Disability and Residential Mobility among the Elderly: Changes from the Eighties to the Nineties

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In 1991, Speare, Avery and Lawton showed that, during the eighties among the American elderly, disability triggered residential mobility, institutionalization, and the need of living in a more complex living arrangement. The loss of ability over time was even a better predictor for the latter two situations. The United States has experienced a decrease in disability prevalence and an increase in the mean age of disabled people. The aim of this paper is to analyze whether the impact of disability on residential mobility and institutionalization changed during the last decades of the 20th century. It compares residential mobility, institutionalization, and living arrangements among people 70 years old or older in 1984 (LSOA I) with people of the same age in 1994 (LSOA II). The evidence shows that disability at baseline has a stronger effect on residential mobility and on living with others during the 1990s than during the 1980s.

In 1991, Speare, Avery and Lawton analyzed the first two waves of the I Longitudinal Study of Aging (LSOA I) and showed that, during the eighties among the American elderly, disability triggered residential mobility, institutionalization, and the need of living in a more complex living arrangement. The loss of ability over time was even a better predictor for the latter two situations. During the 1990s, the old age population of the United States has experienced a particular historical context characterized by an increase in life expectancy, a decrease in disability prevalence (Freedman et al, 2004), more exposure to Medicare benefits (Manton et al, 1997), and an augment in the mean age of disabled people. Period and cohort effects might then be playing a role in how and when the elderly move from one place to another.

The aim of this paper is to analyze whether the impact of disability on residential mobility, living arrangements, and institutionalization changed during the last decades of the 20th century. It compares residential mobility and institutionalization among people 70 years old or older in 1984 (LSOA I study population) with people who were 70 years old or older in 1994 (LSOA II study population), taking the advantage of having these two longitudinal studies that are roughly comparable between them. We utilize random effects logistic regressions to account for repeated measures in the outcomes. Besides, in their paper, these researchers recommend caution in interpreting a causal relationship between disability and residential mobility or institutionalization, because they can not clearly establish the ordering of the events, given the data that they used. However, for their paper, they only use the first two LSOA I waves (1984 and 1986). In contrast, we use LSOA I four waves (period 1984-1990) and LSOA II three waves (period 1994-2000) to provide conservative estimates of the effects of disability and change in disability status on the three dependent variables, by lagging the change in disability one wave apart.

Theoretical background

One of the most recurrent approaches to explain theoretically the relationship between disability and moves by the elderly (institutionalization, residential mobility, living arrangements) is Lawton's (1982) Person-Environment Fit or Person-Environment Model, cited also by Speare, Avery and Lawton. According to this framework, the older persons modify their behavior in order to negotiate their capacity or functionality –

competence- with their environmental "press", that is, the set of demands that the circumstances play on them. Lawton assumes that older individuals are "environmentally proactive" in adjusting to changes in their competence, transforming their surroundings in order to fulfill their own needs. Adjustments may come in the form of entering a nursing home, moving to another house, or entering into a more complex living arrangement.

As Speare and colleagues note, Lawton's approach is similar to other sets of explanations built to study residential mobility, such as Wolpert's stress threshold (1966) and Speare's residential satisfaction (1974). Both authors highlight the process of decision making, which evolves from changes in the environment or in the needs of the family. These changes produce stress or dissatisfaction, then trigger the weighing of costs and benefits, and subsequently a move to another place. In this case, the incongruity between a disabled status and their surroundings may produce dissatisfaction and may make an older person to decide to move. A complement to this type of framework is research done on preferences and motivations. Angel, Angel, McClellan and Markides (1996) discuss how institutionalization is a measure of last resort for the old-age population they are studying (Mexican-Americans in South West U.S.A.) because the vast majority prefers to live with family if health declines; more than three quarters of the respondents that lived with their spouses expressed that they would prefer to stay in their current living arrangement. Meyer and Speare (1985) and DeJong and Fawcett (1981) discuss that there are different motivations for moving out of current home towards another place. Motivations are a product not only of the environmental "press" suggested by Lawton, but by values and expectations of what the present and the future of one's family would be. Using data from LSOA I, DeJong, Wilmoth, Angel and

Cornwell (1995) analyze the motivations given by American elderly who moved from one residence to another. They find that change in disability predicts only residential mobility motivated by health, comfort and functional independence reasons, but does not predict moves motivated by affiliation (living closer to relatives) or by family crisis; the first set of motivations accounts for half of the moves.

In a sense, the existence of different motivations is closely related to the categorization of risk factors of institutionalization summarized by Miller and Weissert (2000), and inspired in Andersen's Behavioral Model of Health Services Use (1995). Risk factors of institutionalization are classified in needs, predisposing conditions, and enabling conditions. Whereas disability is a need, age and current living arrangements can be seen as predisposing factors, usually exogenous characteristics that act as distal causes. Enabling factors are necessary but not sufficient causes for institutionalization, such as lack of homeownership or state reimbursement rates. Linking this framework with DeJong et al's findings (1995), disability levels would trigger moving (to an institution or into another household structure) when motivation is health, comfort, or functional independence, because disability creates needs for better services. However, if these special services are not needed, or there are other conditions (death of a spouse, eviction) that generate more need for a change, other motivations for residential mobility or shifts in living arrangements may arise. This behavioral model –particularly its emphasis in needs as proximate determinants- can also explain the rationale behind the developmental typology of old-age residential mobility offered by Litwak and Longino (1987). For these authors, there are three stages over the life course of the elderly that may facilitate migration: a first stage is the period after retirement, when working

constraints no longer exist and healthier people can migrate long distances (e.g., to the Sun Belt); a second stage, when disability increases moderately and therefore some help starts to be needed, and a third stage, when major disability or chronic diseases makes institutionalization or residential mobility a more explicit need.

Empirical background

These different theoretical frameworks have been used to support different empirical research about the link between disability and any of the three moves studied by Speare, Avery and Lawton. As mentioned before, they found that disability was a good predictor of institutionalization, while change in the number of ADL-IADL limitations over time were good predictors for residential mobility and living with others. In their "Background section", they provide a good literature review to that moment. A similar article, published approximately at the same time as theirs and with the same dataset, but restricted to unmarried persons at baseline is the one written by Worobey and Angel (1990). They report that deterioration of physical functioning was related to moving into a more complex household or to a nursing home, too. They also show that -even though the occurrence of this pattern- still most of the elderly remained in the same living arrangement in which they were at baseline. As mentioned before and using the same dataset (LSOA I), DeJong et al (1995) find that disability was related to certain types of residential mobility (those motivated by health, comfort, or functional independence), but not to others (affiliation and family crisis). Silverstein and Zablotski (1996) also find a relationship between the number of IADL limitations and the

likelihood of American elderly to migrate to retirement communities or institutions; the only relationship that was not significant was with migration to other kinds of communities, which provide less number of services. A more recent article utilizes hazard models to study institutionalization and household expansion as competing risks (Hays, Pieper and Purser, 2003). Again, increases in ADL limitations augmented the hazards of experiencing a shift in household of residence; people with worsening capacities tended to have higher odds of moving into a nursing home rather than into an expanded household. In a good review of articles published in scholarly journals between 1985 and 1995, Miller and Weissert (2000) describe that, among 49 studies, 36 found a significant positive relationship between lower ADL functioning and nursing home placement, and among 14, five reported a significant link between ADL and hospitalization; regarding IADL limitations, among 19 articles, 12 had a significant positive relationship with nursing home placements, and among 6, only one had a significant positive association with hospitalization.

It is important to take into account another body of research that proposes the reverse direction in causality between the two sets of variables: type and change of living arrangements as well as institutionalization take a toll on functionality and on health, in general. Using cross-sectional data, Waite and Hughes (1999) explain that old adults living with a spouse only or with a spouse and their children have better physical mobility (measured as an index) than households where the person lives alone or with others; they consider these latter types of households as either more demanding or less supportive of the needs of the elderly. Based on results from LSOA I, Chen and Wilmoth (2004) report that elderly that moved to another residence experienced short-term, but not

long-term, increases in ADL and IADL limitations, but only among those that their motivation for moving was due to health reasons. Given that the association is with short-term functional worsening, there might be some effect of expectations of functional decline that leads to moving out, and that subsequently might prompt increases in disability. Walk, Fleishman and Mandelson (1999) discuss how, in Israel, nursing home can both improve or deteriorate the functional status of their elderly residents, depending on the quality of rehabilitation provided.

Changes between the 1980's and the 1990's: The role of context?

The aim of this paper is to test whether the effect of disability on moves by the elderly have changed from the 1980 decade to the 1990 decade. American elderly has experienced sharp transformations during the last two decennia of the 20th century. The population ages 65 and over grew from 25.5 million in 1980 to 35 million in 2000. Its proportion with respect to the total population augmented from 11.3% to 12.4%. Minorities (Blacks, Hispanics, Asians and Asian-Americans) have grown faster than Whites (National Center for Health Statistics, 2005). Part of this growth in the whole age group is explained by higher probabilities of survival, since life expectancy at age 65 increased almost 1.5 years during this period; the increase among males was stronger (almost 2 years) than among females (Federal Interagency Forum on Aging-Related Statistics, 2004). Additionally, according to official data about Medicare enrollees, based on the National Health Care Survey, disability prevalence has been falling from 25% in 1985 to 20% in 1999 (Federal Interagency Forum on Aging-Related Statistics, 2004).

Reynolds, Crimmins and Saito (1998) report a similar trend. A special report written by a technical working group on disability estimate that prevalence of ADL limitations has been falling in around 1% to 2.5% per year during the same period; however, they find inconsistencies in this estimate if the definition of disability or of the target population is varied (Freedman, Crimmins, Schoen et al, 2004). Nursing home utilization has been declining, too: the rate of population 65 and over in nursing homes went from 54 per thousand to 43 per thousand (Federal Interagency Forum on Aging-Related Statistics, 2004). In part, this trend is due to rising mean age of entrance to this kind of institutions: from 81.1 in 1985 to 82.6 years old in 1997; in part, it is also due to a drop in mean length of stay -from 89 days in 1985 to 45 days in 1997-; besides, nursing home discharge was more frequent at the end of the nineties than during the mid-eighties (Sahyoun, Pratt, Lentzner, Dey and Robinson, 2001).

Can the different frameworks discussed previously explain secular changes? They stress on factors that affect individuals' decision making processes; however, they are incomplete in explaining why the effect of risk factors might evolve over time. Macro-level processes might be better in understanding this evolution, although the literature is scant on this topic (Hays, 2002), except for the articles that use Andersen's Behavioral Model (Miller and Weissert, 2000; Hays, Pieper and Purser, 2003). Using this framework, it is possible to state that at the same level of need (same number of ADL and IADL limitations), there might be a different mix of enabling (homeownership, Medicaid reimbursements) and predisposing factors (culture, longer spouse survival) that might affect the probability that a disabled person would look for residential mobility or a change in living arrangements.

Among these predisposing factors, culture has been one of the most cited by international studies (Brown, Liang, Krause et al, 2002; Chattopadhyay and Marsh, 1999; Pérez-Amador and Brenes, forthcoming) and by researchers that investigate living arrangements among ethnic groups in the U.S.A. (DeJong, Wilmoth, Angel and Cornwell, 1995; Phua, Kaufman and Park, 2001; Waite and Hughes, 1999; Worobey and Angel, 1990). Most of these researchers have focused on the so-called familistic type of households that characterizes certain groups like Asians and Latin Americans. Although not all the differences between racial, ethnic or international groups should be explained by such a general concept as culture, there are certain particular traditions, values and beliefs that can affect the decision of institutionalizing an old person, or of expanding a household with a senior. The argument is valid in this analysis, since Speare, Avery and Lawton do not control for race and ethnicity. It is also valid in the sense that the growth in the relative presence of Hispanics and Asians in the U.S.A. can even affect the views that natives might have on nursing homes or living arrangements.

Another set of predisposing factors that might have a stronger effect on American daily living is the one that encompasses economic trends and welfare policy. Costa (1997) noted how the creation of the pension system allowed Union Army Veterans to keep independent living arrangements during the late 19th century and early 20th century, and McGarry and Schoeni (2000) derive a similar conclusion for the effect that the Social Security program had on widows' autonomy during the late part of the 20th century. Welfare policy is capable of making institutionalization easier or harder depending on the incentives provided. For example, Carriere and Pelletier (1995) argue that, compared to the other Canadian provinces, the higher likelihood of institutionalization in Quebec,

Ontario and The Prairies is due to more lenient requisites for accepting a person into a nursing home. Besides, welfare policy can protect against macro-economic downturns. The relationship between the American macroeconomic context and welfare institutions is important to consider given the rise in health care costs, which in theory might affect the elderly harder. The percentage of the Gross Domestic Product (GDP) represented by health expenditures have grown from 8.8% in 1980 to 13.3% in 2000. National average annual health care costs for people over 64 years old are higher than $11,000, but among people in nursing homes, costs increase to almost $47,000, money that comes mainly from public investment. In 2001, 46% of nursing home expenditure was covered by Medicaid, but another 48% was covered by out-of-pocket sources (National Federal Interagency Forum on Aging-Related Statistics, 2004). For low and middle income elderly that are not eligible for public support, institutionalization turns out to be a very expensive alternative. Elderly immigrants are particularly vulnerable, because they are less likely to fulfill the eligibility standards (Angel and Angel, 1997). The effect of policy has been clearly observed in the U.S.A. when the 1997 Balanced Budget Act modified Medicare payment procedures. This modification discouraged home health care usage, making it more expensive as an alternative to institutionalization (National Federal Interagency Forum on Aging-Related Statistics, 2004; McCall, Petersons, Moore and Korb, 2003; Sahyoun, Pratt, Lentzner, Dey and Robinson, 2001). Summarizing, acknowledging the economic and institutional context is useful in understanding changes over time; however, research in the U.S.A. tends to neglect this framework in a larger scale than their European counterparts (Mayer and Schoepflin, 1989).

An additional kind of enabling factor that have been varying over time with a very fast pace during the last centuries is technological development (Russell, Hendershot, LeClere et al, 1997; Hoenig, Taytor and Sloan, 2003). Again, a senior during the eighties might have been experiencing the same level of difficulty in performing certain ADL's and IADL's than another senior during the nineties, but the latter might have possibly had available more technological resources to deal with the limitations: scooters or walkers for going from one place to another, better hearing devices, better glasses, or drugs .

Data

As mentioned before, this analysis was possible because of the availability of the datasets from the two Longitudinal Studies of Aging: LSOA I and LSOA II. The studies were conducted collaboratively by the National Center for Health Statistics (NCHS) and the National Institute on Aging. In both cases, the baselines (1984 and 1994) were the Supplements on Aging of the National Health and Interview Survey. The study populations were comprised by all individuals who were non-institutionalized and 70 years of age and over during the first wave interviews. In both cases, the surveys used stratified multistage probability sampling designs. Interviews were conducted in person only for the two baseline surveys and with self-report, except when proxy respondents were needed; the criteria used for selecting proxies were very similar between studies. Respondents of the follow-up waves were interviewed by phone or mail in LSOA I, and with a CATI (Computer-Assisted Telephone Interview) system in LSOA II. The original sample size was of 7527 subjects in 1984 and of 9447 in 1994. However, in 1986, the

project drew a subsample of 5151 individuals; the whole original sample (not the subsample) was the basis for the 1988 and 1990 follow-ups: The analysis for LSOA I is based on the 5151 subsample, because of the missing information for the persons that were not interviewed in 1986. Decedents and losses to follow-up were relatively high in the two LSOAs. Table 1 shows the level of attrition for each sample. Proportions dead or in institutions with respect to the total original sample remain very similar from the first to the second cycle. However, the most striking difference is that refusals and missing persons ("status unknown") were no larger than 14% at the end of LSOA I, but reached a level of 27% in 2000, at the end of LSOA II. In both studies, missing or dead persons were more likely to be males, older, disabled, and confused, have worse self-reported health, and live with others. Besides, losses to follow-up in LSOA I tend to be residing at their houses for a shorter period, while missing subjects in LSOA II were more likely to be poorer and have no children. The fact that dead or missing subjects were sicker than the ones that remained in the sample -and thus more likely to be institutionalized or residentially mobile for health reasons- makes it plausible that positive effects of disability on the outcome variables produced by this analysis as well as by Speare and colleagues are underestimated.

There are some design differences between the two studies. While in LSOA I, baseline interviews were held at the same time as the NHIS interviews, there was a lag between them in LSOA II. This lag caused a decrement in the response rate from 93.2% to 87.4%. Additionally, the 1994 NHIS oversampled the black population, and the number of PSU's sampled was reduced. There were three biennial follow-up surveys after baseline in LSOA I, while there were only two in LSOA II held every three years.

Another important difference is related to the 1986 interview (the first follow-up after baseline). Institutionalized persons were not interviewed in 1986, but were included in the sample in 1988 and 1990, as well as in the second and third waves of LSOA II. This causes some trouble in the estimation of models because being in a nursing home in 1986 is almost perfectly correlated with having no information about previous status in 1988. There was also a special tracking of non-interviewed persons that was performed only for the 1986 wave, too; this might introduce problems of comparability, especially producing overestimation of the proportion of elderly in institutions in 1986, because there was an extra effort in locating people that otherwise would have been difficult to find.

The main outcome variables that are analyzed in this paper are the same studied by Speare, Avery and Lawton: institutionalization, moving between waves, and living in a household with other people besides spouse and children under age 18. Institutionalization is computed from the status of the individual recorded at the beginning of the interview; as explained above, problems of comparability may arise because of the special tracking done only for the 1986 follow-up. Residential mobility is determined from a question asked earlier in the questionnaire about whether the person has moved since last interview. Finally, living with others was defined as respondents who lived in a household with somebody other than respondent's spouse or children under 18. There is an important difference between LSOA I and LSOA II. The former dataset contains complete information from the household roster therefore it is straightforward to compute this variable. LSOA II dataset does not include the whole household roster, thus "living with others" was computed indirectly by taking into

account all those respondents who did not have information in the questions that should not be answered by those who lived only with spouse and minors.

The main explanatory variable is disability and change in disability status from one wave to the other. Given that the main goal of the paper is to study whether results found by Speare, Avery and Lawton have changed from the eighties to the nineties, we decided to use the same operationalization utilized by these authors: disability is equal to the sum of the Activities of Daily Living (ADL's) and Instrumental Activities of Daily Living (IADL's) for which the respondents have any difficulty to perform. ADL's and IADL's have been popular as indexes of functional capacity, especially for elderly population (Katz et al, 1963). In their article, Speare, Avery and Lawton decided to use this sum instead of other operationalizations because it was a good predictor of death and institutionalization, and because other ways of defining disability did not seem to change results much (p.S136). Although the main goal of this paper was to try to reproduce these authors' methods, the LSOA II questionnaire does not enquire for having any difficulty for getting outside, one of the ADL's. This means that the index for disability used in this paper ranges from 0 to 12, instead of 0 to 13. The ADL's included in the index are: bathing and showering, dressing, eating, getting in and out of a bed or chairs, waking, and using the toilet. The IADL's in the sum are: preparing meals, shopping for personal items, managing money, using the telephone, heavy housework and light housework. Each one was added in the sum if the respondent had any difficulty performing it because of health reasons.

Two other health-related independent variables are in the analyses: a self-rated scale that ranges from 1 to 5, where 1 is "Excellent" and 5 is "Poor", and whether the

person is often confused or not. Speare, Avery and Lawton had the possibility of splitting this variable in three categories: "Never or rarely", "Somewhat", or "Frequently". However, LSOA II classified respondents in only two categories: "Frequently confused" and "Not frequently confused". As the authors did, all those whose interviews were responded by a proxy were characterized as "often confused". Regarding the scale, it is used as a continuous variable in the analyses. The other variables are: sex, age, living arrangements (living alone, only with spouse, with spouse and others, only with others), living children (none, only sons, at least one daughter), duration of residing in current house, and family income. Because LSOA I and LSOA II datasets report income in categories, it was not straightforward to compute real income and create income classes comparable to those of 1984. Since we noticed that the limits for the income brackets used by Speare and colleagues were approximately equal to the first and third quartiles, we decided to split 1994 income in 3 categories using the same percentiles as cutoff points; there is a set of quartiles for LSOA I (1984 dollars) and another one for LSOA II (1994). Income is the variable with the largest number of missing values: the analyses imitate Speare, Avery and Lawton's strategy of including all the missing values in the reference category of middle income. Except for the disability index and age, all the rest of the covariates refer to their values at baseline: they are not time-varying covariates. Replicating these authors' procedures, all the analyses were performed with casewise deletion due to missing values in the covariates. Additionally, LSOA II does not enquire about homeownership at baseline; thus, this variable is excluded from the analysis, in spite of the fact that it is a good predictor of the outcomes, particularly of residential mobility.

Statistical Methods

In the original article, the effect of disability was examined using logistic regressions. This article is taking advantage of using the complete longitudinal cycles of the two LSOA's. Thus, there are a maximum of 3 observations per individual in LSOA I, and 2 observations per individual in LSOA II. Because we wanted to account for the intra-individual covariance in responses and understand how the likelihood of the outcome variables varies over time, we decided to use random effects logistic regressions. We chose this models, above others such as marginal effects (by General Estimating Equations GEE) or fixed effects models for the following reasons: a) the aim of the study is to analyze how levels of disability that can vary over time for the same individual may affect residential mobility and living arrangements, not to measure the average effect of this explanatory covariate on the outcomes -for which marginal effects would be better- (Hosmer and Lemeshow, 2000; Carriere and Buoyer, 2002); b) the marginal effects model estimated through GEE assumes missing observations completely at random (MCAR), while random effects has a less rigorous assumption, missingness at random (MAR); this means that in the latter, missing cases in the explicated variable can depend on observed covariates, while in the former, this is not allowed; in this analysis, attrition and missing data (because death or refusal) may depend on the same explanatory variables that are used to explain institutionalization, residential mobility, or living arrangements (Carriere and Buoyer, 2002). Additionally, we did not use a typical survival model (such as Cox proportional hazard models, or parametric hazard models)

because the dataset refers only to status at each of very few time points (3 for LSOA I, 2 for LSOA II), therefore, the measurement of time is too rough for hazard models to provide interesting information.

The random effects model can be expressed in the following way (Hosmer and Lemeshow, 2000: p.310):

$$\text{logit}\,(\mathbf{x}_{ij}, \alpha_i, \boldsymbol{\beta}_s) = \alpha_i + \mathbf{x'}_{ij}\,\boldsymbol{\beta}_s$$

where $\mathbf{x}_{ij}$ is a vector of covariates for the j^{th} observation in the i^{th} cluster, $\boldsymbol{\beta}_s$ is a vector of coefficients, and α_i is a random effect for each cluster (a cluster of observations of the same individual i in different points in time).

Results

As explained before, this paper's main objective is to analyze change in the effect of disability on residential mobility, institutionalization, and complex living arrangements among the elderly. It was remarked earlier that demographic characteristics of the American old-age population have been evolving too. Table 2 describes variables that might act as confounders of the relationships under study in 1984 and 1994 (baselines in each LSOA). While the mean number of ADL and IADL limitations has not changed much in a decade, it appears that there has been a slight improvement among the people ages 70 and over, since the mean self-rated health moved towards better health, the percent of them categorized as confused dropped from 25% to 20%, and the percent

being 80 years old or older augmented (which means that mortality has diminished). That the proportion residing with a spouse and the proportion having a living daughter increased too might reflect improvements in survival (of spouses and children) and the fact that most of the members of these cohorts are the baby-boomers' parents.

Operationalization of disability as the sum of ADLs and IADLs with which respondents had difficulty was chosen to keep comparability to Speare, Lawton and Avery's paper. These authors explained that they tried different ways of measuring disability, and all of them yielded very similar results. Nonetheless, it is good to have in mind that this constructed variable has a very skewed distribution, where more than 60% had a value of zero (0) in the variable at baseline in 1984 and in 1994 (Figure 1). According to Table 2, it appears that the prevalence of disability increased during this period. However, it is useful to know that this growth might be explained by shifts in the composition of the population, especially more survivors at older ages. Figure 2 shows the mean number of ADL and IADL limitations by 5-year age groups in the two studies. At baseline, the youngest groups have a slight higher mean in 1984 than in 1994, but at older ages disability appears to have diminished from one decade to another. However, 6 years after, at the last cycle of each study, people in 2000 have on average less disability than respondents in 1990 (except among the oldest-old groups). Therefore, according to the two longitudinal studies of aging, the prevalence and severity of disability has been decreasing, especially if controlling for age.

As for the main outcome variables of this study, according to Table 3, at similar disability levels, institutionalization and living in complex living arrangements (living with others) appear to be diminishing, while moving out of one's home appears to be

increasing slightly. Moreover, the effects of disability on institutionalization and on living with others seem also to be leveling off. Table 3 also contains evidence of the heavy sample attrition observed in the LSOAs, primarily due to death.

Before reporting the models that analyze change, it is useful to acknowledge that Speare, Avery and Lawton's results could not be reproduced exactly using the same first wave of LSOA I. This might be due to different analytic decisions made by the authors from the data derived from a special follow-up study to recover lost respondents. This special follow-up was done only once, after the first wave; none of the other waves had this kind of tracking procedure. Given this lack of exact reproducibility, we present a comparison of the same models estimated by Speare, Avery and Lawton but with the dataset used for the current paper (Table 4). The effect of disability and change in disability are very similar. The most remarkable differences between their analyses and ours is: a) a somewhat stronger effect of confusion on the three outcome variables; b) stronger and significant coefficients of self-rated health, sex, types of living arrangements, and the interaction of living alone and disability, in the institutionalization equation; and c) a slightly weaker effect of homeownership on residential mobility. Consistently, there were more missing values in our analyses than in theirs, since our sample sizes are always smaller. This comparison is also useful as a remind of the differences between Speare, Avery and Lawton's model specifications, and the ones estimated in the present paper. As explained before, LSOA II does not have information about homeownership at baseline; therefore, the variable was excluded from the analyses. This decision implies less goodness of fit, since homeownership was a very good predictor of residential mobility. Besides, LSOA II datasets do not contain direct

information to know family relationships between the respondent and the rest of the household members in the two subsequent waves. This means that the living arrangement typology used as a covariate is not time-varying but fixed at baseline. Since disability was made time-varying using information from each of the follow-ups, we decided not to create the interactions of living alone with disability or with change in disability status. This decision might affect mainly the equations for institutionalization and for living with others, because the coefficients of these interactions were significantly different from zero in the 1984 model. An additional modification to simplify interpretation was to use in all the equations the living arrangements typology that Speare, Avery and Lawton defined only for the "living with others" equation: "alone", "with spouse", "with spouse and others", and "with others", instead of just "alone", "only with spouse", and "with others". Finally, instead of running the models with "deviation coding" of categorical variables as in the original article, we rather preferred the usual operationalization with a set of binary (0/1) variables where the reference category is indicated by zeroes in the rest of the dichotomies ("simple coding").

Starting with the analysis of change between the eighties and the nineties, Table 5 contains the results of the random effects logistic regression of being institutionalized on disability, controlling for the rest of the covariates mentioned before. The coefficient of disability for LSOA I (including the three follow-up waves) is similar to the one reported by Speare, Avery and Lawton, although slightly stronger; it confirms that an increasing level of disability augments the odds of being institutionalized. The interaction coefficient of disability level with LSOA II (which is the one that measures change from the eighties to the nineties) is rather small, but negative and statistically significant. The

odds ratio of being institutionalized given an additional difficulty with ADL's or IADL's is still larger than one, but diminished in 6.5% from one decade to the other; this means that disability increases the odds of moving into a nursing home, but a disabled elder has less chances of being institutionalized during the last ten years of the 20th century than in the previous decennium. Most of the coefficients for the rest of the covariates changed from the eighties to the nineties; they significantly varied for sex, age, living arrangements at baseline, living children, family income, and the intercept.

There is a significant effect of disability and of change in disability on residential mobility (Table 6). These effects seem stronger than Speare, Avery and Lawton´s results, given that these authors do not find a significant coefficient for the mean number of ADLs and IADL's difficult to perform. However, the relationship between disability and moving out of the house has not changed in a decade, since the coefficients for the interactions with LSOA II are not statistically significant. Regarding the other covariates, age, living arrangements, living children and duration of residence, all are good predictors of residential mobility. Finally, disability status and change in disability levels have strong positive effects on the probability of living with others (Table 7); however, according to the interactions with LSOA II, only the effect of change in disability is modified from one decade to the other: it is diminished. This means that elderly that got more disabled increased their probability of living with others (instead of living alone or only with a spouse), but they were more likely to do so during the 1980's than during the 1990's. As expected, living arrangements at baseline have a strong effect on living arrangements at each wave under analysis; the availability of living children has also a

significant effect on the outcome variable, and it seems that having only sons favors living with others in the nineties, but not in the eighties.

Speare, Avery and Lawton report that they tried different operationalizations for disability and they chose the sum of ADL and IADL limitations because it was the best predictor of death and institutionalization. This analysis uses the same specification to keep comparability with the original article. However, given that the distribution of this scale is highly skewed and that there might be an important difference on the outcome variables between those having no disability and those having at least one difficulty with ADL's and IADL's, we also estimated models with the following dichotomous variables:

Disabled-Not disabled	1, if sum of (ADL's+IADL's) >0; 0, otherwise
From disabled to not disabled	1, if sum of (ADL's+IADL's) in previous wave≥1, and sum of (ADL's+IADL's)=0 in current wave; 0, otherwise
From not disabled to disabled	1, if sum of (ADL's+IADL's) in previous wave=0, and sum of (ADL's+IADL's) ≥1 in current wave; 0, otherwise

This operationalization makes results clearer to interpret, although the conclusions are roughly the same. In Table 8, it is possible to see that the odds of being institutionalized

among disabled in previous wave is 4 times (= $e^{1.4}$) the odds among non-disabled. This odds ratio drops to 2.6 (= $e^{1.40-0.44}$) during the nineties. Table 8 also shows a significant effect of disability on residential mobility, although there is no change from the eighties to the nineties, except for a relatively small increase in the odds among those who transit into disability from previous to current wave. Disability, and especially the transition into it, has a positive effect on living with others too. The effect of the transitions (into and out of disability) diminished considerably from the eighties to the nineties. In general, this pattern is very similar to the one described when a numerical scale was used to represent disability; nonetheless, this operationalization is eloquent in signaling that the effects are stronger when an elderly person falls into disability rather than when the individual moves out of it.

In their analysis, Speare, Avery and Lawton remark that there might be a problem in determining the correct direction of causality between changes in disability in one hand, and residential mobility and expanded living arrangements in the other, because there is no way to know for sure which of the events happened first. The concern is valid to the extent that other researchers –some of them cited before- have found that residential mobility or certain types of households can deteriorate an old person's health. Given that the whole set of follow-up waves for the two LSOA's is available for the current analysis, it is possible to compute a conservative estimate of the effect of changes in disability on the two outcomes mentioned before. The random effects model can be estimated again but including change in ADL-IADL limitations lagged one wave. As an example, the log-odds of moving to another house between 1986 and 1988 will be regressed on disability status in 1986 and change in disability status between 1984 and

1986 –controlling for the rest of the covariates-, rather than the way the current models were specified: the log-odds of residential mobility between 1986 and 1988 regressed on the same disability status and the change in ADL-IADL limitations between 1986 and 1988. This alternative can be seen as producing conservative estimates because it is assuming that all disability change between the current and the previous wave (e.g., 1986-1988) happened after persons moved or after persons modified their living arrangements during the same period. However, it might also introduce some selection bias, because respondents with information about the lagged change in ADL-IADL limitations are only the ones that survived one more wave. Also, the analyses can only be performed for 1988, 1990, and 2000, because those are the only years in which there can be a variable with lagged disability change. In spite of these problems, Table 9 shows the results. There are two sets of estimates: one without the lag and the other with the lag, but only with information from the three waves mentioned above. With respect to residential mobility, the effect of disability (specified as both a continuous and a dichotomous variable) remains statistically significant, but the coefficients for disability change are no longer significantly different from zero; there are also some shifts in the signs of the coefficients as well. This suggests that the effect found by Speare, Avery and Lawton might be spurious because in some cases residential mobility might have lead to a functional decline, and not the reverse. Regarding living with others, the general effects of disability and change in disability become weaker but with the same sign, and the coefficients are still statistically significant. The most important shifts are in the results about changes from the eighties to the nineties. In LSOA II, after taking the lag into account, the interaction of LSOA II with disability status becomes significant; this

means that the elderly are more likely of being in a complex household given their previous levels of disability during the nineties than during the eighties[1]. Also, transiting into a non-disabled status during the nineties –but not during the eighties- increases the odds of living with others.

Discussion

The fact that disability status can have a direct effect on institutionalization, residential mobility, and the likelihood of being in an expanded living arrangement has been analyzed by several authors through theoretical and empirical approaches. At the beginning of the 1990 decade, the article by Speare, Avery and Lawton gave important empirical support to such theories. However, few studies have tried to discern whether the patterns described by both theory and empirical models remain constant over time. The current article shows that the effects described by these authors have changed from the eighties to the nineties. According to these results, the observed pattern that people in nursing homes are more disabled that in the past (Sahyoun et al, 2001) might be due to the fact that disability has a weaker effect on deciding whether to move an old person to an institutions, and therefore persons that are moved to them are the ones that are more disabled.

Although the analyses do not provide evidence of the causes of this shift towards weaker effects, these results suggest that context is important to take into account. The

[1] Notice that comparison between coefficients of moving from one state to another in Table 9 is not so straightforward. In the model without the lag, the effect of transiting from not disabled to disabled is captured entirely by the coefficient of this variable, while in the model with the lag, this effect is captured by the sum of the coefficient for disability status in previous wave and the coefficient for this transition variable.

economic context is relevant in shaping decisions within households. The U.S.A. has experienced a sharp inflation in the prices of health goods and services. Nursing homes and retirement communities can be afforded by only a relatively small fraction of the American elderly. Besides, the old age minority population is increasing at a very fast pace, and Angel and Angel (1997) have already remarked that they are among the least likely groups to have resources for institutionalization and to have sufficient relatives as means of social support (this is the case of immigrants, mainly). The decrease in the odds of institutionalization from one decade to the other, given the same levels of disability and controlling by income level, might reflect that during the nineties it was more expensive and thus harder to move an old-age person to a nursing home or other similar institution. However, the odds of living with others (besides spouse and minor children) when a change happens from non-disabled to disabled status also diminished from one decade to the other, too. This suggests either that spouses might be taking this responsibility or that the disabled elderly population is increasingly receiving support from persons outside their households; the analysis does not provide enough evidence to know which of these mechanisms may actually be occurring. Another explanation might be that results are generated by a data artifact due to reverse causation, given the last model presented, which included a one-wave-lagged change in disability; as commented before, in the nineties, disability status during the previous wave increases the odds of living with others. Some of the changes in disability might be occurring after the person gets into an expanded living arrangement, and therefore after controlling for this, it is likely that changes in functionality increase the odds of living in a more complex household, and not the other way around.

Another possible context that might be happening is a shift in attitudes. The General Social Survey indicates that, from the 1970's to the mid-1990's there has been an augment in the proportion of respondents who agree in the statement that elderly parents are welcome to live with their grown children (Davis, Smith and Marsden, 2005). Again, this hypothesis will not agree with the models that do not include the lagged variables, but with the ones that do include them. If these latter models are incorrect, then the hypothesis of an evolution in the attitudes is also incorrect.

An additional possible approach to what is driving this decrease in the odds of institutionalization and complex living arrangements is that old people are better fit to deal with this kind of disabilities by themselves, especially with regard to Instrumental Activities of Daily Living: they can manage themselves lacking these abilities without the need of somebody in the same residence as theirs. As mentioned in the "Context Section", the availability of new technology is helping older adults to be more autonomous (Hoenig, Taytor and Sloan, 2003). There is no study that analyzes how robust is the number of ADL and IADL limitations in measuring disability over time, but disabled elderly might be comfortable of living by themselves even though it is difficult for them to go shopping, doing light housework, or using the phone, especially if new medical devices are helping them in their daily life.

Results might be also affected by data or methodological limitations. It was commented earlier in the paper that attrition was higher in LSOA II than in LSOA I. The analysis did not use any method for correcting selection bias, and therefore selection could be spuriously making the interaction terms significant. The strategy of making only small variations to Speare, Avery and Lawton's model specifications can also be

limiting the real findings by introducing biases due to omitted variables. The analyses described in this paper did not include covariates that have been good predictors of living arrangements, residential mobility and institutionalization in other articles; some of these variables are: race and ethnicity, chronic conditions that can be independent of disability status, wealth, education, and Medicare and Medicaid affiliation. The efforts of keeping comparability with Speare and colleague's paper helped in maintaining a parsimonious model that proved useful in explaining the effects of disability on the outcome variables in the past. Another limitation which derives from both data availability and methodological decisions is the use of time-fixed covariates in random effects models. Random effects models were better suited in analyzing the relationship between variables that changed over time: disability and the chosen dependent characteristics. However, except for age, the rest of the covariates were fixed in time because the information was asked only at baseline. This circumstance was also the main reason for not computing the interactions between ADL and IADL limitations with previous living arrangements, since the former varied over time while the latter did not.

Regardless of which of the hypotheses posed before is better fit in explaining the observed patterns, home health care services appear to be becoming more prevalent, and homes appear to be housing people with more severe disabilities than in the past. Whether this is the most appropriate direction for the elderly in the U.S.A. is something that the American society has to analyze in terms of the welfare policies for the aged that it should promote. Are the results evidence that Americans express more solidarity towards their elderly population?, or is there an increasingly vulnerable subpopulation that needs the help of nursing homes and rising health care costs are hampering this help?

Further research is needed on how satisfied are American seniors with staying at home while facing disability levels that would have caused institutionalization in the past.

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Table 1. Response and attrition in the follow-up waves of LSOA I and LSOA II.

Status at follow-up	LSOA I			LSOA II	
	1986	1988	1990	1997	2000
(n)	(7527)	(7527)	(7527)	(9447)	(9447)
Dead	11.3	21.4	31.0	12.6	13.8
In Institutions	2.7	3.2	3.5	2.4	3.3
Unknown (losses to follow-up)	2.7	11.9	13.3	12.9	27.2
Alive (Response)	83.4	63.6	52.2	72.1	55.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Note: Institutionalized individuals were not interviewed in 1986

Table 2. Respondents' characteristics in 1984, according to Speare, Avery and Lawton, and in 1984 and 1994 according to dataset used in current analysis.

Characteristics	According to S,A&L	Dataset to be analyzed	
	1984	1984[1]	1994
Mean number ADL+IADL limitations [2]	1.42	1.30	1.34
Mean health rating (1=Excelent to 5=Poor)	2.94	2.94	2.82
Percent confused [3]	24.8	24.8	19.8
Percent aged 80+	27.9	27.9	31.3
Percent female	61.3	61.3	59.9
Percent living alone	36.6	36.6	34.5
Percent living with spouse	46.6	46.6	52.2
Percent with a living daughter	61.7	61.8	70.2
Percent homeowner	75.5	75.5	-[4]
Percent w/duration of residence > 15 yrs.	56.3	56.3	63.0
Number of cases			
--Weighted	*5152*	*5151*	*9336*
--Unweighted	*5151*	*5151*	*9336*

Notes:
1 In this column we present descriptives according to the dataset that is used for the models in the article, which has differences in the operationalization of certain variables from the ones used by Speare, Avery and Lawton. Nonetheless, it was not possible to reproduce the exact figures presented by these authors.
2 The ADLs in the dataset to be analyzed do not include difficulty in getting outside.
3 Speare, Avery and Lawton defined confused as sometimes or usually confused, or proxy interview because incapacitated. Because of limitations of the questionnaire in the second cycle, for the dataset to be analyzed, confused means usually confused, or proxy interview because incapacitated.
4 In LSOA II, the questionnaire does not inquire for home ownership at baseline

Figure 1. Histogram of disability, by study cycle.

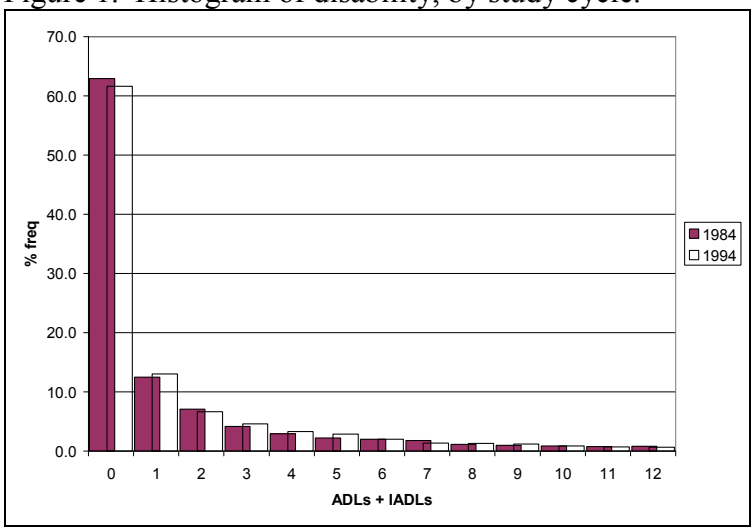

Figure 2. Mean number of limitations with ADL and IADL at baseline and 6 years after, by five-year age groups, according to study cycle (LSOA I = 1984-1990, LSOA II = 1994-2000).

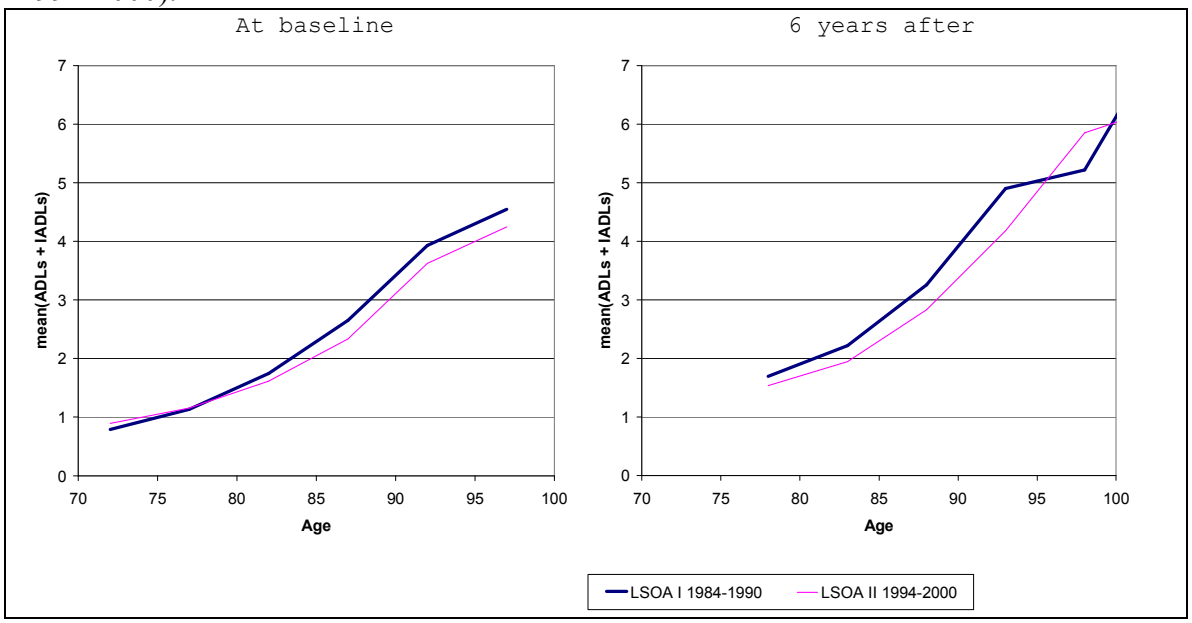

Table 3. Percent of respondents who were institutionalized, who moved, and/or who lived with others, by level of disability (number of ADL and IADL limitations) in previous wave, according to study cycle and study wave.

Characteristic and level of disability	LSOA-I			LSOA-II	
	1986	1988	1990	1997	2000
Percent in institutions: (n) [1]	*(4171)*	*(3150)*	*(2557)*	*(6994)*	*(4706)*
None	2.4	3.2	3.4	2.9	2.9
1 to 4	10.0	6.8	10.3	8.9	6.7
5 to 8	19.9	22.5	38.8	17.7	20.0
9 and more	34.2	38.6	31.9	25.0	21.8
Percent who moved: (n) [2]	*(4165)*	*(2929)*	*(2321)*	*(6802)*	*(4539)*
None	6.9	6.7	5.0	8.2	7.5
1 to 4	8.4	9.1	7.6	9.9	11.8
5 to 8	6.9	14.1	11.5	12.3	13.9
9 and more	11.7	10.1	11.4	6.0	14.4
Percent who lived with others: (n) [3]	*(4153)*	*(3274)*	*(2650)*	*(8011)*	*(5099)*
None	16.3	15.3	15.2	10.6	12.4
1 to 4	21.7	20.1	20.4	17.0	18.9
5 to 8	32.2	28.0	30.0	20.1	24.4
9 and more	52.3	45.1	35.6	31.4	42.4

Notes:
1 Based on survivors, minus missing values in institutionalization
2 Based on non-instititutionalized survivors, minus missing values in moving out, minus unknowns in moving out
3 Based on non-institutionalized survivors, minus missing values in living arrangements.

Table 4. Comparison of coefficients of logistic regressions for institutionalization, residential mobility, and living with others, between original article and dataset used in this article.

Independent variables		Institutionalization				Residential mobility				Living with others			
		Original results		Current data		Original results		Current data		Original results		Current data	
Disability		0.180	***	0.167	***	0.004		0.024		0.117	***	0.099	***
Change in disability						0.100	***	0.099	***	0.141	***	0.133	***
Confused in 1984:			***		***								
--Never or rarely [b]		-0.409		-0.498		-0.130		-0.174		-0.098		-0.126	
--Sometimes		0.081		0.089		-0.023		-0.104		-0.032		-0.094	
--Frequently		0.328		0.409		0.153		0.279		0.130		0.220	
Self-assessment of health		0.189	*	0.249	***	-0.047		-0.044		-0.058		-0.043	
Sex:	Male	0.127		0.224	***	0.073		0.004		-0.015		-0.049	
	Female [b]	-0.127		-0.224		-0.073		-0.004		0.015		0.049	
Age:	70-74	-0.897	***	-1.210	***	0.042	**	0.057	**	-0.158	**	-0.241	***
	75-79	-0.226		-0.137		-0.351		-0.328		-0.163		-0.212	
	80-84	0.457		0.510		0.172		0.150		0.116		0.078	
	85 + [b]	0.666		0.837		0.137		0.121		0.205		0.375	
Living arrangements in 1984:			*		***						***		***
--Alone		0.259		0.318		0.039		0.101		-1.854		-1.813	
--With spouse		-0.348		-0.457		-0.110		-0.100		-2.036		-2.072	
--With others [b]		0.089		0.139		0.071		-0.001		1.479		1.532	
--With spouse and others		-								2.411		2.353	

Notes: *** : p<.01; ** : p<.05; * : p<.10

Table 4. Comparison of coefficients of logistic regressions for institutionalization, residential mobility, and living with others, between original article and dataset used in this article (Continue).

Independent variables	Institutionalization		Residential mobility		Living with others	
	Original results	Current data	Original results	Current data	Original results	Current data
Living children:			*	**		
--None [b]	0.197	0.138	-0.175	-0.193	0.019	-0.021
--Sons only	-0.049	-0.137	-0.042	-0.053	-0.096	-0.091
--One or more daughters	-0.148	-0.001	0.217	0.246	0.077	0.112
Homeowner:			***	***		
--Yes [b]	-0.024	0.059	-0.389	-0.172	0.121	0.100
--No	0.024	-0.059	0.389	0.172	-0.121	-0.100
Duration of residence:			***	***	**	*
--0 to 4 years	0.181	0.216	0.463	0.530	0.275	0.254
--5 to 14 years	-0.138	-0.058	0.071	0.093	-0.163	-0.145
--15 or more years [b]	-0.043	-0.157	-0.534	-0.623	-0.112	-0.109
Family income:						
--< $7.000	0.146	0.030	-0.036	0.008	0.102	-0.033
--$7.000 to $19.999 [b]	-0.055	0.009	-0.027	-0.054	-0.027	0.023
--$20.000 or more	-0.091	-0.040	0.063	0.046	-0.075	0.010
Disability X Living Alone	0.016	0.056 **	0.010	0.016	0.033	0.051
Change in disability X Living Alone			0.034	0.040	0.068 ***	0.099 ***
Intercept	-3.769 ***	-3.420 ***	-2.148 ***	-2.266 ***	-0.890 ***	-0.974 ***
-2 log likelihood	1190.6	1529.0	1965.2	1906.4	2190.5	2114.7
Pseudo R^2	0.173	0.209	0.074	0.067	0.454	0.453
Number of cases	4318	4147	3889	3826	3877	3817

Notes: *** : p<.01; ** : p<.05; * : p<.10

Table 5. Random effects logistic regression for being institutionalized during the following wave, with interaction with study cycle.
(For categorical variables, the significance is for the whole set of dichotomous variables).

Independent variable		LSOA I			Interaction w/LSOA II		
		b	SE		b	SE	
Disability (in previous wave)		0.260	0.013	***	-0.067	0.013	***
Often confused		0.502	0.092	***	-0.039	0.092	
Not often confused (Ref)		0.000			0.000		
Self-rated health (1=Exc,5=Poor)		0.108	0.037	***	0.003	0.037	
Male		0.146	0.049	***	-0.227	0.049	***
Female (Ref)		0.000			0.000		
Age	70-74	-1.008	0.095	***	-0.456	0.095	***
	75-79	-0.213	0.071		-0.859	0.071	
	80-84	0.352	0.072		-0.693	0.072	
	85 + (Ref)	0.000			0.000		
Living arrangem. at baseline	Alone	0.499	0.087	***	-0.127	0.087	***
	W/ spouse	-0.055	0.083		0.277	0.083	
	W/sp and others	-0.402	0.154		0.492	0.154	
	W/others (Ref)	0.000			0.000		
Living children at baseline	None (Ref)	0.000		?			***
	Sons only	-0.175	0.080		-0.055	0.080	
	One or more daughters	-0.012	0.059		-0.275	0.059	
Duration of resid at baseline	0 to 4 y	0.130	0.072		0.528	0.072	***
	5 to 14 y	-0.006	0.065		0.242	0.065	
	15 + y (Ref)	0.000			0.000		
Family income:	< Q1	0.006	0.074		0.071	0.074	***
	Q1 to Q3 (Ref)	0.000			0.000		
	> Q3	-0.032	0.082		-0.337	0.082	
Time		-0.029	0.001	***			
Intercept		-3.489	0.138		0.620	0.139	***
Rho		0.071	0.000	***			
-2 log likelihood		10,357,680.8					
Number of cases		11,161					

Notes: *** : p<.01; ** : p<.05; * : p<.10

Table 6. Random effects logistic regression for residential mobility during the following wave, with interaction with study cycle.
(For categorical variables, the significance is for the whole set of dichotomous variables).

Independent variable		LSOA I			Interaction w/LSOA II		
		b	SE		b	SE	
Disability (in previous wave)		0.099	0.020	***	-0.018	0.020	
Change in disability (from previous wave)		0.141	0.018	***	-0.027	0.018	
Often confused		0.048	0.119		0.095	0.119	
Not often confused (Ref)		0.000					
Self-rated health (1=Exc,5=Poor)		-0.045	0.043		-0.008	0.043	
Male		-0.017	0.055		-0.020	0.055	
Female (Ref)		0.000			0.000		
Age	70-74	0.042	0.087		-0.397	0.087	***
	75-79	-0.197	0.082		-0.082	0.082	
	80-84	-0.023	0.093		-0.118	0.093	
	85 + (Ref)	0.000			0.000		
Living arrangem. at baseline	Alone	0.331	0.096	***	-0.057	0.096	***
	W/ spouse	0.102	0.088		-0.343	0.088	
	W/sp and others	-0.344	0.167		0.393	0.167	
	W/ others (Ref)	0.000			0.000		
Living children at baseline	None (Ref)	0.000		***	0.000		***
	Sons only	-0.192	0.091		0.428	0.091	
	One or more daughters	0.225	0.067		0.122	0.067	
Duration of resid at baseline	0 to 4 y	0.570	0.075	***	0.717	0.075	***
	5 to 14 y	0.006	0.068		0.747	0.068	
	15 + y (Ref)	0.000			0.000		
Family income:	< Q1	-0.015	0.085		-0.087	0.085	
	Q1 to Q3 (Ref)	0.000					
	> Q3	0.088	0.085		-0.110	0.085	
Intercept		-3.188	0.147	***	-0.304	0.147	**
Rho		0.238	0.001	***			
-2 log likelihood		13,703,078.2					
Number of cases		9842					

Notes: *** : p<.01; ** : p<.05; * : p<.10

Table 7. Random effects logistic regression for Living with Other adults during the following wave, with interaction with study cycle.
(For categorical variables, the significance is for the whole set of dichotomous variables).

Independent variable		LSOA I			Interaction w/LSOA II		
		b	SE		b	SE	
Disability (in previous wave)		0.296	0.032	***	-0.017	0.032	
Change in disability (from previous wave)		0.267	0.025	***	-0.067	0.025	***
Often confused		0.191	0.207		-0.389	0.207	*
Not often confused (Ref)		0.000			0.000		
Self-rated health (1=Exc,5=Poor)		-0.051	0.079		-0.045	0.079	
Male		-0.090	0.103		0.052	0.103	
Female (Ref)		0.000			0.000		
Age	70-74	-0.223	0.131		-0.112	0.131	*
	75-79	-0.185	0.116		-0.207	0.116	
	80-84	0.067	0.139		-0.289	0.139	
	85 + (Ref)	0.000					
Living arrangem. at baseline	Alone	-3.020	0.161	***	-4.284	0.161	***
	W/ spouse	-3.848	0.151		2.140	0.152	
	W/sp and others	2.500	0.231		-10.400	0.232	
	W/ others (Ref)	0.000			0.000		
Living children at baseline	None (Ref)	0.000		***	0.000		***
	Sons only	-0.260	0.166		0.486	0.166	
	One or more daughters	0.552	0.124		0.141	0.124	
Duration of resid at baseline	0 to 4 y	0.101	0.167		-0.247	0.167	
	5 to 14 y	-0.086	0.139		-0.254	0.139	
	15 + y (Ref)	0.000			0.000		
Family income:	< Q1	-0.100	0.158		0.276	0.158	-0.100
	Q1 to Q3 (Ref)	0.000			0.000		0.000
	> Q3	0.067	0.157		-0.231	0.158	0.067
Intercept		-2.766	0.263	***	4.099	0.263	***
Rho		0.752	0.000	***			
-2 log likelihood		13,256,854.8					
Number of cases		9,837					

Notes: *** : p<.01; ** : p<.05; * : p<.10

Table 8. Coefficients for disability covariates in random effects logistic regressions for each dependent variable, with two different operationalizations of disability (as continuous variables, and as a set of dichotomies).

Independent variable	Disability as continuous variable						Disability as dichotomous variable					
	LSOA I			Interact w/LSOA II			LSOA I			Interact w/LSOA II		
	b	SE		b	SE		b	SE		b	SE	
Institutionalization												
Disability (in previous wave)	0.260	0.013	***	-0.067	0.013	***	1.403	0.099	***	-0.444	0.099	***
Residential mobility												
Disability (in previous wave)	0.099	0.020	***	-0.018	0.020		0.499	0.121	***	0.154	0.121	
Change in disability	0.141	0.018	***	-0.027	0.018							
From disabled to not disabled							-0.052	0.176		-0.021	0.176	
From not disabled to disabled							0.482	0.126	***	0.244	0.126	*
Living with others												
Disability (in previous wave)	0.296	0.032	***	-0.017	0.032		1.309	0.188	***	-0.083	0.188	
Change in disability	0.267	0.025	***	-0.067	0.025	***						
From disabled to not disabled							-0.406	0.237	*	-0.499	0.237	**
From not disabled to disabled							1.178	0.177	***	-0.502	0.178	***

Notes: *** : p<.01; ** : p<.05; * : p<.10

Table 9. Coefficients for disability covariates in random effects logistic regressions for residential mobility and living with others, with and without a one wave lag in "change of disability", only for observations in years 1988, 1990, and 2000.

Independent variable	Residential mobility						Living with others					
	Without lag			With lag			Without lag			With lag		
	b	SE		b	SE		b	SE		b	SE	
With continuous variables												
--LSOA I												
Disability (in previous wave)	0.121	0.022	***	0.061	0.029	***	0.154	0.019	***	0.125	0.024	***
Change in disability	0.147	0.021	***	0.042	0.034	***	0.152	0.019	***	-0.015	0.028	
--Interaction w/ LSOA II												
Disability (in previous wave)	-0.019	0.022		0.017	0.029		0.020	0.019		0.078	0.024	***
Change in disability	-0.061	0.021	***	-0.036	0.034		-0.041	0.019	**	-0.065	0.028	**
With dichotomous variables												
--LSOA I												
Disability (in previous wave)	0.622	0.143	***	0.495	0.143	***	0.645	0.112	***	0.322	0.114	***
From disabled to not disabled	-0.099	0.193		-0.035	0.251		-0.320	0.163	**	-0.239	0.192	
From not disabled to disabled	0.532	0.170	***	-0.197	0.153		0.598	0.135	***	0.012	0.124	
--Interaction w/ LSOA II												
Disability (in previous wave)	0.145	0.143		0.046	0.143		0.005	0.112		0.366	0.114	***
From disabled to not disabled	0.239	0.193		-0.174	0.251		0.077	0.164		0.760	0.192	***
From not disabled to disabled	0.090	0.170		0.152	0.153		-0.343	0.135	**	-0.187	0.124	
Number of individuals			7329									

Notes: *** : p<.01; ** : p<.05; * : p<.10