of the Symptom List Questionnaire (Tibblin et al. 1990) (see Table 1). A total *number of symptoms of depression* (range 0-15) was collected with the Geriatric Depression Scale (Sheikh and Yesavage 1986). Four tasks from the Mini Mental State Examination (Folstein et al. 1975) considered being sensitive to indicate *cognitive deficits* (Eccles et al. 1998) were used. As one of the tasks was to write a sentence which for some participants was not possible due to physical limitations, the variable used was the proportion of correctly performed applicable tasks. *Use of mobility devices* was obtained from two items of the personal component of the Housing Enabler instrument (described below) (Iwarsson and Slaug 2001), dichotomised as either non-use (0) or use (1). *Independence in ADL* was professionally assessed with the ADL Staircase, by means of observation and interview (Sonn and Hulter Åsberg 1991). Five personal ADL (P-ADL) items (feeding, transferring, toileting, dressing and bathing) and four I-ADL items (cooking, using transportation, cleaning and shopping) were obtained on a 3-graded scale (independent/partly dependent/dependent). For this study, the items were dichotomised as independent (0) or dependent (1) according to recommended procedures (Sonn and Hulter Åsberg 1991). *Perceived functional independence* was obtained as a single item “In all, how do you perceive your functional independence regarding performing activities in daily life?” from the Neuropsychological Ageing Inventory (Oswald 2005), scored from 0 (totally dependent) to 10 (totally independent). *Perceived health* was rated by the single item “In general how would you say your health is” retrieved from the SF-36 (Sullivan and Karlsson 1994), scored from 1 (excellent) to 5 (poor). A single item on *life satisfaction* “In all, how satisfied are you with your life?” was scored from 0 (very unsatisfied) to 10 (very satisfied) (Iwarsson et al. 2005). For description of health variables, see Table 1.

--Table 1 here.--

### *Aspects of housing*

Data on objective aspects of housing were collected by means of study-specific questions developed for the ENABLE-AGE Project (Iwarsson et al. 2005). *Tenure* was dichotomised as either rented (0) or owned (1). *Type of dwelling* was coded either as multi-dwelling (0) or one-family house (1). In addition, the sum of *years lived in the present dwelling* as well as *number of rooms* (not including kitchen and bathroom) were obtained (see Table 2).

Often treated as a variable capturing an objective aspect of housing, while in fact representing a composite variable that combines individual capacity and environmental demand (P-E fit), housing *accessibility* was assessed by means of a project-specific version (Iwarsson et al. 2005) of the Housing Enabler (Iwarsson and Slaug 2001). In the first step, by means of the personal component of the instrument, 15 functional limitations were assessed by a combination of interview and observation. In the second step, the environmental component was administered as an observation of 188 environmental barriers indoors, at entrances and in the close outdoor surroundings. The third step comprised the calculation of a total

accessibility score, i.e. the relationship between the personal and the environmental components, based on predefined severity ratings from 0 to 4 that quantify the severity of the P-E fit problems predicted to arise in each case. Based on the assessments accomplished in step 1-2, using a complex matrix comprising the predefined severity ratings, the profile of functional limitations identified in each person is juxtaposed with the environmental barriers found present. This analysis is run item by item, and each P-E fit incongruency is quantified by means of the 0-4 scale. The sum of all the predefined points yields a score summing up the problems anticipated (theoretical range 0 - 2,150). Thus, the magnitude of problems caused by a particular combination of functional limitations and environmental barriers, i.e. the magnitude of P-E fit problems, is calculated. In cases where no functional limitations or dependence on mobility devices are present, the score is always zero. Higher scores mean more P-E fit problems.

Perceived aspects of housing were captured by means of a four-domain model of perceived housing: i.e., usability, meaning of home, housing related control belief, and housing satisfaction (Oswald et al. 2006). Due to the results of psychometric testing within the ENABLE-AGE Project, Oswald and co-authors recommend using parts of four different questionnaires in the following way: The *Usability in My Home* Questionnaire (Fänge and Iwarsson 1999, 2003) captures the degree to which the person perceives that the physical environment supports the performance of activities in the home, each item scored from 1 (not at all suitable) to 5 (very suitable) (see Table 1). One subscale captures usability in terms of activity and included four items ( $\alpha=0.67$ ) for example, “In terms of how you normally manage your cooking or preparation of snacks, to what extent is the home environment suitably designed in relation to this?”. The other subscale used captures usability as related to the physical home environment and included six items ( $\alpha=0.75$ ) for example, “How usable do you feel that the interior of your home is?” (Oswald et al. 2006). Given the individually-tailored response options, some items were not applicable to all participants. Thus, a mean based on the scores of the applicable items was calculated and imputed; higher mean scores on each subscale indicate better usability. The *Meaning of Home* Questionnaire (Oswald et al. 1999) covered home attachment in terms of different kinds of bonding to the home. The participants rated each item from 0 (strongly disagree) to 10 (strongly agree). The physical bonding-subscale included seven items ( $\alpha=0.60$ ) for example, “Being at home means for me to be living in a place that is comfortable and tastefully furnished”. The behavioural bonding-subscale included six items ( $\alpha=0.67$ ), for example, “Being at home means for me to be able to do what I want”. The cognitive/emotional bonding-subscale included ten items ( $\alpha=0.62$ ), for example, “Being at home means for me feeling safe” (Oswald et al. 2006). A mean score on each subscale was calculated; higher score means stronger attachment to the home. With the *Housing-Related Control Belief* Questionnaire (Oswald et al. 2003) the participants rated to what extent events in the home were dependent on him/herself or upon external control of, for example, powerful others, chance, or of faith, rated from 1 (not at all) to 5 (very much) on each item. A mean score of sixteen items ( $\alpha=0.67$ ) was calculated; higher scores indicate more external control (Oswald et al. 2006). *Housing satisfaction* was captured by a single item. “Are you happy with the conditions of your home?” retrieved from the Housing Options for Older People (HOOP) questionnaire (Sixsmith and Sixsmith 2002), rated from 1 (no, definitely not) to 5 (yes, definitely).

In addition to the four-domain model, another two items from the HOOP questionnaire, relevant for relocation, were retrieved “Do you think your home will still suit you in the future if things change?” and “Would moving from this home be a big upheaval for you?”, each question rated from 1 (no, definitely not) to 5 (yes, definitely). *Neighbourhood satisfaction*



was rated with a study-specific single item “In all how satisfied are you with your neighbourhood?” graded from 0 (very unsatisfied) to 10 (very satisfied) (Iwarsson et al. 2005). For description of housing variables, see Table 2.

--Table 2 here--

## **Statistical analyses**

Cox regression analyses were used in order to explore aspects of health and housing that related to time to relocation, either to ordinary or to special housing. The participants were followed up to four years from baseline until whichever of the following dates came first: date of relocation to ordinary housing, date of relocation to special housing, date of death, or end of study. End of study was exactly four years after baseline, defined by the individual date of the first data collection. Those who died before the end of study, without having moved, were considered censored at the time of the death (n=69). Furthermore, those who moved to special housing were considered censored when studying predictors of relocation to ordinary housing and vice versa for studying predictors of relocation to special housing. For participants who moved more than once (n=6) only the first move was considered in the analyses.

All variables representing aspects of health and housing were inserted separately in Cox regression analyses, modelling time to relocate to ordinary housing and to special housing, respectively. P-values < 0.05 were regarded to indicate statistical significance.

Aware of that variables being non-significant when considered alone could add significant information in combination with other variables, those variables with a p-value <0.25 in the bivariate analyses were in the subsequent multivariate analyses entered into a model for moves to ordinary housing. This model was reduced in a backward, step-wise manner, implying that the independent variable with highest p-value was taken out of the model at each step until the remaining variables had p-values <0.05. Sex and age were entered into the model to control for possible confounding.

Regarding relocation to special housing, the bivariate analyses gave a large number of variables with a p-value <0.25, implying a risk of over-fitting the models by including all predictors in the multivariate analyses. Hence we first considered models including only variables representing aspects of health, and then models including only variables representing aspects of housing. Since the composite P-E fit (accessibility) variable captures aspects of both health and housing in an integrated manner, it was not included in any of these models. Each set of models was reduced in the same backward, stepwise manner as described above. In order to arrive at a model testing a combination of aspects of housing and health, the two thus reduced models were combined including also the P-E fit (accessibility) variable. Aiming at a parsimonious model, it was again reduced into a final model, and controlled for confounding by sex and age. P-values < 0.05 were regarded to indicate statistical significance for the final multivariate model.

The software SPSS 20.0 was used in all analyses.

## Results

### Relocation to ordinary housing

When testing the variables separately, being dependent in the I-ADL transportation was the only health variable that predicted relocation to ordinary housing on the 0.05 level (see Table 3). Objective aspects of housing such as tenure, type of dwelling, years living in present dwelling, and number of rooms all predicted a move significantly (see Table 4). That is, being a home-owner, living in a one-family house, living since many years in the same dwelling, or living in a dwelling with many rooms increased the possibility of a move within the ordinary housing stock.

The multivariate analyses resulted in a model with dependence in the I-ADL cleaning, perceived functional independence and type of dwelling as significant predictors (see Table 5). The predictors were not influenced by the confounders sex and age. Expressed differently, to live in a one-family house, to need help with cleaning, but still evaluating yourself as functionally independent increased the possibility for a move to another ordinary dwelling.

### Relocation to special housing

When tested separately, a majority of the health variables predicted a move to special housing significantly (see Table 3). No objective aspect of housing predicted a move to special housing however accessibility did; i.e., the more accessibility problems the stronger the possibility of a move (see Table 4). Several aspects of perceived housing were significant predictors. Decrease in usability of the physical environment, less behavioural and cognitive/emotional bonding to the home, and high external housing-related control beliefs all predicted a move to special housing. Furthermore, the less suitable the home was perceived for future changes, the higher the possibility of a move.

In the analytic step accomplished to reduce the number of variables, four health variables and one housing variable remained significant; the composite variable accessibility was seen to be significant already in the bivariate analyses (see Table 6). When combined in one model, reduced in a backwards stepwise way, first Meaning of Home: behavioural bonding ( $p=0.831$ ), then use of mobility device ( $p=0.506$ ) and finally number of symptoms of depression ( $p=0.089$ ) turned out insignificant. Thus the final multivariate model for a move to special housing comprised three significant variables; cognitive deficits, the I-ADL cooking, and accessibility. The coefficients remained the same when tested for confounding of sex and age. In other words, to live in a dwelling with severe accessibility problems, to have indications of cognitive decline, and no longer being able to cook independently all increased the possibility of a move to special housing within four years (see Table 6).

## Discussion

The main contribution of this study is the demonstration of different and contrasting patterns of predictors for moves to ordinary housing or special housing among very old people living alone in Sweden, based on the notion of P-E fit (Lawton & Nahemow 1973). Overall, the results show that dependence in the I-ADL cleaning, perceived functional independence and type of housing are related to a move to ordinary housing, while dependence in the I-ADL cooking, cognitive deficits, and accessibility problems are related to a move to special housing. The results deepen the knowledge on the complex dynamics of the components of P-E fit as related to relocation in very old age, based on comprehensive, prospective data on aspects of housing and health.

When asking older people retrospectively why they moved to another dwelling in the ordinary housing stock, numerous interacting aspects of housing and health have been mentioned (Sergeant and Ekerdt 2008). Studies on younger samples or samples with greater age spans have shown that aspects of housing are important in relation to moves to ordinary housing (Hansen and Gottschalk 2006; Oswald et al. 2002). The current study indicates that such associations are relevant also for people 80-89 years old living alone. Based on the strength of a prospective design, the explicit differentiation between objective and perceived aspects of housing and the inclusion of a composite variable that captures accessibility, hitherto not seen in studies on relocation in very old age, the present study contributes to the knowledge base in this field of research.

The findings show that predictors of a move to ordinary or special housing differ substantially, and presumably also the decision-making process differs substantially between these types of moves. Even if we cannot state anything about the decision process based on the current study, according to previous research (Nygren and Iwarsson 2009), arriving at the decision to move is a long process of negotiations with family and friends. Alternatively, a move can occur involuntarily and abruptly after a hospital visit (Bekhet et al. 2008). Most important, our findings indicate that up to four years in advance, specific but diverse aspects of housing and health are related to moves either to ordinary or special housing when living alone in very old age. In accordance with previous research (Hallberg and Lagergren 2009, Miller and Weissert 2000, Bharucha et al. 2004) the present study shows that health aspects such as dependence in I-ADL and cognitive decline are related to relocation, in particular to special housing. Since a move to special housing in Sweden requires an approved needs assessment, such results are expected. However, it should be kept in mind that in our analyses, it was not possible to account for the fact that in Sweden a need-based decision made by a municipality official is required prior to a move into special housing. In future studies, to what extent this factor influences the relations studied deserves attention.

Due to the risk of over-fitting the models to special housing, the models for moves to ordinary housing and special housing were treated slightly different. It might seem strange that when combining the reduced amount of variables of housing, health and accessibility in the final model, two well-established health-related predictors and one housing variable ended up non-significant. The final model, constituting of two health variables and the composite accessibility variable, indicates that the accessibility variable does capture important facets of the housing and health interaction, but further research is needed to understand such dynamics. Depending on the ambitions for practical application of their results, researchers should be aware of the pros and cons of using single variables that represent aspects of home and health versus a composite measure such as accessibility. Exploring aspects of health and housing as well as composite variables that capture P-E fit can deepen the knowledge on the complex interactions that are related to relocation in very old age.

The variables that were related to a move within the ordinary housing stock (Table 5) might be interpreted as a support for proactivity according to Lawton (1989) as well as for the employment of coping strategies according to Golant (2011). The indication that cognitive decline, dependence in the I-ADL cooking, and accessibility problems are related to a move to special housing within four years is in line with the assumptions implied by the ecological model of ageing. That is, poor P-E fit triggers relocation to another type of housing, implying that a move is a major form of adaptation in order to reduce environmental press (Lawton and

Nahemow 1973). However, considering the results of previous studies on ageing in place, meaning of home, identity and attachment to home in very old age (Haak et al 2011), the fact that no perceived aspects of housing remained in the final multivariate models was unexpected. Overall, the different patterns of variables related to relocation to ordinary and special housing, respectively, are intriguing and require further study.

The questionnaires on perceived housing used had only been in limited use prior to the ENABLE-AGE Project. This is a limitation, not the least since some of the sub-scales of the instruments demonstrated low internal consistency (Oswald et al. 2006). Further developments are in progress (Oswald and Kaspar 2012), and studies based on data collected with these instruments have potential to further deepen our knowledge on complex dynamics on home and health in old and very old age.

Regarding I-ADL dependence, diverging results on type of activity appearing as significantly related to relocation deserve consideration. Commonly in studies on aspects of health as predictors for relocation in old age, ADL have been treated as only one or at best as two variables, typically denoted P-ADL and I-ADL (see for example Bharucha et al. 2004; Hallberg et al. 2009). In order to better understand the complexity of P-E fit interactions and the outcome in terms of behaviour, we examined the influence of each of nine specific activities (Sonn and Hulter Åsberg 1991) on relocation. The fact that cleaning was related to a move to ordinary housing, whereas cooking was related to a move to special housing, supports that behaviour in terms of specific activity performance can be related to relocation.

It should be noted that the participants of the Swedish ENABLE-AGE national sample were relatively healthy people aged 80-89 years, living alone (Iwarsson et al 2004). Relocation occurred to both ordinary and special housing during the four-year study period, but since the sizes of the sub-samples were small, the results should be interpreted with caution. While this means a restriction in terms of generalizability, it is unusual to have such detailed information not only on aspects of health but also on objective as well as perceived aspects of housing, among very old people living in the community. The availability of exact dates for moves and deaths retrieved from a Public National Registry is another advantage. However, the four-year follow-up period in which other life events and health changes might occur in a sample of very old people is a limitation. In order to further investigate aspects of housing and health as predictors for relocation in very old age, there is a need to examine larger samples with longitudinal designs.

This study reflects the issue of relocation in very old age in a Nordic welfare state, during a four-year period starting in 2002. Contextual factors specific for Sweden could possibly impact on the relocation decision for older people, and thus also on the results of the present study. Firstly, Sweden has a well-developed home care system to support ageing in place, including provision of assistive devices and grants for housing adaptations, making staying put a viable option even for people with severe health problems. Since these services are financed by taxes and available to all citizens, most people who want to stay put despite poor health status and dependence on help can do so. Secondly, the needs-based assessment required for a move to special housing most likely influence how people reason around the potentials and challenges coming with the decision process (Nygren & Iwarsson 2009). In contrast to the possibilities described, based on the needs assessment people who want to move can be refused to do so. With its specific focus on aspects of housing and health, variables capturing influential factors on the macro level were not included in our study.

In conclusion, the results of the current study indicate that both aspects of home and of health are related to relocation in very old age, but in different patterns for relocation to ordinary housing and special housing, respectively. That is, dependence in specific I-ADL is related to both types of relocation, while perceived functional independence and type of housing are related to a move to ordinary housing, and cognitive deficits and accessibility problems are related to a move to special housing. This kind of knowledge has practical implications for relocation counseling and societal planning targeting very old people.

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Table 1. Description of aspects of health, N=384

Aspects of health	N = 384 <sup>1</sup>	
Number of symptoms <sup>2</sup> , Md (q1-q3)	7	(4-10)
Number of symptoms of depression <sup>3</sup> , Md (q1-q3)	3	(1-4)
Cognitive deficits <sup>4</sup> , Md (q1-q3)	100	(75-100)
Use of mobility device, n (%)	161	42%
Independence in P-ADL:		
Feeding, n (%)	384	100%
Transfer, n (%)	380	99%
Toileting, n (%)	379	99%
Dressing, n (%)	378	98%
Bathing, n (%)	359	94%
Independence in I-ADL:		
Cooking, n (%)	305	79%
Transportation, n (%)	218	57%
Shopping, n (%)	291	76%
Cleaning, n (%)	258	67%
Perceived functional independence <sup>5</sup> , Md (q1-q3)	9	(8-10)
Perceived health <sup>6</sup> , Md (q1-q3)	3	(2-4)
Life satisfaction <sup>7</sup> , Md (q1-q3)	9	(8-10)

Md (q1-q3) Median and (first quartile - third quartile)

<sup>1</sup>Due to internal dropout n varied from 373 to 384. <sup>2</sup>Possible range 0-30 (Tibblin et al. 1990). <sup>3</sup> Possible range 0-15 (Sheikh and Yesavage 1986). <sup>4</sup>Study-specific short version of the MMSE (Iwarsson et al. 2005); proportion of correctly performed tasks, 0-100%. <sup>5</sup>0 (totally dependent) to 10 (totally independent) (Oswald 2005). <sup>6</sup>1 (excellent) to 5 (poor) (Sullivan and Karlsson 1994). <sup>7</sup>0 (very unsatisfied) to 10 (very satisfied) (Iwarsson et al. 2005).

Table 2. Description of aspects of housing and P-E fit, N=384

Aspect of housing	N=384 <sup>1</sup>	
<b>Objective aspect</b>		
Tenure		
Rented, n (%)	194	52%
Owned, n (%)	182	48%
Type of dwelling		
Multi dwelling, n (%)	321	84%
One family house, n (%)	63	16%
Years living in present dwelling, mean (SD)	22	(17)
Number of rooms, Md (q1-q3)	3	(2-4)
<b>P-E fit</b>		
Accessibility <sup>2</sup> , Md (q1-q3)	124	(41-228)
<b>Perceived aspects</b>		
Usability <sup>3</sup> , Md (q1-q3):		
Activity	5.0	(4.5-5.0)
Physical environment	4.8	(4.3-5.0)
Meaning of home <sup>4</sup> , Md (q1-q3):		
Physical bonding	9.1	(8.4-10.0)
Behavioral bonding	9.0	(7.5-10.0)
Cognitive/emotional bonding	8.6	(8.0-9.1)
Housing-related control belief, external <sup>5</sup> , Md (q1-q3)	2.8	(2.5-3.2)
Housing satisfaction <sup>6</sup> , Md (q1-q3)	5	(5-5)
House still suitable in the future <sup>7</sup> , Md (q1-q3)	4	(3-5)
Upheaval to move <sup>7</sup> , Md (q1-q3)	5	(4-5)
Neighborhood satisfaction <sup>8</sup> , Md (q1-q3)	9	(7-10)

Md (q1-q3) Median and (first quartile - third quartile)

<sup>1</sup>Due to internal dropout n varied from 366 to 384. <sup>2</sup>Higher scores indicate more accessibility problems, max-min in this sample; 0-670 (Iwarsson et al. 2005). <sup>3</sup>Possible range 1-5, higher scores indicate better usability (Fänge and Iwarsson 1999, 2003). <sup>4</sup>Possible range 0-10, higher scores indicates stronger attachment to home (Oswald et al. 1999). <sup>5</sup>Possible range 1-5, higher score indicates higher external housing-related control belief (Oswald, 2003). <sup>6</sup>Single item, possible range 1-5; higher value indicates higher housing satisfaction (Sixsmith and Sixsmith 2002). <sup>7</sup>Single item, 1 (no, definitely not) to 5 (yes, definitely) (Sixsmith and Sixsmith 2002).

<sup>8</sup>Single item, 0 (very unsatisfied) to 10 (very satisfied) (Iwarsson et al. 2005).



Table 3. Aspects of health as predictors of relocation to ordinary (n=24) and to special (n=46) housing (single variables)

Aspects of health	Ordinary housing (n=24)			Special housing (n=46)		
	HR	p-value	95 % CI	HR	p-value	95 % CI
Number of symptoms		†			†	
Number of symptoms of depression	0.87	(0.210)	0.70-1.08	1.19	(0.001)	1.07-1.32
Cognitive deficits <sup>1</sup>		†		0.12	(<0.001)	0.04- 0.38
Mobility device <sup>2</sup>		†		2.80	(0.001)	1.54-5.10
P-ADL <sup>3</sup> :						
Feeding		†			†	
Transfer		†			†	
Toileting		†			†	
Dressing		†			†	
Bathing		†		4.14	(<0.001)	1.93-8.87
I-ADL <sup>3</sup> :						
Cooking		†		3.95	(<0.001)	2.20-7.09
Transportation	2.28	(0.047)	1.01-5.13	2.51	(0.002)	1.39-4.55
Shopping		†		3.46	(<0.001)	1.93-6.20
Cleaning	1.85	(0.137)	0.82-4.18	2.81	(<0.001)	1.57-5.02
Perceived functional independence <sup>4</sup>	1.21	(0.207)	0.90-1.63)	0.77	(<0.001)	0.70-0.86
Perceived health <sup>5</sup>		†		1.34	(0.039)	1.02-1.77
Life satisfaction <sup>6</sup>		†		0.80	(0.002)	0.69-0.93

HR = hazard ratio; 95% CI = 95% confidence interval for hazard ratio; † p > 0.25; Statistical significance: p < 0.05

<sup>1</sup>Proportion of correctly performed tasks, 0-100%. <sup>2</sup>No-use=0 use=1. <sup>3</sup>Independent=0 dependent=1. <sup>4</sup>0 (totally dependent) to 10 (totally independent). <sup>5</sup>1 (excellent) to 5 (poor). <sup>6</sup>0 (very unsatisfied) to 10 (very satisfied).

Table 4. Aspects of housing and P-E fit as predictors of relocation to ordinary (n=24) and to special (n=46) housing (single variables)

Aspects of housing	Ordinary housing (n=24)			Special housing (n=46)		
	HR	p-value	95 % CI	HR	p-value	95% CI
<b>Objective aspects</b>						
Tenure <sup>1</sup>	2.95	(0.024)	1.16-7.54	0.59	(0.092)	0.32-1.09
Type of dwelling <sup>2</sup>	4.39	(<0.001)	1.97-9.80	†		
Years living in present dwelling	1.02	(0.049)	1.00-1.04	†		
Number of rooms	1.31	(0.035)	1.02-1.68	†		
<b>P-E fit</b>						
Accessibility <sup>3</sup>		†		1.50	(<0.001)	1.23-1.83
<b>Perceived aspects</b>						
Usability <sup>4</sup> :						
Activity		†		0.71	(0.154)	0.44-1.14
Physical environment		†		0.53	(0.004)	0.35-0.82
Meaning of home <sup>5</sup> :						
Physical bonding	1.44	(0.156)	0.87-2.27	0.78	(0.073)	0.60-1.02
Behavioral bonding		†		0.76	(<0.001)	0.65-0.88
Cognitive/emotional bonding	1.73	(0.057)	0.98-3.06	0.72	(0.006)	0.57-0.91
Housing-related control belief, external <sup>6</sup>		†		3.15	(0.001)	1.60-6.20
Housing satisfaction <sup>7</sup>		†		0.75	(0.099)	0.54-1.05
House still suitable in the future <sup>8</sup>		†		0.78	(0.038)	0.62-0.99
Upheaval to move <sup>9</sup>		†		0.87	(0.232)	0.69-1.09
Neighborhood satisfaction <sup>10</sup>		†		†		

HR = hazard ratio; 95% CI = 95% confidence interval for hazard ratio; † p > 0.25; statistical significance: p < 0.05.

<sup>1</sup>Rented (0), owned (1). <sup>2</sup>Multi-dwelling (0), one-family house (1). <sup>3</sup>Min-max: 0-670, higher scores indicate more accessibility problems. The score is used in the analyses as the original score/100. <sup>4</sup>Possible range 1-5, higher scores indicate better usability. <sup>5</sup>Possible range 0-10, higher scores indicates stronger attachment to home. <sup>6</sup>Possible range 1-5, higher score indicates higher external housing-related control belief. <sup>7</sup>Possible range 1-5, higher value indicates higher housing satisfaction. <sup>8</sup>Possible range 1-5, higher value indicate more suitable

house. <sup>9</sup>Possible range 1-5, higher value indicates more upheaval to move. <sup>10</sup>Possible range 0-10, higher value indicates higher satisfaction.

Table 5. Model on aspects of health and housing predicting relocation to ordinary housing (multivariate analyses)

Covariate	HR	p-value	95% CI
Sex <sup>1</sup>	2.81	(0.067)	0.93-8.47
Age	1.10	(0.216)	0.95-1.27
Cleaning (I-ADL) <sup>2</sup>	2.52	(0.041)	1.04-6.12
Perceived functional independence <sup>3</sup>	1.53	(0.008)	1.12-2.10
Type of dwelling <sup>4</sup>	7.07	(<0.001)	3.03-16.51

HR = hazard ratio; 95% CI = 95% confidence interval for hazard ratio; Statistical significance: p < 0.05

<sup>1</sup>Men (0) women (1). <sup>2</sup>Independent (0) dependent (1). <sup>3</sup>Totally dependent (0) to totally independent (10).

<sup>4</sup>Multi-dwelling (0) one-family house (1).

Table 6. Models on aspects of health, housing and P-E fit predicting relocation to special housing (multivariate analyses)

Covariate	HR	p-value	95% CI
<b>Reduced health model</b>			
Cooking (I-ADL) <sup>1</sup>	2.55	(0.003)	1.37-4.74
Number of symptoms of depression	1.14	(0.027)	1.01-1.27
Cognitive deficit <sup>2</sup>	0.16	(0.004)	0.05-0.55
Mobility device <sup>3</sup>	2.22	(0.011)	1.20-4.12
<b>Reduced housing model</b>			
Meaning of home; behavioral bonding <sup>4</sup>	0.76	(<0.001)	0.65-0.88
<b>P-E fit model</b>			
Accessibility <sup>5</sup>	1.50	(<0.001)	1.23-1.83
<b>Final model</b>			
Sex <sup>6</sup>	1.58	(0.245)	0.73-3.40
Age	1.06	(0.281)	0.95-1.18
Cooking (I-ADL) <sup>1</sup>	2.86	(0.002)	1.48-5.54
Cognitive deficit <sup>2</sup>	0.18	(0.006)	0.05-0.60
Accessibility <sup>5</sup>	1.27	(0.036)	1.02-1.58

HR = hazard ratio; 95% CI = 95% confidence interval for hazard ratio; Statistical significance: p < 0.05

<sup>1</sup>Independent (0) dependent (1). <sup>2</sup>Proportion of correctly performed tasks, 0-100%. <sup>3</sup>No use (0) use (1). <sup>4</sup>Possible range 0-10, higher scores indicates stronger attachment to home. <sup>5</sup>Min-max: 0-670, higher scores indicate more accessibility problems. The score is used in the analyses as the original score/100. <sup>6</sup>Men (0) women (1).