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Moving in and out of public geriatric care in Sweden

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MOVING IN AND OUT OF PUBLIC GERIATRIC CARE IN SWEDEN

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Moving in and out of public geriatric care in Sweden^{*}

Daniel Hallberg¹ and Mårten Lagergren²

2007-02-01

Abstract. In this paper we present empirical results concerning the interplay between the development of dependency in activities for daily living (ADL), the informal support from a partner, and the mode of public old age care (OAC) services among the very old (75+). We also study excess-mortality conditional on the mode of OAC.

Three forms of publicly provided OAC are distinguished: independent living in ordinary home without public support, independent living in ordinary home or special accommodations with home help and home health care, and living in special accommodations with round-the-clock-care.

Our results suggest, given the level of ADL and age, that the propensity to move to a more intensive mode of care was higher for women compared to men. There was, however, also an effect of the availability of informal care support that moved in the opposite direction; men with a partner were more likely to move from home-help service to a living in special accommodation, while women with a partner were more likely to remain with the same care mode than women without a partner. We also find a lower mortality among cohabitants with home-help services, while it is higher among cohabitants with special accommodation. Our estimates furthermore show the importance of removing the influence of unobserved heterogeneity.

Keywords: old age care, mortality, informal support from a partner

JEL-code: I12, I18, J14

^{*} We are grateful for comments and suggestions from “the baby-boom” workgroup. This analysis results in a model for the public old age care (OAC) service choice among the very old that is used in the health module in SESIM, and a model for the excess-mortality among the very old conditional on the choice of OAC. SESIM is a large micro-simulation model organized by the Ministry of Finance in Sweden. Financial support from the Swedish council for working life and social research (FAS) are gratefully acknowledged.

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1. Introduction

On-going demographic changes in the Western societies has focused public interest on the problems of providing care and services for an increasing number of elderly persons. It is estimated that in the coming decade's public expenditures for care and services in the welfare states will grow very rapidly. At the same time slow economic growth makes it extremely important that scarce public resources are used in an optimal way (Thorslund and Bergmark, 2000). Part of this problem concerns the possibilities to prevent or delay needs by public health measures. The need for care and services is obviously related to age. Among the very old a large proportion need help in their daily life. However, there are large differences between individuals and between different socio-economic groups in society with respect to needs of support (Thorslund and Lundberg, 1994). Successful aging means maintaining independence in activities of daily life as long as possible. Societal ambitions thus should focus on increasing the possibilities of retaining this independence, which among others means supporting continued independent living in the community through different measures such as home adaptations, home help and home health care (Birch, 2002).

A key feature of aging and the development of needs is that it is a dynamic process shaped by the interplay between incidence and progression of disease and disability on one hand and mortality on the other. Also the different means of support take on a dynamic character with initially predominantly instrumental services like help with cleaning and washing in your own home, changing into more personal care including help with bathing and toilet etc. and finally in many cases very extensive around-the-clock-care in special accommodations. This dynamic feature of aging and needs for care calls for longitudinal

studies and dynamic analysis in order to understand the interplay between the different processes involved. Modern tools of analysis are making this increasingly possible.

The Swedish municipalities are responsible for providing long-term care and services in the form of home help for those that live in ordinary housing and in special forms of housing accommodation for those in need of extensive care. These special accommodations can either provide home help in the same way as for people in ordinary housing or around-the-clock-care. In the former case the main difference to ordinary living is the access to certain common facilities for therapy and recreation. The county councils are responsible for medical treatment and health care until the medical treatment is considered completed, at which point the responsibility for the long term care and services is transferred to the municipalities. Home nursing care and rehabilitation are provided by municipalities in some parts of Sweden and by the county councils in others.

In this paper we present an analysis concerning the interplay between the development of dependency in activities for daily living (ADL), the informal support from a partner, the mode of old age care (OAC) and the mortality among the very old aged 75+. In the present study we distinguish between three forms of OAC: independent living in ordinary home without public support, independent living in ordinary home or special accommodations with home help and home health care, and living in special accommodations with round-the-clock-care.

Data are from Kungholmen, which is part of the inner city of Stockholm. The Kungsholmen-study started in 1987 as a longitudinal population-based study with the aim of following a large number of elderly persons and study incidence and prevalence of disability with a special focus on dementia (Fratiglioni et al. 1992). However, as the available data are limited in several respects, we had to make adjustments to the analysis. Because data were collected only at certain time points we do not have access to exact dates for the transfers

between modes of care – only when a person died. The Kungsholmen-study is furthermore from a rather special part of the country, and may therefore not be representative for the whole of Sweden. The first problem is addressed by using the elapsed time between observations as an independent variable. As for the second limitation, a comparison with national data, HINK/HEK from 1997-1998 (see below), shows that the transitions measured in the present study are not too different from those of the entire country. We did not have the possibilities to compare data along all dimensions, such as by health level.

Transfer between modes of care in a system of care for the elderly has been studied by many authors – both regarding utilization of home help and transfer to institutional care. The most important predictor of use of home help seems to be dependence in activities for daily living – instrumental (IADL) and personal (PADL) (Thorslund et al. 1991; Larsson and Thorslund 2002; Meinow, Kåreholt and Thorslund, 2005).

The impact of dementia and depression has been studied by Larsson using the same data from the Kungsholmen-study as the present project (Larsson, 2004). Also other studies using different data have confirmed the observation that demented persons are more likely to receive home help (Livingstone et al. 1997; Stoddard et al. 2002). Others factors identified as associated with the use of home help are difficulties in moving outdoors (Sakari-Rantala et al.,1995) and general health (Stoddart et al.,2002).

Findings concerning the impact of gender are mixed. Controlling for the fact that women tend to outlive their spouses and consequently lack support from a partner at old age, gender does not seem to affect the use of formal home help (Larsson & Thorslund, 2002). Generally speaking access to informal care and having children has been shown repeatedly to reduce the likelihood of receiving formal in-home support (Stoler & Cutler, 1993; Lagergren, 1994; Szebehely, 1998).

Also when it comes to transfer to institutional care, ADL-limitations and cognitive impairment stand out as the most important predictors (Willcocks, 1987; Kelman & Thomas, 1990; Brown et al. , 1990; Agüero-Torres et al., 2001; Larsson, Kåreholt & Thorslund, 2006). Access to informal care also seem to influence the probability to move to an institution (Tennstedt 1990; Pearlman & Crown 1992; Larsson & Thorslund, 2002). However, it has further been argued that adult children act as advocates for their parents and often urge them to move (Thorslund 2003). Connected to this is also the question of care giver burden and “burn-out”, which may prompt a decision to transfer (Brown et al., 1990). Other predictive factors that have been discussed in this context are education and income, which at least in Sweden do not appear to influence the propensity to move to institutional care (Palme et al, 2003). In other countries, however, the situation may be different (Mustard et al. 1999).

2. Data

The Kungsholmen-study followed elderly persons by the choice of OAC from age 75 until the person deceased. In total 2,368 persons living in the parish of Kungsholmen and born in 1913 or earlier (aged 75 years or more) were included (Fratiglioni, 1997). Persons living in the community as well as in institutions were included. After an initial examination in 1987-1988 the involved persons were re-examined four times with intervals of 2-3 years until year 2000 (in the sequel denoted phase 1, 3, 4, 5, 6). The examination included among others estimation of dependence in instrumental and personal activities for daily life (IADL, PADL). A subset of 1,810 of the above 2,368 persons participated in all phases of the study.

With respect to this general description of the system of OAC, three basic modes of care can be distinguished (denotation in parentheses):

- Independent living in ordinary home without public support (state 0)

- Independent living in ordinary home or special accommodations with home help and home health care (state 1)
- Living in special accommodations with around-the-clock-care (state 2).

One might be worried that data from the Kungsholmen study are not representative for the whole of Sweden, considering that they are drawn only from a quite small part of the country. We have, luckily, the opportunity to compare them with panel data from the Swedish Household Income Survey (HINK/HEK) from 1997-98.³ Unfortunately that data does not contain such variables as health or activities of daily life measures, aspects of the elderly population of particular interest in the present study.

A couple of things complicates a direct comparison with the HINK/HEK-study:

1) The age distribution in subsequent waves of the Kungholmen study is not representative of the original population, while the HINK/HEK data should be comparable to the overall population, see Figure 1. In order to increase comparability with HINK/HEK data, one might consider using only the transition between the first and second waves from the Kungholmen study. We therefore included in Table 1 also the transition rates using the first transitions only (i.e., those between the first and second wave) As can be seen there are some minor deviations in the transition rates reported. We have split the sample into two samples above and below age 85.

2) The duration between data collection points is on average about three times longer in the Kungsholmen study compared to HINK/HEK, which is annual. One can accomplish a comparable three-year "translation" of the HINK/HEK transition matrix by assuming a Markov assumption. The original transition matrix along with the three-year

³ Conducted by Statistics Sweden, this is a large data base containing both register based income and wealth data and survey questions. For a broad description of HINK/HEK, visit the internet adress of Statistics Sweden, www.scb.se.

equivalence is given in Table 1. Again we have divided the sample into two age groups (above and below the age 85).

Table 1, top panel, gives the transition rates (per cent) between two subsequent phases (denoted entrance state and exit state) in the Kungsholmen study. The typical pattern seems, not unexpectedly, to be that individuals went from having less care to more, although some move in the opposite direction. One can note that very few moved from having 24-hour care (state 2) to less care (state 0 or 1). From the state of living in special accommodations with around-the-clock-care, most exit to death. Hence, it seems unfeasible to model the transition for individuals in this mode of care as a multinomial choice. Another result is, not unexpectedly, that the mortality risk increases with higher mode of care.

Table 1 about here

Transitions in HINK/HEK, are shown in the bottom panel in Table 1. A comparison with the Kungsholm study shows that the transition rates are rather similar, but also that some differences emerge. a) The mortality risk is lower at the national level than at Kungsholmen. b) The probabilities of changing from state 2 (24-hour care) to state 0 (no home-help service). Finally, c) changing from state 1 to state 0, are substantially higher at the national level than at Kungsholmen. However, the number of observations is low, and hence these differences may not be a big problem. Further, the Markov assumption is by no means harmless and the observed differences may be an artifact of this assumption. Also, with low frequent data, as in the Kungsholmen study, it is possible that states with a relative short duration are missed. It can be assumed that transitions from a higher to a lower state usually have shorter duration than the opposite. We conclude that the data from Kungsholmen can be used for our purposes.

3. Methodology

We have chosen to perform two separate analyses; one analysis concerning the transitions between OAC states and another one concerning the transition to death. The reason is that while the exact date of death is known, durations to transfer to the other states are interval-censored in data, as they do not contain the exact transition date. In case of transfer to another care mode, all that is known is that it occurred some time between two data collection dates. In the first analysis, we model the change from the current (entrance) state to one of states 0, 1, and 2 as a multinomial logit model (McFadden, 1973). The elapsed time between data collection dates is included as a covariate in this model to account for the fact that there may be duration dependence. We estimate the exit state conditional on current (entrance) state.

A few simplifications are made. First, individuals usually contribute with more than one transition, so observations may not necessarily be independent within observations from the same individual (they may well however be independent across individuals). We have, for simplicity, settled for an estimator that assumes independence. However, we use a robust variance-covariance estimator that allows for this type of observation clustering. Second, although an ordered choice specification is conceivable for these data we have settled for a multinomial one. We have not performed any formal test of a multinomial (probit) model against an ordered one since such a test is quite cumbersome. Simulation of multinomial logit and ordered logit shows very little differences in outcome. It matters some for the sign and the level of significance of the marginal effect whether we treat choices as ordered or unordered. The multinomial logit model is used since this is more flexible specification. Furthermore, we have not conditioned on state-history longer back than the previous data collection point. It would of course be possible to include prior states, if we think it is likely that these would matter for the current transition (in other words, that the

process is not characterized as a “Markov-chain”). The determining factor for not doing this, considering the limited sample size, is that we would then lose subjects who only participated in the starting phase of the study or contributed with only one phase observation.

The second analysis study the mortality risk, again conditional on current (entrance) state, using a piece-wise constant hazard (PWCH) model. Thus we estimate an exponential model with intercepts varying with survival time. This model uses a baseline hazard with a flexible functional form. An advantage with the PWCH model is that it is possible to capture unobserved heterogeneity, which represents a particular complication in duration models, and test whether unobserved heterogeneity matter for our estimates. In an appendix, details about the model are presented.

4. Multinomial OAC choice analysis

Explanatory variables

The degree of ADL limitations (IADL and PADL) is constructed in four levels (*ADL*), (0) no ADL limitations, (1) only IADL limitations but no PADL limitations, (2) not so severe PADL limitations (1-2 PADL), and (3) severe PADL limitations (3-6 PADL).⁴ Table 2 shows a cross tabulation between the ADL variable and the entrance state of OAC. The general impression is that individuals who are more dependent in terms of a higher *ADL* code also demand a higher mode of care. The majority (73%) of the most dependent persons have 24-hour care. Interestingly, there is also a group of individuals (7%) who were coded as very dependent (*ADL*=3) but did not receive any public care service. The probable reason is that

⁴ IADL stands for Instrumental Activities in Daily Life and means that a person have difficulties to clean, cook, go shopping, etc. PADL stands for Personal Activities in Daily Life and means that a person has difficulties to handle her personal hygiene, and must have help with washing, dressing, getting out of bed, etc. Since it was partially missing, the incidence of IADL was imputed in phases 3 and 4, and for part of the sample in phase 1.

these persons receive their care from the family or some other informal source. There might also be measurement errors in the ADL score.⁵

Table 2 about here

One expects the informal support and help that an elderly person is receiving to affect the transition between modes of formal care. For instance, a spouse, partner, or ones children should make individuals demand less outside home help. For a description of the importance of the informal care given by an adult child in Europe, see e.g. Börsch-Supan, et al. (2005) In our data there exists some aspects of this information. Thus we have possibility to control for living with a partner (*sambo*). This might, however, not catch all the effects of informal help considering that, an adult child might be giving more informal help than the partner.⁶ Unfortunately data on support from children were not available in the Kungsholmen database.

Spell length (in years, *ytid*) is included as covariate in the model to control for differences in time length between data collection dates. We also consider gender (*man*) and age group dummies (*age75-79*, *age80-84*, ..., *age95+*) as covariates in the model.

One can note, however, as these spell lengths exaggerate the true duration; we will underestimate the effect of durations on separation probability. It is also possible that

⁵ Actually, a transition matrix of the health variable (not shown) shows unexpectedly that there was some substantial recovery rate among those with ADLi=2. (However, individuals with severe PADL limitations were very unlikely to recover). A closer inspection showed that the high recovery rate for these was mainly between phases 1 and 3 in the study. In subsequent phases the rates were what could be expected. One explanation for this, besides the obvious fact that individuals in the study becomes older by each phase, is that the questionnaire changed from phase 3 and onwards. A careful check of these differences revealed, however, that we unfortunately have no reasonable possibility to correct for this problem.

⁶ We have tried to use was another variable, which was a proxy for the distance to a relative by coding the telephone area code number to the next of kin reported in data. In a preliminary analysis this variable turned out significant but was, unfortunately, missing for a substantial part of the sample (around 65.1 percent in phase 1 was missing).

some individuals changed state more than once between data collection points. The analysis will not handle this problem.

Results

Table 3 shows the estimated marginal effects from two multinomial logit models, with entrance states 0 and 1, respectively. Both allow 0, 1, and 2 as exit states (in other words, transition probabilities conditional on survival). As noted above, very few change from having 24-hour care (state 2) to a lower mode of care (state 0 or 1). Hence it seems not feasible to model this transition as a multinomial choice. Instead transitions away from 24-hour care to death is handled within a duration model framework (see below).

Table 3 about here

The reference group consists of women aged 75-79 years of age without any ADL limitations (*ADL0*) and not married or cohabiting. The results show that men, both those who receive home-help service and those who do not, have a higher probability of staying with the same care mode, and a lower probability to move to a higher care mode, compared to women. IADL limitations (*ADL=1*) do not seem to have any significant effect on transition probabilities. It is rather persons with PADL limitations (either severe or not so severe) that have a higher chance of receiving more help in the next period, and significantly so. These ADL limitations also lowers the chance of receiving less or the same amount of help in the next period. We furthermore find, although we control for IADL and PADL limitations, that higher age speeds up the transition to higher modes of public care.

Moreover, we get the expected sign of the spell length variable (*ytid*). It also comes out strongly significant in our models. We hence find support for the proposed estimation strategy. Longer time interval results in a higher probability that the individual will change state (e.g. positive marginal effects of going from state 0 to 1, from 0 to 2, and from 1

to 2) and a lower probability that the individual will not change state or remain in the same state.

We interact *sambo* with gender. The results indicate that the partner effect for men is negative (i.e., men with a partner are more likely to move from home-help service to a living in special accomodation with 24-hour care), while it is positive for women (i.e., women with a partner are more likely to remain with the same care mode than women without). The partner-age interaction effect might be difficult to interpret since it may pick up unexpected associations. There may be strong selection effects of marriage and cohabitation, which we have no control over in the present study. Furthermore, *sambo* measures the present marriage/cohabiting status. The group of singles thus incorporates those who never had a partner and widow/widowers. The data put limits, however, on the depth of study of the partner effect in terms of number of observations in each combination.

5. Mortality analysis

As mentioned, mortality is analyzed within a duration model framework (explained in the appendix). To estimate the PWCH model, one need to episode-split at the times the hazard varies, generate appropriate dummy variables, and then include them in the exponential model. Estimation thus requires pre-specified intervals within which the hazard may be regarded as constant. A rough way of determining these is by studying the shape of the empirical hazards. Because the number of observations decreases rapidly by survival time we have chosen to partition the first 1825 days (5 years) into relatively short intervals units of 365 days, and then used longer intervals for longer durations; at 2500 and 4000 (maximum is 5348 days).⁷

Results

⁷ Note that, due to the episode-splitting, the number of observations increases.

We use the same specification as in the multinomial analysis above – with gender-specific partner effects. Estimation results are given in Table 4. For those living in special accommodation with 24-hour care (entrance state=2), the estimates strongly suggest that there is unobserved heterogeneity. Except for this subgroup the estimated coefficients change very little compared to the PWCH model without frailty.

Most slope estimates are what we would expect. The estimates clearly illustrate the importance of different models depending on the current care mode. For the group with either no assistance or home-help (entrance states 0 and 1), we find that the mortality is higher among men, among those with severe ADL limitations, and among older persons. Further, the age-gradient seems to be steeper among those that lives in an ordinary home without public care compared to those that have home-help. For those living in special accommodation with 24-hour care, there are very few significant coefficients. Only when we control for unobserved heterogeneity in the exponential-gamma mixture model, we find some significant partial effects: there is a higher mortality risk among males (significant at 5 percent level) and among those who have a partner. This latter result goes in the opposite direction compared to those with home-help services. In that subgroup we find significantly *lower* mortality risk compared to not having a partner.

Table 4 about here

To study gender-specific effects, we have also estimated the duration model separately by gender. The estimation algorithm for the model with frailty did not reach convergence for all subgroups, presumably as a result of too few observations. We therefore present, in Table 5, only the simpler specifications where we do not we control for unobserved heterogeneity.

Table 5 about here

We see that many of the results in the aggregated model are in fact driven by females. This is presumably a result of the uneven distribution between men and women in the sample. One can also note that the age-gradient is about the same for both genders. The excess mortality among men without home-help or special accommodations seems mainly to be caused by a steeper ADL-gradient compared to women; both ADL2 (not so severe PADL limitations) and ADL3 (severe PADL limitations) affect men's mortality risk harder than that of women. The effects on mortality of having a partner that was found in the aggregated model (lower mortality among those with home-help services and higher among those with special accommodation) seems to be about the same for both gender, however only significant for the female sub sample.

In general we would expect to find lower mortality rates among married or cohabiting men compared to single men, but the point estimates are positive and insignificantly different from zero. First, there are rather few men in the sample. At higher ages, as one could expect, we find a higher rate of single women than single men, simply because men have a higher mortality rate and husbands usually are a few years older than their wives. Second, the variable which is used here – *sambo* – measures the present marital/cohabiting status, thus mixing widows/widowers with individuals never married. Third, the partner's health and age is unknown.

6. Conclusions

In this paper we have estimated models for old age care (OAC) and mortality for a population of elderly persons. Limitations in the data at our disposal have been discussed. The available data is limited in several respects: we did not have access to exact dates for the transfers – except in the case of death – and the number of observations is fairly small. The data are furthermore from a very small part of the country – Kungsholmen, a part of the inner

city of Stockholm. The first problem was addressed by using the elapsed time between observations as an independent variable. Of course, this does not give ideal estimates and efforts can be made to improve the database in these respects. As for the third limitation, a comparison with national data (HINK/HEK) showed that the transitions measured in the present study do not deviate too much from those of the entire country.

Variables explaining the choice of OAC and mortality were age, gender, activities of daily life (ADL) limitations, and having a partner (representing informal help or care). The results seem consistent with general beliefs and research results obtained from similar analyses. Thus we find that the propensity to move to a more intensive mode of care was connected to gender, PADL-limitations and age. As should be expected the probabilities also increased with time between interviews. There was also an effect of the availability of informal care support, as measured by marriage or cohabitation.

Patterns of mortality could be studied with greater precision, since we in this case had access to the exact date of death. A model allowing for piecewise changes in the hazard function and unobserved heterogeneity clearly indicated neglected unobserved heterogeneity in our mortality model for those with 24-hour care. The observed relations pointed in the expected directions – mortality increases with increasing PADL-limitations and age and is higher for men than for women.

Gender-specific mortality estimates showed that the age-gradient and the effect of having a partner are about the same for both gender (however some of these effects are only significant for females). It seems, on the other hand, as if the excess mortality among men living in ordinary homes without home-help is driven by a steeper ADL-gradient compared to women.

Demand for old age care will increase substantially in the future since the share of elderly will increase. This affects both home help and institutional care, but also the informal care from relatives. This increase regards especially the age group 85 years and above. As by present a much higher proportion of single-living persons than cohabitating will demand public old age services. Most of these singles are women.

References

- Aguero-Torres H, von Strauss E, Viitanen M, Winblad B, Fratiglioni L. Institutionalization in the elderly: the role of chronic disease and dementia. Cross-sectional and longitudinal data from a population-based study. *Journal of Clinical Epidemiology* 2001; 54: 795 –801.
- Börsch-Supan, A., Brugiavini, A., Jürges, H., Mackenbach, J., Siegrist, J., Weber, G. (eds.) (2005): *Health, Ageing and Retirement in Europe – First Results from the Survey of Health, Ageing and Retirement in Europe*. Mannheim: MEA, available at <http://www.share-project.org>.
- Brown L J, Potter J F, Foster B G. Caregiver burden should be evaluated during geriatric assessment. *Journal of American Geriatric Society* 1990; 38: 455-460.
- Fratiglioni L et al. Occurrence of dementia in advanced age: the study design of the Kungsholmen project. *Neuroepidemiology* 1992; 11 (Suppl. 1):29-36.
- Kelman H R, Thomas C. Transitions between community and nursing home residence in an urban elderly population. *Journal of Community Health* 1990; 15:105-122.
- Larsson K, Thorslund T, Kårehult I. Are public care and services for older people targeted according to need? Applying the Behavioural Model on longitudinal data of a Swedish urban population. *Eur J Aging* 2006; 3:22-33.

- Larsson K, Thorslund M. Does gender matter? Differences in patterns of informal support and formal services in a Swedish urban elderly population. *Research on Aging* 2002; 24:308-326.
- Larsson K, Thorslund T, Forsell Y. Dementia and depressive symptoms as predictors of home help utilization among the oldest old: A population based study in an urban area of Sweden. *Journal of Aging and Health* 2004; 16:641-648.
- Livingston G, Manela M, Katona C. Cost of community care for older people. *British Journal of Psychiatry* 1997; 171:56–59.
- McFadden (1973) “Conditional Logit Analysis of Qualitative Choice Behavior”, in P. Zarembka, ed., *Frontiers in Econometrics*. New York: Academic Press.
- Meinow B, Kåreholt I, Lagergren M. According to need? Predicting the amount of municipal home help allocated to elderly recipients in an urban area in Sweden. *Health and Social Care in the Community* 2005; 13:366-377.
- Mustard C, Finlayson M, Derksen S & Berthelot J M. What determines the need for nursing home admission in a universally insured population? *Journal of Health Services Research* 1999; 4:197-203.
- Palme J, Berrgmark A, Backman O et al. (2003) A welfare balance for the 1990's. Final report of the Swedish Welfare Commission. *Scandinavian Journal of Public Health* 60 (suppl.):7 –143.
- Pearlman D N, Crown W H. Alternative sources of social support and their impacts on institutional risk. *Gerontologist* 1992; 32: 527-535.
- Sakari-Rantala R, Heikkinen E & Ruoppila I. Difficulties in mobility among elderly people and their association with socio-economic factors, dwelling environment and use of service. *Aging: Clinical and Experimental Research* 1995; 7:433-440.

- Stoddart H, Whitley E, Harvey I & Sharp D. What determines the use of home care services by elderly people. *Health and Social Care in the Community* 2002; 10:348-360
- Stoller E P & Cutler S J. Predictors of use of paid help among older people living in the community. *Gerontologist* 1993; 33:31-40.
- Szebehely M. (1998) Changing divisions of carework: caring for children and frail elderly people in Sweden. In: J Lewis (Ed.). *Gender, Social Care and Welfare State Restructuring in Europe*, pp. 257-283. Ashgate, Aldershot.
- Tennstedt S L, Sullivan LM, McKinley J B, D'Agostino R B: How important is functional status as a predictor of service use by older people? *Journal of Aging and Health* 1990; 2: 439-441.
- Thorslund M, Norström T, Wernberg K. The utilization of home help in Sweden:a multivariate analysis. *Gerontologist* 1991; 31:116-119.
- Thorslund M. (2003) Äldre som flyttar till service och vård. Uppföljning av situationen i Sundsvall 2002.[Elderly people moving to service and care facilities. A follow-up study from Sundsvall 2002. Stockholm: National Board of Health and Welfare.
- Willcocks D, Peace S, Kellaher L. (1987) *Private lives in public places*. London, Tavistok

Appendix: The PWCH duration model

The PWCH duration model can be written as follows. In a regression setting, let time for observation i , $t_i \geq 0$ be exponential, with probability density function (PDF)

$$f(t_i | \mathbf{x}_i) = \theta_i \exp(-\theta_i t_i^\alpha), \text{ where } \theta_i = \exp\left(\mathbf{x}_i \boldsymbol{\beta} + \sum_s \delta_s \mathbf{I}[a_s \leq t_i < b_s]\right) > 0, \mathbf{x}_i \text{ is a vector of}$$

regressors including the unit vector to accommodate an intercept, $\boldsymbol{\beta}$ is a vector of parameters,

δ_s is an intercept parameter for time interval s , and $\mathbf{I}[a_s \leq t_i < b_s]$ is an indicator function,

which is 1 if the duration is equal to or longer than a_s but shorter than b_s , and 0 otherwise.

An advantage with the PWCH model is that it is possible to capture unobserved heterogeneity, which represents a particular complication in duration models. In duration models, it is most common to include unobserved heterogeneity, denoted ν_i , multiplicatively in the hazard function: $h(t_i; \mathbf{x}_i, \boldsymbol{\omega}, \nu_i) = \lambda(t_i; \mathbf{x}_i, \boldsymbol{\omega}) \nu_i$, where $\lambda(\cdot)$ is the original hazard, $\boldsymbol{\omega}$ is the vector of parameters in that hazard, and ν_i is unobserved heterogeneity. ν_i is assumed independent identically distributed (IID), and independent of the included regressors \mathbf{x}_i . The unconditional distribution of t_i (obtained by integrating out ν_i) is called the mixture distribution, and if $g(\nu_i)$ is the density of ν_i , then it is called the mixing distribution (thereby the notion *mixture models*).

A closed form solution of the marginal (unconditional) distribution of t_i is obtained by assuming that $g(\nu_i)$ is gamma. For the modified version of the PWCH model with ‘gamma-

frailty’ (exponential-gamma mix), the PDF is $f(t_i | \mathbf{x}_i, \boldsymbol{\omega}, \sigma) = \theta_i (1 + \sigma \theta_i t_i)^{-\left(\frac{1}{\sigma} + 1\right)}$, where $E[\nu_i]$

is normalized to unity and σ is the variance parameter of the mixing distribution. The greater

σ the greater the effect of heterogeneity. The exponential distribution is obtained as the limit of $f(\cdot)$ when $\sigma \rightarrow 0$ (no unobserved heterogeneity).

TABLES AND FIGURES

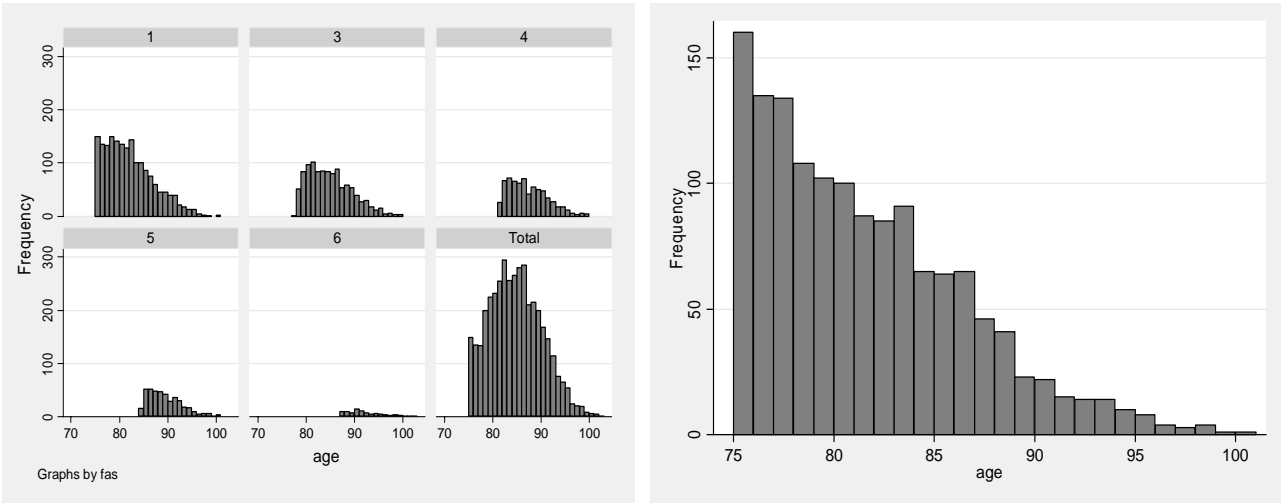


Figure 1 Age distribution in the Kungsholmen study (left) and HINK/HEK (right)

Table 1 Transitions in the Kungholmen study (top panel) and national data, HINK/HEK 1997-98 (bottom panel), frequencies and percentages

<i>All waves</i>						<i>Waves 1 and 2</i>					
age>=75 & age<=84, N=2,146						age>=75 & age<=84, N=1900					
	Exit state						Exit state				
Entrance state	0	1	2	Death	Freq.	Entrance state	0	1	2	death	Freq.
0	60.0%	9.1%	3.2%	27.7%	1644	0	60.7%	8.2%	3.1%	28.1%	1460
1	15.4%	31.3%	8.7%	44.5%	402	1	15.8%	30.0%	8.3%	45.8%	360
2	2.0%	0.0%	32.0%	66.0%	100	2	2.5%	0.0%	33.8%	63.8%	80
Age>=85, N=1,904						Age>=85, N=951					
	Exit state						Exit state				
Entrance state	0	1	2	Death	Freq.	Entrance state	0	1	2	death	Freq.
0	40.0%	15.0%	6.7%	38.3%	882	0	37.8%	13.4%	5.5%	43.3%	418
1	4.9%	30.8%	13.7%	50.6%	652	1	6.9%	29.3%	14.2%	49.6%	379
2	0.8%	1.1%	29.7%	68.4%	370	2	0.6%	1.9%	23.4%	74.0%	154
<i>1-year (raw data)</i>						<i>3-year equivalence (Markov)</i>					
age>=75 & age<=84, N=1,067						age>=75 & age<=84, N=1,067					
	Exit state						Exit state				
Entrance state	0	1	2	Death	Freq.	Entrance state	0	1	2	Death	Freq.
0	87.7%	5.6%	1.8%	4.9%	891	0	70.6%	10.4%	3.1%	15.9%	-
1	20.0%	66.2%	1.4%	12.4%	145	1	36.4%	31.7%	2.4%	29.5%	-
2	12.9%	6.5%	58.1%	22.6%	31	2	23.8%	9.1%	20.2%	46.9%	-
age>=85, N=335						age>=85, N=335					
	Exit state						Exit state				
Entrance state	0	1	2	Death	Freq.	Entrance state	0	1	2	Death	Freq.
0	62.0%	19.3%	4.8%	13.9%	166	0	29.7%	24.0%	7.7%	38.7%	-
1	15.2%	63.6%	8.3%	12.9%	132	1	18.9%	32.2%	9.9%	39.1%	-
2	2.7%	5.4%	51.4%	40.5%	37	2	4.2%	6.5%	14.6%	74.8%	-

Table 2. ADL score (in three levels) and entrance state OAC in the Kungsholmen study, frequencies and percent

<i>ADL</i>	<u>Entrance state OAC</u>			Total
	Independent living in ordinary home without public support	Independent living in ordinary home or special accommodations with home help and home health care	Living in special accommodations with around-the-clock-care	
0	1,024 87.1	140 11.9	12 1.0	1,176 100.0
1	1,213 70.2	482 27.9	32 1.8	1,727 100.0
2	301 40.7	360 48.7	78 10.6	739 100.0
3	35 7.0	99 19.7	368 73.3	502 100.0
Total	2,573 62.1	1,081 26.1	490 11.8	4,144 100.0

Table 3. Marginal effects of the multinomial choice of care mode (exit state), conditional on current mode (entrance state)

	entrance state=0 exit state=0		entrance state=0 exit state=1		entrance state=0 exit state=2		Mean
Man	0.072*	(2.12)	-0.080**	(-2.73)	0.007	(0.43)	0.240
ADL1	-0.018	(-0.86)	0.013	(0.68)	0.005	(0.47)	0.463
ADL2	-0.081*	(-2.21)	0.028	(0.86)	0.053*	(2.24)	0.113
ADL3	-0.605***	(-4.37)	0.196	(1.22)	0.409*	(2.14)	0.006
sambo	0.046*	(1.78)	-0.049*	(-2.08)	0.003	(0.21)	0.305
sambo*man	-0.083	(-1.17)	0.100	(1.42)	-0.017	(-0.92)	0.152
Age80-84	-0.159***	(-4.97)	0.102***	(3.50)	0.056**	(2.89)	0.390
Age85-89	-0.330***	(-7.84)	0.180***	(4.40)	0.150***	(4.42)	0.255
Age90-94	-0.509***	(-8.61)	0.238***	(3.24)	0.271***	(3.35)	0.059
Age95+	-0.637***	(-5.56)	0.287	(1.31)	0.350	(1.26)	0.003
Ytid	-0.069***	(-3.61)	0.031*	(1.85)	0.038***	(3.98)	3.191
	entrance state=1 exit state=0		entrance state=1 exit state=1		entrance state=1 exit state=2		Mean
Man	0.002	(0.08)	0.148**	(2.51)	-0.150**	(-2.66)	0.131
ADL1	0.005	(0.29)	-0.013	(-0.22)	0.008	(0.14)	0.536
ADL2	-0.043**	(-2.87)	-0.052	(-0.76)	0.096	(1.39)	0.281
ADL3	-0.044**	(-2.35)	-0.167	(-1.23)	0.210	(1.53)	0.039
sambo	0.037	(1.25)	0.145**	(2.36)	-0.182**	(-3.09)	0.135
sambo*man	-0.020	(-0.65)	-0.364*	(-1.70)	0.384*	(1.65)	0.058
Age80-84	-0.037**	(-2.56)	-0.153	(-1.39)	0.190*	(1.66)	0.287
Age85-89	-0.070***	(-4.21)	-0.217*	(-2.14)	0.287**	(2.73)	0.384
Age90-94	-0.078***	(-6.90)	-0.179	(-1.40)	0.257*	(1.99)	0.178
Age95+	-0.147***	(-7.87)	-0.138	(-0.75)	0.286	(1.55)	0.032
Ytid	-0.004	(-0.36)	-0.079**	(-2.36)	0.083**	(2.53)	3.022

Note. Except for the variable ytid, dy/dx is for discrete change of dummy variable from 0 to 1. Z-statistics in parenthesis. * p<0.05; ** p<0.01; *** p<0.001. *ADL1*: dummy variable for having only IADL limitations but no PADL limitations, *ADL2*: dummy variable for having not so severe PADL limitations (1-2 PADL), and *ADL3*: dummy variable for having severe PADL limitations (3-6 PADL).

Table 4 Estimates of a piece-wise constant hazard (PWCH) model of mortality risk given current care (entrance state)

Variable	No frailty			Model with frailty		
	entrance state=0	Entrance state=1	entrance state=2	entrance state=0	entrance state=1	entrance state=2
Man	1.625***	1.472*	1.503	1.625***	1.472*	1.906*
ADL1	0.983	0.809	0.655	0.983	0.809	0.711
ADL2	1.214	1.049	0.99	1.214	1.049	0.997
ADL3	2.901***	1.509*	1.321	2.901***	1.509*	1.509
Sambo	1.134	0.513**	3.212	1.134	0.513**	4.549*
sambo*man	1.004	1.473	0.513	1.004	1.473	0.336
age80-84	1.563***	1.134	0.985	1.563***	1.134	1.759
age85-89	2.303***	1.820***	0.872	2.303***	1.820***	1.871
age90-94	3.389***	2.633***	1.402	3.389***	2.633***	3.213
age95+	6.432***	2.536***	1.623	6.433***	2.536***	4.419
time0-365	0.125***	0.229**	0.438***	0.125***	0.229**	0.083***
time365-730	0.221***	0.328*	0.529*	0.221***	0.328*	0.129
time730-1095	0.303***	0.444		0.302***	0.444	
time1095-1460	0.288***	0.693	1.536	0.288***	0.693	3.40E+176
time1460-1825	0.307***	0.254*		0.306***	0.254*	
time1825-2500	0.268***	0.366		0.268***	0.366	
time2500-4000	0.507*	0.444		0.507*	0.444	
Cons	0.001***	0.002***	0.003***	0.001***	0.002***	0.006***
Ln(sigma)				-14.989	-14.354	-1.511
Z				-0.04	-0.05	-5.50
P> z				0.968	0.963	0.000
N	3716	1503	338	3716	1503	338
LogL	-1043.259	-645.033	-248.761	-1043.259	-645.033	-250.931
chi2	227.109	134.912	33.023	227.109	134.912	28.683

Note: The estimates are displayed in exponentiated form. * p<0.05; ** p<0.01; *** p<0.001. *ADL1*: dummy variable for having only IADL limitations but no PADL limitations, *ADL2*: dummy variable for having not so severe PADL limitations (1-2 PADL), and *ADL3*: dummy variable for having severe PADL limitations (3-6 PADL). Variables *time0-365*, *time365-730*, etc., are dummy variables indicating intervals (in the number of days) where the hazard is assumed piece-wise constant.

Table 5 Gender specific estimates of a piece-wise constant hazard (PWCH) model of mortality risk by mode of care, no frailty

Variable	Males			Females		
	entrance state=0	entrance state=1	entrance state=2	entrance state=0	entrance state=1	entrance state=2
ADL1	0.896	0.614		1.045	0.802	0.667
ADL2	1.719**	0.816	3.153	0.989	1.064	1.015
ADL3	4.002***	1.311	5.795	2.524**	1.525*	1.283
Sambo	1.081	0.678	1.141	1.155	0.511**	3.774
age80-84	1.554*	1.644	1.724	1.610***	1.041	0.765
age85-89	2.402***	1.605	1.963	2.311***	1.872***	0.72
age90-94	3.419***	2.157	1.356	3.567***	2.722***	1.33
age95+	5.101*	1.37	12.322	6.980***	3.007***	1.407
time0-365	0.268***	0.871	0.082	0.113***	0.214**	0.321
time365-730	0.456*	1.194	0.075	0.208***	0.316*	0.424
time730-1095	0.709	1.293	0.153	0.269***	0.453	0.81
time1095-1460	0.655	2.351		0.266***	0.678	
time1460-1825	0.667	3.07		0.295***	0.215**	
time1825-2500	0.595			0.258***	0.369	
time2500-4000		2.636		0.494*	0.432	
time4000+	1.337					
Constant	0.001***	0.001***	0.004***	0.001***	0.002***	0.004***
N	975	216	45	2741	1287	293
LogL	-343.112	-112.669	-37.498	-694.532	-525.984	-207.468
chi2	74.125	16.631	8.286	139.092	126.802	31.077

Note. See Table 4.

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