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Socio-economic determinants of long-term institutionalization in a community-dwelling elderly population

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ABSTRACT

As the public expenditure on long-term care is likely to increase with population ageing, better understanding of socioeconomic factors related to long-term institutional care is of particular interest. Using large population-based longitudinal data of the Finnish elderly (n=280 662), we estimated determinants of long-term institutionalization between 1998 and 2002 with Cox proportional hazards models. High income, home ownership, living in a well equipped dwelling, living in a detached house, possession of a car, and being married were associated with decreased risk of institutionalization. Having dementia, Parkinson's disease, cerebrovascular diseases, hip fracture, diabetes, psychotic symptoms, and other mental health disorders were strongly associated with increased risk of institutionalization in both men and women. The relative institutionalization ratio between the lowest and the highest income quintile was 1.43 for women and 1.96 for men. These effects were partly attributed to income differences in living arrangements, other socio-economic characteristics, housing conditions, and presence of certain illnesses, especially psychotic symptoms in both men and women, and diabetes in women. Overall, these results show that the future demand of institutional care does not only depend on population ageing but also on the development of elderly income and other socio-demographic factors.

Introduction

As the European populations continue to age, the public expenditure on long-term care is likely to increase in the future (Economic Policy Committee 2001). Long-term institutional care is one of the most expensive forms of long-term care provided for the elderly needing help with daily activities. In addition, the elderly are believed to prefer living in the community rather than in an institution as long as they are able to cope with daily activities and do not feel being burden to others. Therefore, it is important to investigate the factors associated with the risk of long-term institutionalization.

Despite numerous methodological differences (e.g. study design, sample selection and coverage, definition of institutional care, and data sources) several analyses give broadly similar results on some determinants of institutionalization. Several longitudinal studies have shown that advanced age, functional dependency, and cognitive impairment are associated with increased risk of institutionalization in general older populations (Branch & Jette, 1982; Shaphiro & Tate, 1988), and in older populations with disabilities (Chan, Kasper, Black, & Rabins, 2003; Greene & Ondriche, 1990; Pearlman & Crown, 1992; Yaffe, Fox, Newcomer, Sands, Lindquist, Dane; & Covinsky, 2002). In addition, certain health conditions such as dementia (Garber & MaCurdy ,1989; Tomiak, Berthelot, Guimond, & Mustard, 2000; Aguero-Torres, von Strauss, Viitanen, Winblad, & Fratiglioni, 2001; Chan et al., 2003), and hip fracture (Aguero-Torres et al., 2001) are shown to raise the risk of institutionalization. However, poor health, and cognitive and functional impairment are not the only factors associated with institutionalization. Previous studies, based on data from large population based samples in England and Wales, have shown that having no spouse and living alone are associated with an increased probability of institutionalization (Breeze, Slogget, & Fletcher, 1999; Grundy, 1992; Grundy & Glaser, 1997). In addition, several other studies indicate that after controlling for health living alone still raises the risk of institutionalization in the elderly (Branch & Jette, 1982; Steinbach, 1992), and in the disabled elderly (Greene & Ondriche, 1990; Liu, Coughlin, & McBride, 1991; Yaffe et al., 2002). These results indicate that informal care and emotional support of co-resident household members enable the elderly to continue living in the community.

However, studies that have examined associations between income and other indicators of socio-economic status and the risk of institutionalization give partly inconsistent results. Some analyses from the USA and Canada indicate that after controlling for health income has no significant effect on institutionalization (Garber & MaCurdy 1989; Speare, Avery, & Lawton,1991; Steinbach, 1992; Tomiak et al., 2000), while some analyses indicate that high income diminishes the risk of institutionalization in general older populations (Foley, Ostfeld,

Branch, Wallace, McGloin, & Cornoni-Huntley, 1992; Himes, Wagner, Wolf, Aykan, & Dougherty, 2000), and in chronically disabled elderly (Greene, Lovely, Miller, & Ondriche, 1995). Current evidence thus only partially indicates that wealthier elderly have characteristics other than better health that decrease their risk of institutionalization, e.g. wealthier elderly can afford home help services and live in better equipped apartments.

The inconsistency of previous results may be partly attributed to differences in measurement of income, the other variables included in the multivariate analysis, and the differences in the populations from which data are drawn from. For example, Green et al. (1995) examined the effect of monthly household income on the risk of institutionalization in the United States, Himes et al. (2000) annual household income in Germany and in the United States, and Tomiak et al. (2000) used various income measurements, including private pension income and investment income among others, in Manitoba (Canada). In addition, Foley et al. (1992) compared the risk of institutionalization in East Boston (Massachusetts), New Haven (Connecticut), and Iowa and Washington Counties (Iowa), and showed that low self-reported annual household income was associated with an increased probability of institutionalization only in Iowa. These different results could be related to missing income information on a large number of participants.

In addition, previous studies that have examined the associations between education and the risk of institutionalization give partly inconsistent results. Some studies indicate that after adjusting for health and some other socio-demographic factors, education has no significant effect on institutionalization (Cohen, Tell, & Wallack, 1986; Green et al., 1990; Wolinsky, Callahan, Fitzgerald, & Johnson, 1992), and some studies indicate that high education is associated with an decreased probability of institutionalization in older women (Tomiak et al. 2000). However, studies that have used home ownership as a measurement of socio-economic status give more consistent results. Several studies have shown that after adjusting for other socio-demographic factors home ownership is associated with decreased risk of institutionalization in general older population (Breeze et al.,1999; Grundy, 1992; Grundy & Glaser, 1997). Some studies have also shown that home ownership raise the risk of institutionalization, independent of health status, in disabled elderly (Garber & MaCurdy, 1989; Greene & Ondriche, 1990; Liu et al. 1991).

Some previous studies have indicated that the effect of income on the risk of institutionalization is attributed to health status. While studies on how the effect of income on the risk of institutionalization is mediated through housing conditions are infrequent. Wealthier elderly may have better possibilities to live in well equipped houses with central heating,

washing facilities, and piped water. These equipments may facilitate living in the community, especially for functionally impaired elderly.

The main propose of this study was to find socio-demographic and economic factors that are associated with long-term institutionalization, and analyse in more detail the effect of income. This study used population-based data of elderly Finnish men and women living in private households. These persons were followed during a five-year period of 1998-2002. The data combined detailed socio-demographic information, date of death, dates of institutional entrances and exits, and information on prior hospital use and drug purchases. The specific research questions of this study were: 1) to estimate the survival probabilities from long-term institutionalization by age and sex; 2) to estimate how marital status, living arrangements, income and other socioeconomic factors, housing conditions, and certain illnesses were associated with institutionalization; 3) to estimate the independent effects of these factors after adjustment for all other factors; 4) to examine if the association between income and institutionalization could be attributed to income differences in family characteristics and living arrangements, other socio-economic factors, housing conditions, and illnesses.

Data and methods

Data

The data for these analyses were based on a 40 per cent individual level random sample of the total Finnish elderly population at the end of 1997, drawn from a population registration database at the Statistics Finland. The baseline data were linked with information on prior hospital use diagnoses, drug purchases, and the right of reimbursement for drug costs by chronic illnesses for the period 1996-97. The sample was followed for long-term institutionalization and death during the period of 1998-2002. Death records came from the register of death certificates held at the Statistics Finland, information on institutionalization and prior hospital use came from the individual level service records at National Research and Development Centre for Welfare and Health (STAKES), and information on drug purchases, and the right of reimbursement for drug costs came from the Social Insurance Institution (KELA). Data linkage was carried out using personal identification codes. Permission to use the anonymised data was obtained from all register holders (permission TK 53-576-04). The data contained 5-year residential home, and hospital use histories of 301 263 persons aged 65 and over. From this group we eliminated all persons that were in long-term institutional care (5.9%), or did not reside in private households (0.9%) at the baseline. As a result, the effective study population consisted of 280 662 individuals, of which 32 147 entered into long-term institutional care, and 43 238 died without entering into institutional care during the follow-up period of 1998-2002. The sample is representative of Finnish elderly population residing in private households on 31st December 1997.

Dependent variable

The dependent variable was the time between the baseline of the study and the first entry into long-term institutional care during the follow-up period. The time was measured in days. Long-term care was inferred if a study person had stayed in an institution for at least 90 days, or institutionalization had been confirmed by a long-term care decision. Institution was defined as a care unit that provided long-term care and 24-hour assistance. These were residential homes and service houses with round-the-clock assistance, and inpatient care in hospitals and health centres. Long-term psychiatric care was also included. Ordinary service houses that did not have staff on duty 24 hours a day were not regarded as institutions. The 90 day criterion for long-term care was met if a patient had stayed in the same institution for the time required or in several institutions without returning back to the community for more than a day between the stays.

Information on institutionalization was based on six client censuses carried out at the end of each calendar year from 1997 to 2002, and residential home and hospital discharge data registered during the period of 1997-2002. Client censuses covered information on patients that were in the institution at the end of each year, and the discharge data covered information on patients that had left the institution during the calendar year. Such follow-up data of a large population-based sample, covering also residential home and hospital stays that start and end during the same calendar year, are internationally unique.

Independent variables

Independent variables were measured at the baseline at the end of 1997, expect for illnesses and social class. Illnesses were measured during two years prior to baseline, from 1st of January 1996 to 31st of December 1997. Prior social class came from the census at the end of 1995.

This study used household disposable income per consumption unit to measure income. Income includes all annual taxable income received by household members, including wages, capital income, pensions, unemployment benefits and other taxable income transfers. From this household income all taxes and certain social security payments have been subtracted, e.g. income, capital, municipal and church taxes, national pension insurance, health insurance payment, and forestry levy. Information on disposable income came from the register of the Tax Administration. In this study, disposable income of a household has been adjusted for the number of persons in the household. The first person in the household corresponds to one consumption unit and all others 0.5 units. In our analyses we used income quintiles. Cut-points for the quintiles were calculated from the combined data for elderly men and women.

Three other measures of socio-economic status were used. Educational categories were based on the highest completed educational degree. The categories were: tertiary education, intermediate education, and basic education. Social class categories were: upper white-collar, lower white-collar, worker specialized, worker non-specialized (or specialization unknown), farmer, other self-employed, and others and unknown. Retired persons were categorized according to their previous occupations and positions, housewives were categorized according to the social class of the head of the household. Housing tenure categories were: owners, renters, and others and unknown, mostly persons having the right of residence.

This study used two measures to characterise individual's dwelling. The house type categories were: detached house, semi-detached house, apartment house with lift, apartment house without lift, and other. The level of equipment in a dwelling was categorised in three categories: well equipped, poorly equipped, and very poorly equipped. A dwelling was regarded as well equipped if it had piped water, sewer, hot water, flush toilet, and central or electric heating, and as poorly equipped if it lacked washing facilities (e.g. shower, sauna, bathroom) and/or central or electric heating, and as very poorly equipped if it lacked one of the following: piped water, sewer, hot water or flush toilet. The possession of a car was measured dichotomously (yes/no). In these data, possession of a car was a characteristic of the individual, not of the household.

This study used three measures to characterise individual's family situation and living arrangements. The five marital status categories were: married, cohabiting, never married, divorced, and widowed. Living alone was measured dichotomously (no/yes), and number of children in the household was categorised as: no children, one child, at least two children. Children were person's own or spouse's adult or minor children that did not have own spouse or children in the same household.

We used age, and the area of residence as control variables in the first analyses (Model 1 in Tables 1 and 2), and age, the area of residence, and first language in the later analyses (Table 3). Area of residence was used as a control variable to adjust for differences in the supply and access of long-term institutional care between the areas. Two measurements of the area of residence were used: provinces, and a classification of municipalities that reflects the type of municipality in terms of population density. The classification of municipalities was based on the proportion of people living in built-up areas and the population of the largest built-up area. The categories were: urban municipalities, densely populated municipalities, and rural municipalities. The provinces were: Helsinki, Espoo-Vantaa-Kauniainen, Uusimaa, Itä-Uusimaa, Varsinais-Suomi, Satakunta, Kanta-Häme, Pirkanmaa, Päijat-Häme, Kymenlaakso, Etelä-Karjala, Etelä-Savo, Pohjois-Savo, Pohjois-Karjala, Keski-Suomi, Etelä-Pohjanmaa, Pohjanmaa,

Keski-Pohjanmaa, Pohjois-Pohjanmaa, Kainuu, Lappi, Ahvenanmaa. These are the official province categories (NUTS3), except that it distinguishes Helsinki (capital), and Espoo-Vantaa-Kauniainen (metropolitan area) from the province of Uusimaa. The first language was categorised dichotomously: Swedish speakers, and Finnish speakers and others.

This study used nineteen dichotomous variables to characterise illness (Appendix 1). These variables were: cancer, diabetes, dementia, psychotic symptoms, Parkinson's disease, other mental health disorders (than psychotic symptoms or dementia), other neurological diseases (than dementia or Parkinson's disease), cerebrovascular diseases, other serious circulatory diseases (that lead to hospital use), other circulatory diseases, asthma, other respiratory diseases, arthritis or rheumatism, arthrosis, other musculoskeletal diseases, hip fracture, other accidents or violence, other hospital diagnoses, and other chronic diseases that give the right of reimbursement for drug costs under the Special Refund Categories. We used three register sources to assess illnesses: 1) main diagnoses for hospitalization in 1996-1997, 2) purchase of prescription drugs in 1996-1997, and 3) right to get reimbursement for drug costs under the Special Refund Categories for certain chronic illnesses in 1997. A study person was categorized as having the illness if he/she had it according to at least one source. The hospital diagnoses were based on the Tenth Revision of the International classification of diseases (ICD10), drug purchases were based on the Anatomical Therapeutic Chemical Classification (ATC), and the right to get reimbursement for drug costs under the Special Refund Categories were based on the Finnish disease classification of the Social Insurance Institution (STAKES, 1999; Lääkelaitos 1997, Lääkelaitos 1998; KELA 1998).

In Finland, certain chronic illnesses were reimbursed under the Special Refund Categories that covered 75% or 100% of the costs of one drug purchase that exceeded a fixed deductible of 25 marks, 4.20 euros (KELA 1998; Martikainen & Rajaniemi 2002). In order to receive reimbursement under the Special Refund Categories the patient had to submit a doctor's certificate to the Social Insurance Institution stating the illness, its severity and the medication needed to treat it. Patient's wealth, age, or belonging to other special groups did not affect reimbursement, but severity of illness and effectiveness of medicinal product did (Martikainen & Rajaniemi 2002).

Statistical methods

This study used the Kaplan-Meier survival method to estimate the probabilities of survival from long-term institutional entry during the five-year follow-up. The method gives an estimate of the probability of not having entered into the institution as a function of time (every day during the follow-up). The Kaplan-Meier survival estimator is a widely used nonparametric method for censored survival data. The estimation procedure is called nonparametric because the class of

admissible distributions from which the best-fitting one (that best fits the observations) is to be chosen need not to be specified or known (Kaplan & Meier 1958). Censoring refers to situations where individuals cannot be observed for the full time to event. In this study the survival time is right censored as some individuals die or the follow-up ends before institutionalization occurs. In this study survival data is presented by estimating the cumulative survival curve by sex and age. (Kaplan & Meier 1958; Christensen 1987; Dickman 2004). The Kaplan-Meier estimate of the cumulative survival function at time *t* is:

$$\hat{S}(t) = \begin{cases} 1 & \text{if } t < t_1 \\ \prod_{t_i \le t} (1 - \frac{d_i}{l_i}) & \text{if } t \ge t_1 \end{cases}$$

where d_i is the number of institutionalization occurring at time t_i, and l_i the number of persons at risk. Censorings (deaths) do not affect the estimate of S(t) but decreases the number of persons at risk at the next time institutionalization occurs (Dickman, 2004).

We used Cox proportional hazards regression models to estimate the determinants of the first entry into long-term institutional care. The Cox regression model is a multiple regression model for analysis of censored survival data (Cox, 1972; Christensen, 1987; Dickman, 2004). The Cox model is often used to examine the pattern of association of several explanatory variables with survival time to find the combination of variables that best predicts the survival. The Cox proportional hazards model does not make any assumptions about the distribution of the survival times but makes the assumption of proportional hazards. The Cox model assumes that the hazards of any two subgroups are proportional over time, i.e. the ratio between the hazards is constant at any time *t*. In the Cox regression model, the hazard at time *t* is assumed to be:

$$\lambda(t; \mathbf{x}) = \lambda_0(t) \exp(\beta_1 x_1 + ... + \beta_k x_k) ,$$

where $x_1,...,x_k$ are explanatory variables, $\beta_{1, ..., } \beta_k$ regression coefficients, and $\lambda_0(t)$ the baseline hazard component. The Cox model provides estimates of regression coefficients but provides no estimate of the baseline hazard. From the regression coefficient β of a variable, it is possible to estimate relative risks (hazard ratios) of institutionalization between the different categories of that variable, all other variables being unchanged. In this study, the results from the Cox model are shown as hazard ratios (called HR: ratios for hazard of institutionalization). All analyses were carried out using Stata (Special Edition) 8 (StataCorp., 2003).

Results

Survival from long-term institutionalization by sex and age

Kaplan-Meier survival estimates are shown in Figure 1. The probability of survival from long-term institutional entry was 0.86 for elderly women, and 0.90 for elderly men. The probability of survival from long-term institutionalization decreased dramatically with age (Figure 2). The age pattern was similar for men and women. The sex differences in the probability of survival from long-term institutionalization became apparent with age. In the youngest age-groups of 65-69-years, the probability of survival was the same among men and women (0.96 for both). In the older age-groups the sex differences were more explicit: the probability of survival was lower for women than men.

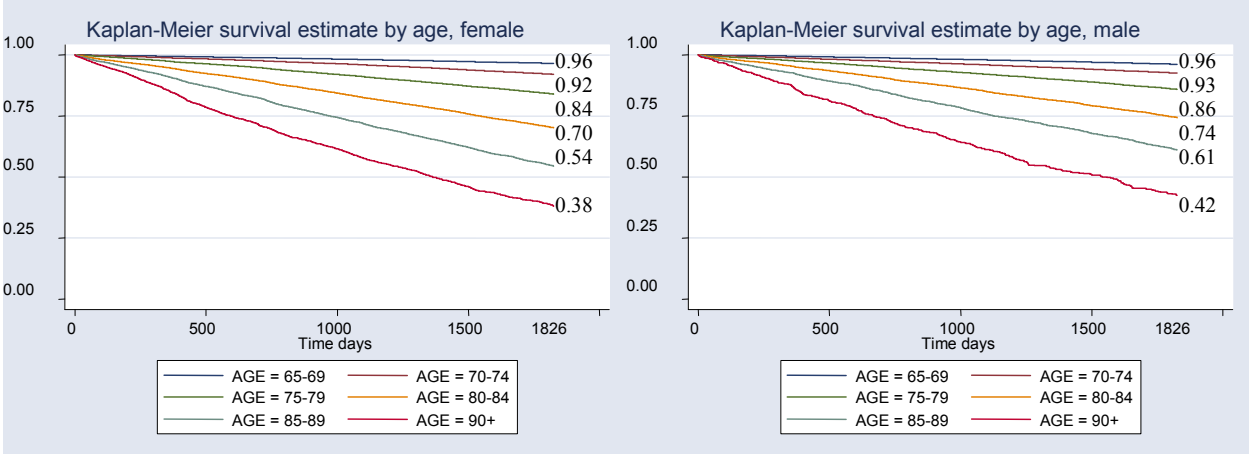

Figure 1.

Kaplan-Meier survival estimates of long-term institutional entry by sex and age, 1.1.1998-31.12.2002

Associations between socio-demographic factors and long-term institutionalization

This study indicates that 13% of elderly women and 9% of elderly men entered into long-term institutional care during the 5-year follow-up (Tables 1 and 2). Factors associated with the risk of institutionalization were partially the same among men and women (Model A in Tables 1 and 2). For both men and women, advanced age was strongly associated with increased risk of institutionalization. High household disposable income, high education, home ownership, and possession of a car were associated with decreased risk after adjustment for age and area of residence. Living in an apartment house or semi-detached house was associated with increased risk compared with living in a detached house. Having a lift, if living in an apartment house, was not associated with the risk of institutionalization (significance test not shown). For both men and women, being a manual worker was associated with increased risk. Also lower white-collar workers, farmers, and self-employed had a higher risk compared with upper-white

collar workers. The level of equipment in a dwelling was associated differently with the risk of institutionalization for men and women when adjusted only for age and area of residence. Among men, those residing in a very poorly equipped dwelling had a higher risk of institutionalization than those residing in a well equipped dwelling. In contrast, among women, those living in a poorly equipped dwelling had lower risk than those living in a well equipped dwelling. This is related to poorly and very poorly equipped dwellings being more often detached houses in which the risk of institutionalization is lower. Overall, the associations between all socioeconomic measures and institutionalization were stronger in men than in women. Relative differences between the top and bottom of education were about 20% in women and 50% in men. For income, housing tenure and car access the associations were even stronger at about 50-60% excess in women, and 100% excess in men.

Living in an urban municipality was associated with increased risk of institutionalization only for women. In men, the type of municipality was not associated with institutionalization. Conversely, being a Swedish speakers was associated with decreased risk in men but was not associated with institutionalization in women.

Marital status differences in institutionalization were larger among men than women, except for cohabiting persons. Among both men and women, the married had the lowest risk of institutionalization, the never married the highest risk, and the divorced second highest. Among men, cohabiting persons had clearly lower risk of institutionalization than the widowed. In contrast, among women the widowed had lower risk of institutionalization than cohabiting persons. For both men and women, living alone was associated with increased risk of institutionalization after adjustment for age and area of residence. For women, the number of children in the household was associated with decreased risk. For men, those having one child in the household had lower risk than those having no children.

For both men and women, dementia, Parkinson's disease, cerebrovascular diseases, psychotic symptoms, other mental health disorders, hip fracture, other accidents or violence, other neurological diseases, diabetes, other respiratory diseases than asthma, other musculoskeletal diseases, other circulatory diseases, arthritis or rheumatism, and cancer were associated with increased risk of institutionalization. In addition, other hospital diagnoses, and other diseases that give the right of reimbursements for drug costs under the Special Refund Category were associated with increased risk. For men, also asthma was associated with increased risk after adjustment for age and area of residence. For women, arthrosis was associated with increased risk.

Table 1. Summary statistics and results from proportional hazard regression models for long-term institutional entry, 1.1.1998-31.12.2002, females

Females 65+	Distribution %	Entering institution %	Number of institutionalized	Model A + Age + Province + Type of municipality		Model B Full model	
				HR	95% CI	HR	95% CI
Age							
65-69	29.8	3.5	1778	1.00		1.00	
70-74	27.2	7.6	3530	**2.27**	(2.15 - 2.41)	**2.02**	(1.91 - 2.14)
75-79	20.9	14.8	5325	**4.82**	(4.57 - 5.09)	**3.78**	(3.57 - 3.99)
80-84	13.5	26.0	6063	**9.76**	(9.26 - 10.29)	**6.83**	(6.45 - 7.22)
85-89	6.7	36.7	4253	**16.85**	(15.94 - 17.81)	**10.88**	(10.24 - 11.55)
90+	1.9	44.8	1473	**27.56**	(25.71 - 29.54)	**17.46**	(16.21 - 18.81)
Type of municipality							
Urban	55.8	13.4	12882	1.00		1.00	
Densely populated	15.9	12.6	3449	**0.94**	(0.91 - 0.98)	**0.92**	(0.88 - 0.96)
Rural	28.2	12.5	6091	**0.93**	(0.90 - 0.96)	**0.91**	(0.87 - 0.94)
Language							
Swedish	7.4	15.1	1925	1.00		1.00	
Finnish	92.6	12.9	20497	1.04	(0.99 - 1.11)	0.94	(0.89 - 1.00)
Marital status							
Married	36.2	7.1	4439	1.00		1.00	
Cohabiting	1.4	9.3	224	**1.38**	(1.21 - 1.58)	**1.24**	(1.08 - 1.42)
Never married	10.2	16.5	2899	**1.49**	(1.42 - 1.56)	**1.47**	(1.39 - 1.56)
Divorced	7.8	12.5	1679	**1.41**	(1.34 - 1.50)	**1.26**	(1.18 - 1.35)
Widowed	44.4	17.2	13181	**1.28**	(1.23 - 1.33)	**1.25**	(1.19 - 1.31)
Living alone							
No	50.0	9.5	8136	1.00		1.00	
Yes	50.0	16.6	14286	**1.21**	(1.18 - 1.25)	**0.94**	(0.90 - 0.99)
Number of children in household							
0	89.8	13.3	20562	1.00		1.00	
1	9.0	10.7	1656	**0.88**	(0.83 - 0.92)	0.94	(0.89 - 1.00)
2+	1.3	9.2	204	**0.78**	(0.68 - 0.90)	**0.84**	(0.73 - 0.97)
Education							
Tertiary	8.0	10.6	1445	1.00		1.00	
Intermediate	13.6	10.7	2502	**1.07**	(1.01 - 1.15)	0.97	(0.91 - 1.04)
Basic	78.4	13.7	18475	**1.18**	(1.12 - 1.25)	0.99	(0.93 - 1.06)
Ses 1995							
Upper white-collar	7.4	10.7	1368	1.00		1.00	
Lower white-collar	26.1	11.1	5003	**1.13**	(1.06 - 1.20)	1.01	(0.94 - 1.08)
Worker specialized	17.1	16.4	4829	**1.31**	(1.23 - 1.39)	1.07	(1.00 - 1.15)
Worker non-specialized	25.5	11.5	5051	**1.20**	(1.13 - 1.28)	1.01	(0.94 - 1.08)
Farmer	16.9	15.2	4443	**1.21**	(1.13 - 1.29)	1.02	(0.95 - 1.10)
Self-employed	4.6	11.7	931	**1.13**	(1.04 - 1.23)	1.02	(0.93 - 1.11)
Other	2.3	19.8	797	**1.36**	(1.25 - 1.49)	1.09	(0.99 - 1.20)
Income							
5. Quintile (highest)	17.1	9.1	2668	1.00		1.00	
4. Quintile	17.3	9.2	2747	**1.10**	(1.04 - 1.16)	**1.07**	(1.01 - 1.13)
3. Quintile	19.2	10.7	3528	**1.19**	(1.13 - 1.25)	**1.10**	(1.04 - 1.16)
2. Quintile	21.8	14.1	5315	**1.33**	(1.27 - 1.39)	**1.17**	(1.11 - 1.24)
1. Quintile (lowest)	24.5	19.3	8164	**1.43**	(1.36 - 1.49)	**1.17**	(1.11 - 1.24)
Housing tenure							
Owner	78.1	11.6	15626	1.00		1.00	
Renter	18.1	18.9	5876	**1.44**	(1.39 - 1.48)	**1.19**	(1.15 - 1.23)
Other	3.8	14.0	920	1.04	(0.97 - 1.11)	0.99	(0.93 - 1.06)
House type							
Detached house	42.7	10.6	7763	1.00		1.00	
Semi-detached house	11.9	15.1	3099	**1.30**	(1.25 - 1.36)	**1.10**	(1.04 - 1.15)
Apartment house with lift	23.6	14.8	6003	**1.23**	(1.18 - 1.28)	**1.08**	(1.03 - 1.13)
Apartment house without lift	19.7	14.0	4747	**1.20**	(1.16 - 1.25)	**1.08**	(1.03 - 1.13)
Other	2.2	21.6	810	**1.68**	(1.56 - 1.81)	**1.24**	(1.14 - 1.34)
Level of equipment in dwelling							
Well equipped	81.6	13.0	18205	1.00		1.00	
Poorly equipped	8.3	12.8	1823	**0.94**	(0.90 - 0.99)	**1.07**	(1.02 - 1.13)
Very poorly equipped	10.1	13.7	2394	0.98	(0.94 - 1.03)	**1.13**	(1.08 - 1.19)
Car							
Yes	8.6	5.2	769	1.00		1.00	
No	91.4	13.8	21653	**1.59**	(1.48 - 1.72)	**1.42**	(1.32 - 1.53)

(continued)

Table 1. (continued)

Female 65+	Distribution %	Entering institution %	Number of institutionalized	Model A + Age + Province + Type of municipality		Model B Full model	
				HR	95% CI	HR	95% CI
Cancer (F, ATC, ICD10)							
No	95.9	12.9	21344	1.00		1.00	
Yes	4.1	15.4	1078	**1.43**	(1.35 - 1.52)	**1.25**	(1.17 - 1.33)
Diabetes (F, ATC, ICD10)							
No	89.9	12.3	18999	1.00		1.00	
Yes	10.1	19.7	3423	**1.73**	(1.67 - 1.79)	**1.52**	(1.47 - 1.58)
Dementia (ICD10)							
No	99.4	12.7	21686	1.00		1.00	
Yes	0.6	68.6	736	**7.59**	(7.04 - 8.17)	**4.34**	(4.02 - 4.69)
Psychotic symptoms (F, ATC, ICD10)							
No	92.0	11.6	18347	1.00		1.00	
Yes	8.0	29.6	4075	**2.63**	(2.54 - 2.72)	**1.78**	(1.72 - 1.85)
Parkinson's disease (F, ATC, ICD10)							
No	98.3	12.6	21360	1.00		1.00	
Yes	1.7	36.7	1062	**3.45**	(3.25 - 3.67)	**2.14**	(2.01 - 2.28)
Other mental health disorders (ATC, ICD10)							
No	89.1	11.5	17581	1.00		1.00	
Yes	10.9	25.8	4841	**2.34**	(2.27 - 2.42)	**1.61**	(1.56 - 1.67)
Other neurological diseases (F, ATC, ICD10)							
No	96.0	12.6	20876	1.00		1.00	
Yes	4.0	22.6	1546	**1.85**	(1.76 - 1.95)	**1.30**	(1.23 - 1.37)
Cerebrovascular diseases (ICD10)							
No	98.4	12.7	21541	1.00		1.00	
Yes	1.6	32.4	881	**2.64**	(2.47 - 2.83)	**1.91**	(1.78 - 2.04)
Other serious circulatory diseases ((ICD10)							
No	89.8	12.1	18762	1.00		1.00	
Yes	10.2	20.9	3660	**1.55**	(1.50 - 1.61)	**1.24**	(1.20 - 1.29)
Other circulatory diseases (F)							
No	53.0	11.0	10062	1.00		1.00	
Yes	47.0	15.4	12360	**1.21**	(1.17 - 1.24)	**1.03**	(1.00 - 1.06)
Asthma (F, ATC, ICD10)							
No	88.2	13.2	20017	1.00		1.00	
Yes	11.8	11.8	2405	1.01	(0.96 - 1.05)	**0.89**	(0.85 - 0.93)
Other respiratory disease (ICD10)							
No	97.1	12.7	21211	1.00		1.00	
Yes	2.9	23.9	1211	**1.63**	(1.54 - 1.73)	**1.25**	(1.18 - 1.32)
Arthritis / rheumatism (F, ATC, ICD10)							
No	95.2	12.8	20985	1.00		1.00	
Yes	4.8	17.3	1437	**1.50**	(1.42 - 1.58)	**1.39**	(1.32 - 1.47)
Arthrosis (ICD10)							
No	97.1	13.0	21664	1.00		1.00	
Yes	2.9	15.1	758	**1.15**	(1.07 - 1.24)	1.05	(0.97 - 1.13)
Other musculoskeletal diseases (ICD10)							
No	96.7	12.8	21287	1.00		1.00	
Yes	3.3	19.9	1135	**1.53**	(1.44 - 1.63)	**1.18**	(1.11 - 1.25)
Hip Fracture (ICD10)							
No	99.0	12.8	21819	1.00		1.00	
Yes	1.0	36.1	603	**1.98**	(1.83 - 2.15)	**1.53**	(1.41 - 1.66)
Other accident or violence (ICD10)							
No	96.0	12.4	20543	1.00		1.00	
Yes	4.0	27.2	1879	**1.98**	(1.89 - 2.07)	**1.48**	(1.41 - 1.56)
Other hospital diagnoses (ICD10)							
No	77.6	10.7	14350	1.00		1.00	
Yes	22.4	21.0	8072	**1.64**	(1.59 - 1.68)	**1.28**	(1.24 - 1.31)
Other diseases with right of reimbursement for drug costs (F)							
No	85.3	12.4	18258	1.00		1.00	
Yes	14.7	16.4	4164	**1.12**	(1.08 - 1.16)	1.03	(1.00 - 1.07)
Total	100.0	13.0					
N	172207		22422				

Bold: p-value<0.05
HR: Hazard ratio
F: Right of reimbursement for drug costs under the Special Refund Category 1997 (Finnish Classification)
ATC: Drug purchase 1996-1997 (Anatomical Therapeutic Chemical Classification)
ICD10: Diagnosis during prior hospital stay 1996-1997
(International Statistical Classification of Diseases and Related Health Problems, 10th Revision)

Table 2. Summary statistics and results from proportional hazard regression models for long-term institutional entry, 1.1.1998-31.12.2002, males

Males 65+	Distribution %	Entering institution %	Number of institutionalized	Model A + Age + Province + Type of municipality		Model B Full model	
				HR	95% CI	HR	95% CI
Age							
65-69	38.5	3.6	1516	1.00		1.00	
70-74	29.4	6.7	2146	**1.96**	(1.84 - 2.10)	**1.79**	(1.68 - 1.92)
75-79	17.4	12.1	2274	**3.84**	(3.60 - 4.10)	**3.12**	(2.92 - 3.34)
80-84	9.5	20.4	2102	**7.53**	(7.04 - 8.04)	**5.37**	(5.01 - 5.77)
85-89	4.2	27.9	1255	**12.50**	(11.60 - 13.48)	**7.77**	(7.15 - 8.43)
90+	1.1	38.1	432	**22.07**	(19.82 - 24.58)	**13.43**	(11.97 - 15.06)
Type of municipality							
Urban	51.2	9.3	5144	1.00		1.00	
Densely populated	17.1	8.5	1579	0.95	(0.90 - 1.01)	0.99	(0.93 - 1.06)
Rural	31.8	8.7	3002	0.98	(0.93 - 1.03)	0.98	(0.92 - 1.04)
Language							
Swedish	8.4	9.7	878	1.00		1.00	
Finnish	91.6	8.9	8847	**1.13**	(1.03 - 1.23)	1.05	(0.96 - 1.14)
Marital status							
Married	71.6	7.1	5480	1.00		1.00	
Cohabiting	2.5	6.7	181	**1.17**	(1.01 - 1.36)	1.03	(0.89 - 1.20)
Never married	7.4	12.2	981	**2.14**	(2.00 - 2.29)	**1.54**	(1.41 - 1.68)
Divorced	5.5	11.4	679	**2.01**	(1.85 - 2.18)	**1.44**	(1.30 - 1.59)
Widowed	13.0	17.0	2404	**1.49**	(1.41 - 1.57)	**1.28**	(1.18 - 1.38)
Living alone							
No	78.1	7.4	6236	1.00		1.00	
Yes	21.9	14.7	3489	**1.66**	(1.59 - 1.74)	**1.08**	(1.00 - 1.17)
Number of children in household							
0	88.9	9.3	8934	1.00		1.00	
1	9.4	6.7	680	**0.80**	(0.74 - 0.86)	**0.90**	(0.82 - 0.97)
2+	1.6	6.2	111	0.83	(0.69 - 1.00)	0.97	(0.80 - 1.17)
Education							
Tertiary	13.6	6.8	1010	1.00		1.00	
Intermediate	12.3	8.3	1112	**1.38**	(1.27 - 1.51)	**1.15**	(1.04 - 1.26)
Basic	74.1	9.5	7603	**1.49**	(1.39 - 1.59)	**1.09**	(1.00 - 1.19)
Ses 1995							
Upper white-collar	11.2	6.9	836	1.00		1.00	
Lower white-collar	14.8	8.4	1357	**1.24**	(1.13 - 1.35)	1.03	(0.94 - 1.13)
Worker specialized	28.8	9.6	2988	**1.46**	(1.35 - 1.57)	1.03	(0.93 - 1.14)
Worker non-specialized	16.9	9.2	1683	**1.67**	(1.53 - 1.82)	1.05	(0.94 - 1.17)
Farmer	19.6	9.7	2063	**1.32**	(1.21 - 1.44)	0.94	(0.84 - 1.04)
Self-employed	7.5	7.5	608	**1.28**	(1.15 - 1.42)	1.08	(0.96 - 1.22)
Other	1.3	13.1	190	**2.00**	(1.71 - 2.35)	1.13	(0.95 - 1.34)
Income							
5. Quintile (highest)	24.9	6.3	1696	1.00		1.00	
4. Quintile	23.4	7.0	1789	**1.18**	(1.10 - 1.26)	1.07	(0.99 - 1.14)
3. Quintile	22.2	9.2	2228	**1.47**	(1.38 - 1.57)	**1.23**	(1.14 - 1.32)
2. Quintile	18.0	11.0	2147	**1.55**	(1.45 - 1.66)	**1.14**	(1.06 - 1.23)
1. Quintile (lowest)	11.5	14.9	1865	**1.97**	(1.83 - 2.11)	**1.14**	(1.04 - 1.24)
Housing tenure							
Owner	83.8	8.1	7320	1.00		1.00	
Renter	12.7	14.4	1981	**1.88**	(1.79 - 1.98)	**1.22**	(1.15 - 1.29)
Other	3.5	11.2	424	**1.24**	(1.12 - 1.36)	1.08	(0.97 - 1.19)
House type							
Detached house	55.7	7.4	4496	1.00		1.00	
Semi-detached house	10.7	10.8	1243	**1.43**	(1.34 - 1.52)	**1.10**	(1.02 - 1.18)
Apartment house with lift	16.9	10.8	1978	**1.36**	(1.28 - 1.45)	**1.11**	(1.04 - 1.19)
Apartment house without lift	14.5	10.9	1711	**1.42**	(1.34 - 1.51)	**1.14**	(1.06 - 1.22)
Other	2.2	12.7	297	**1.64**	(1.45 - 1.84)	1.04	(0.92 - 1.18)
Level of equipment in dwelling							
Well equipped	79.0	8.8	7534	1.00		1.00	
Poorly equipped	8.9	9.4	909	1.03	(0.96 - 1.10)	**1.09**	(1.01 - 1.17)
Very poorly equipped	12.1	9.8	1282	**1.10**	(1.04 - 1.17)	**1.13**	(1.06 - 1.21)
Car							
Yes	41.4	5.3	3336	1.00		1.00	
No	58.6	14.2	6389	**2.18**	(2.09 - 2.28)	**1.67**	(1.60 - 1.76)

(continued)

Table 2. (continued)

Male 65+	Distribution %	Entering institution %	Number of institutionalized	Model A + Age + Province + Type of municipality		Model B Full model	
				HR	95% CI	HR	95% CI
Cancer (F, ATC, ICD10)							
No	94.9	8.8	9029	1.00		1.00	
Yes	5.1	12.6	696	**1.48**	(1.37 - 1.59)	**1.35**	(1.25 - 1.46)
Diabetes (F, ATC, ICD10)							
No	89.9	8.4	8209	1.00		1.00	
Yes	10.1	13.9	1516	**1.90**	(1.79 - 2.00)	**1.65**	(1.56 - 1.75)
Dementia (ICD10)							
No	99.5	8.7	9404	1.00		1.00	
Yes	0.6	53.8	321	**9.27**	(8.27 - 10.38)	**4.24**	(3.77 - 4.78)
Psychotic symptoms (F, ATC, ICD10)							
No	94.4	8.1	8327	1.00		1.00	
Yes	5.6	23.0	1398	**2.99**	(2.83 - 3.17)	**1.59**	(1.50 - 1.70)
Parkinson's disease (F, ATC, ICD10)							
No	98.1	8.6	9150	1.00		1.00	
Yes	1.9	28.2	575	**3.73**	(3.43 - 4.06)	**2.40**	(2.20 - 2.62)
Other mental health disorders (ATC, ICD10)							
No	93.0	8.1	8198	1.00		1.00	
Yes	7.1	20.0	1527	**2.62**	(2.48 - 2.77)	**1.55**	(1.46 - 1.64)
Other neurological diseases (F, ATC, ICD10)							
No	95.3	8.6	8886	1.00		1.00	
Yes	4.7	16.6	839	**2.15**	(2.00 - 2.31)	**1.39**	(1.29 - 1.50)
Cerebrovascular diseases (ICD10)							
No	97.5	8.6	9056	1.00		1.00	
Yes	2.5	24.8	669	**3.24**	(2.99 - 3.51)	**2.23**	(2.06 - 2.42)
Other serious circulatory diseases ((ICD10)							
No	87.8	8.5	8087	1.00		1.00	
Yes	12.2	12.4	1638	**1.47**	(1.39 - 1.55)	**1.20**	(1.13 - 1.27)
Other circulatory diseases (F)							
No	54.0	8.4	4911	1.00		1.00	
Yes	46.0	9.6	4814	**1.15**	(1.10 - 1.20)	1.02	(0.97 - 1.06)
Asthma (F, ATC, ICD10)							
No	86.3	8.8	8262	1.00		1.00	
Yes	13.7	9.9	1463	**1.19**	(1.13 - 1.26)	1.05	(0.99 - 1.11)
Other respiratory disease (ICD10)							
No	95.9	8.6	8945	1.00		1.00	
Yes	4.1	17.7	780	**1.98**	(1.84 - 2.13)	**1.36**	(1.26 - 1.47)
Arthritis / rheumatism (F, ATC, ICD10)							
No	97.5	8.9	9444	1.00		1.00	
Yes	2.5	10.4	281	**1.31**	(1.16 - 1.47)	**1.22**	(1.09 - 1.38)
Arthrosis (ICD10)							
No	98.1	8.9	9520	1.00		1.00	
Yes	1.9	10.2	205	1.07	(0.93 - 1.23)	1.05	(0.92 - 1.21)
Other musculoskeletal diseases (ICD10)							
No	97.2	8.9	9351	1.00		1.00	
Yes	2.8	12.4	374	**1.35**	(1.21 - 1.49)	1.10	(0.99 - 1.22)
Hip Fracture (ICD10)							
No	99.5	8.9	9579	1.00		1.00	
Yes	0.5	29.5	146	**2.85**	(2.42 - 3.36)	**1.78**	(1.51 - 2.10)
Other accident or violence (ICD10)							
No	96.5	8.7	9097	1.00		1.00	
Yes	3.5	16.5	628	**1.84**	(1.70 - 1.99)	**1.30**	(1.20 - 1.42)
Other hospital diagnoses (ICD10)							
No	78.2	7.6	6427	1.00		1.00	
Yes	21.8	13.9	3298	**1.64**	(1.57 - 1.71)	**1.27**	(1.21 - 1.33)
Other diseases with right of reimbursement for drug costs (F)							
No	90.2	8.7	8476	1.00		1.00	
Yes	9.8	11.7	1249	**1.12**	(1.06 - 1.19)	1.04	(0.98 - 1.10)
Total	100.0	9.0					
N	108455		9725				

Bold: p-value<0.05
HR: Hazard ratio
F: Right of reimbursement for drug costs under the Special Refund Category 1997 (Finnish Classification)
ATC: Drug purchase 1996-1997 (Anatomical Therapeutic Chemical Classification)
ICD10: Diagnosis during prior hospital stay 1996-1997
(International Statistical Classification of Diseases and Related Health Problems, 10th Revision)

Determinants of long-term institutionalization in the fully-adjusted models

Age was a strong determinant of long-term institutionalization for both men and women. High household disposable income, home ownership, living in a detached house, possession of a car, living in well equipped dwelling, and being married were associated with decreased risk after adjustment for all other factors (Model B in Tables 1 and 2). In women, the risk of institutionalization was the same for the widowed, the divorced, and the cohabiting but higher for the never married. In men, the risk was highest for the never married, followed by the divorced, the widowed, and the married in that order. The protective effect of being married was stronger in men, except when comparing the married with cohabiting persons. Cohabiting did not raise the risk of institutionalization in men. The number of children in the household was associated with the risk of institutionalization for both men and women, although slightly differently. For women, having two children reduces the risk compared with having no children, but having only one child did not significantly reduce the risk. For men, having one child reduced the risk compared with having no children, but having two children was not associated with decreased risk. High education was associated with decreased risk only among men. Among men, persons with intermediate education seem to have a higher risk than persons with tertiary education. Basic education did not clearly raise the risk of institutionalization after adjustment for all other factors. Education and living alone was not associated with institutionalization among women. Among men, living alone raised the risk only modestly. Living in an urban municipality was associated with increased risk only among women. Social class and being a Swedish speaker were not associated with the risk of institutionalization after adjustment for all other variables. Having a lift, if living in an apartment house, was still not associated with the risk of institutionalization (significance test not shown).

Dementia, Parkinson's disease, cerebrovascular diseases, psychotic symptoms, other mental health disorders, hip fracture, diabetes, other accidents or violence, arthritis or rheumatism, other neurological diseases, other respiratory diseases than asthma, cancer, and other serious circulatory diseases raised the risk of institutionalization. In addition, the category of other hospital diagnoses was also associated with increased risk. Other musculoskeletal diseases were associated with increased risk only among women. Asthma seems to be associated with decreased risk among women after adjustment for all other factors. In both men and women, dementia, Parkinson's disease, and cerebrovascular diseases raised the risk of long-term institutionalization the most.

Income and the risk of long-term institutionalization

This study examined in more detail the inverse relationship between household disposable income and the risk of long-term institutionalization. The idea was to study if elderly with lower income have a higher risk of institutionalization because they have less often spouse or family to take care of them, have lower education and social class and are less often home owners, live in poorly equipped dwellings, possess less often a car, and are less healthy.

The first column of Table 3 shows again that household disposable income was inversely and monotonically associated with the risk of long-term institutionalization. Income differences in institutionalization were larger among elderly men than women. The relative institutionalization ratio between the lowest and the highest income quintile was 1.43 for women and 1.96 for men after adjustment for the baseline control variables (Model 1). Income differences in long-term institutionalization were attenuated after adjustment for family characteristics and living arrangements - simultaneous adjustment for marital status, living alone, and number of children in the household (Model 2). For both men and women the relative attenuation was larger the lower the income quintile was. The attenuation was particularly large for the second lowest and the lowest income quintiles among men: 32% and 44% (e.g. [[1.96-1.54] / [1.96-1]]*100). Elderly men with lower income were clearly in a disadvantageous position in terms of family characteristics and living arrangements which raised their risk of institutionalization. Among men, the lower the income quintile was, the higher was the proportion of being never married and divorced, living alone, and having no children in the household (results not shown here). Among women, the family characteristics and living arrangements were less important in explaining the income differences. This is partly because income was not systematically associated with being never married among elderly women.

Income differences in institutionalization were also attenuated after adjustment for other indicators of socio-economic position - simultaneous adjustment for education, social class, and housing tenure (Model 3). The socio-economic position was somewhat more important among women than men in explaining the income differences. The relative attenuation was larger the lower the income quintile was. In women, the attenuation was: 21% in the 4^{th} quintile, 23% in the 3^{rd}, 27% in the 2^{nd}, and 34% in the 1^{st}. The corresponding figures among men were: 8%, 12%, 15%, and 20%. High income elderly were systematically advantaged in owning their home and being in higher social classes (results not shown here). The higher the income quintile was, the higher was the proportion of home owners, and being an upper or lower white-collar worker that were associated with decreased risk of institutionalization. Tertiary education was more systematically associated with income quintiles among women.

Among men, persons in the two lowest income quintiles were clearly in a disadvantageous position in terms of education.

After separate adjustment for house type and level of equipment in the dwelling the income differences in institutionalization were attenuated among both sexes (Model 4). Elderly men and women with lower income were in a disadvantageous position in terms of house type and level of equipment in the dwelling. Higher income was systematically associated with living in a detached house and well equipped dwelling that were both clearly associated with decreased risk of institutionalization in both sexes (logit analyses not shown here)[2]. Income differences in institutionalization were attenuated after separate adjustment for possession of a car (Model 5). Higher income was systematically associated with possession of a car in both sexes. The attenuation was much larger among men than women. This is partially because the income differences in possessing a car between the highest income quintile and the three lowest income quintiles were larger among men than women. In addition, possession of a car reduced the risk of institutionalization more in men than women.

Income differences in institutionalization were also attenuated after adjustment for illnesses (Model 6).[3] The attenuation was larger among women. Among women, the relative attenuation was: 3% in the 4th quintile, 12% in the 3rd, 10% in the 2nd, and 15% in the 1st. The corresponding figures among men were: 5%, 0%, 0%, and 13%. Among women, lower income was systematically and monotonically associated with having diabetes and psychotic symptoms (logit analyses not shown here) that were associated with increased risk of institutionalization. Parkinson's disease was somewhat more frequent in the lowest income quintile compared to the highest income quintile. In addition, other mental health disorders, other respiratory diseases than asthma, other accidents or violence, and other hospital diagnoses were somewhat more frequent in the two lowest income quintiles compared with the highest income quintile. Other circulatory diseases were also less frequent in the highest income group. Income was not systematically associated with other variables of illness in women.

In men, income differences in institutionalization were attenuated less strongly and systematically after adjustment for illnesses. In men, the attenuation was remarkable only in the lowest income quintile. This is mainly attributed to the inverse relationship between income and having psychotic symptoms, which were over 2-fold more common in the lowest

[2] Living in a poorly and very poorly equipped dwellings raised systematically the risk of institutionalization after adjustment for house type in both sexes. Poorly and very poorly equipped dwellings were mostly detached houses.
[3] Simultaneous adjustment for cancer, diabetes, dementia, psychotic symptoms, Parkinson's disease, other mental health disorders, other neurological diseases, cerebrovascular diseases, other serious circulatory diseases, other circulatory diseases, asthma, other respiratory diseases, arthritis or rheumatism, arthrotis, other musculoskeletal diseases, hip fracture, other accidents or violence, other hospital diagnoses, and other diseases that give the right of reimbursements for drug costs under the Special Refund Category

as compared with the highest income group (logit analysis not shown here). Other diseases did not remarkable attenuate the income differences in institutionalization, although having other mental health disorders, diabetes, Parkinsons's disease, other respiratory diseases than asthma, and other accident or violence were more frequent in the lowest income group. This is partly attributable to the interactions between income and several diseases among men which show that having some of the diseases raise the risk of institutionalization more among the high income study participants than among the low (unexpected results that need further studying).

Table 3. Relative long-term institutionalization rates for income quintiles in 1998-2002. Different Cox regression models for Finnish females and males aged 65 years and over

	Model 1 Base model: Income + age + type of municipality + province + language	**Model 2** Base model + marital status + living alone + number of children in household	**Model 3** Base model + education + ses + housing tenure	**Model 4** Base model + house type + level of equipment in dwelling	**Model 5** Base model + car	**Model 6** Base model + illnesses*	**Model 7 (Full model)** Base model + marital status + living alone + number of children in household + housing tenure + level of equipment in dwelling + car + illnesses*
	HR	HR	HR	HR	HR	HR	HR
Females 65+							
Income							
5. Quintile (highest)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4. Quintile	**1.10**	**1.10**	**1.08**	**1.09**	**1.09**	**1.10**	**1.07**
3. Quintile	**1.19**	**1.17**	**1.15**	**1.17**	**1.17**	**1.17**	**1.10**
2. Quintile	**1.33**	**1.29**	**1.24**	**1.28**	**1.30**	**1.29**	**1.17**
1. Quintile (lowest)	**1.43**	**1.36**	**1.28**	**1.35**	**1.39**	**1.36**	**1.17**
Males 65+							
Income							
5. Quintile (highest)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4. Quintile	**1.18**	**1.17**	**1.08**	**1.17**	**1.12**	**1.17**	1.07
3. Quintile	**1.47**	**1.41**	**1.29**	**1.45**	**1.33**	**1.47**	**1.23**
2. Quintile	**1.55**	**1.38**	**1.31**	**1.51**	**1.32**	**1.55**	**1.14**
1. Quintile (lowest)	**1.96**	**1.54**	**1.57**	**1.83**	**1.57**	**1.84**	**1.14**

Bold: p-value<0.05
HR: Hazard ratio
*** Ilnesses:** cancer, diabetes, dementia, psychotic symptoms, Parkinson's disease, other mental health disorders, other neurological diseases, cerebral circulatory diseases, other serious circulatory diseases, other circulatory diseases, asthma, other respiratory diseases, arthritis or rheumatism, arthrosis, other musculoskeletal diseases, hip fracture, other accident or violence, other hospital diagnoses, and other diseases that give the right of reimbursements for drug costs under the Special Refund Categories

In the fully adjusted model, the income differences were attenuated more than in the separately adjusted models. After adjustment for all other explanatory factors, the relative attenuation was larger among men (Model 1 vs. Model 7). The attenuations by income quintiles (from higher to lower quintiles) were 34%, 48%, 48%, and 60% among women, and respectively 63%, 51%, 74%, and 86% among men. Certain income differences were still

significant after controlling for all other factors. The relative institutionalization ratio between the lowest and the highest income quintile was 1.17 for women and 1.14 for men in the fully adjusted model. In women, the income differences between the 2nd and 3rd quintile were not significant in the fully adjusted model, as well as the differences between the 4th and 5th quintile (significance test not shown here). In men, the income differences between the 1st and the 2nd quintile were not significant in the full model, as well as the differences between the 4th and 5th quintile.

Discussion

Summary of the main results and their interpretation

The aim of this study was to identify the relative contribution of several socio-demographic and health status determinants of entry into long-term institutional care. The data were 40% random sample of 280 662 community-dwelling elderly men and women in 1997 with a 5-year follow-up of institutionalization. Our main findings indicate that high income, home ownership, living in a well equipped dwelling, and being married were associated with decreased risk of institutionalization. Having dementia, Parkinson's disease, and cerebrovascular diseases were the strongest health related determinants of long-term institutionalization in our study.

In some previous studies the rate of institutionalization has been observed to be higher in elderly women than in elderly men in every age-group (e.g. Grundy 1992). These sex differences in institutionalization are usually assumed to be due to women being less likely to be still married because of sex differences in mortality and age differences between spouses. In contrast to previous studies, this study indicates that in the youngest age-group of 65-69 years, women's risk of institutionalization is not higher than men's. Younger elderly men were not advantaged in terms of institutionalization even if they lived more often with a partner, had a higher socioeconomic position, and had lower prevalence of several illnesses.

Our research indicates that high household disposable income, home ownership, living in a detached house, living in well equipped dwelling, and possession of a car decreased the risk of long-term institutionalization in the elderly. Associations between these socioeconomic factors and institutionalization were markedly larger among men after adjustment for only control variables. After adjustment for all other explanatory factors only the effect of having a car remains clearly stronger for men than women. This study provides evidence that income is an independent determinant of institutionalization that can not be entirely attributed to income differences in prevalence of diseases or other socio-demographic factors. This finding is similar with some earlier studies on the effect of income (Greene, 1995; Himes et al., 2000)

but different from some other studies indicating that income has no independent effect (Garber & MaCurdy, 1989; Speare et al., 1991; Steinbach, 1992; Tomiak et al., 2000).

This study also confirms some earlier results on the inverse relationship between home ownership and institutionalization (Garber & MaCurdy, 1989; Greene & Ondriche 1990; Liu et al., 1991; Grundy, 1992; Grundy & Glaser, 1997; Breeze et al., 1999). Home ownership can be seen as a measure of property and wealth that can not be entirely measured with income. In addition, own home can be seen as a psychical place that is easier to keep during shorter hospital stays and to which is easier to return to before institutionalization becomes long-term. Previous studies have not examined in a larger extend the associations between institutionalization and physical characteristics of housing. This study showed that the level of equipment in a dwelling and house type were determinants of institutionalization, independent of other factors. The worse the equipment in a dwelling was the higher was the risk of institutionalization. Living in a poorly equipped dwelling (no washing facilities or central/electric heating) raised the risk by 7-8% and living in a very poorly equipped dwelling (lacked one of the following: piped water, sewer, hot water, flush toilet) by 13% compared with living in a well equipped dwelling. This means that better equipment can improve older persons' possibilities to continue living in the community in case of functional limitations. Poorly or very poorly equipped dwellings are also one of the few determinants of institutionalization that could possible be ameliorated through policy interventions. Our results showed that living in a detached house was associated with decreased risk of institutionalization. In this study, presence of a lift, if living in an apartment house, was not associated with long-term institutionalization. Unfortunately, this study did not provide any evidence to the common belief that presence of a lift can help elderly living in the community and delay entrance into long-term institutional care. This unexpected result could possible be attributed to selection to different apartment houses by unmeasured functional health characteristics.

Our study showed that possession of a car was associated with decreased risk of institutionalization. Earlier studies have shown similar results indicating that having a car in the household is associated with decreased risk (e.g. Breeze at al., 1999). In our study, possession of a car was a characteristic of an individual, not of the household. This can mean that possession of a car, besides measuring socioeconomic position and possibility to move, measures also indirectly individual's health. Elderly with functional limitations or poor eyesight can give up driving and possession of a car. Continuation of the driving licence can be denied because of bad health. In our study, the effect of possession of a car on institutionalization was as high as for some of the diseases. In contrast, tertiary education was associated with decreased risk of institutionalization only for men, and social class was not associated with institutionalization after adjustment for other explanatory factors.

In numerous studies, living alone has been shown to be associated with an increased probability of institutionalization (Branch & Jette, 1982; Grundy, 1992; Steinbach, 1992; Wolinsky et al., 1992; Grundy & Glaser, 1997; Breeze et al., 1999; Yaffe et al., 2002). Some studies indicate that living alone is associated with institutionalization, independent of health, marital status and other socio-demographic factors (e.g. Greene & Ondriche, 1990; Liu et al., 1991). This study confirms these earlier results with the excess risk of institutionalization being 20% for women and 65% for men. After adjusting for all covariates the increasing effect becomes insignificant among women and hardly remains among men. The small effect of living alone could be related to methodological differences in measuring other adjusted factors in the model, e.g. being able to distinguish cohabiting persons from other marital status groups. In our study, marital status was strongly associated with institutionalization in both sexes, independent of other factors. The never married were the most disadvantaged marital status group with 50% higher risk of long-term institutionalization than the married. This is in line with earlier studies indicating the protective effect of being married (e.g. Grundy & Glaser 1997). Our study indicated that cohabiting protects elderly men from moving into institution, compared with other non-married groups, but not women. In this study, the excess rate of institutionalisation of the never married is probably partly attributed to not having children. Some previous studies have shown that having living children protects the elderly from moving into institution, especially living daughters (Freedman 1996). In this study, only children living in the same household and not having family of their own could be defined. Thus, the effect of children appears smaller in this study than is probably the case.

Our results indicate that dementia, Parkinson's disease, and cerebrovascular diseases were the strongest health determinants for long-term institutionalization in both sexes. Also hip fracture, diabetes, psychotic symptoms, and other mental health disorders were strongly associated with long-term institutionalization in both men and women. After adjusting for socio-demographic factors and other indicators of illness, all these diseases raised the risk of institutionalization by more than 50%. In addition, other accidents or violence, arthritis or rheumatism, other neurological diseases, other respiratory diseases than asthma, cancer, and other serious circulatory diseases raised the risk of institutionalization. Previous studies have also shown that dementia is a strong determinant of institutionalization (Tomiak et al. 2000; Agüero-Torres et al., 2002). Some studies indicate that hip fracture raises the risk (Agüero-Torres et al., 2002) but some studies indicate that it does not (Tomiak et al. 2000). In our study functional limitations could not be directly measured and adjusted for, which might explain our diverging result compared with Tomiak's and others' result. In our study diabetes, psychotic symptoms (including psychoses, schizophrenic disorders, and psychotic depressions), and other mental health disorders (including depressive symptoms) can be seen

as important determinants of institutionalization because of their relatively high prevalence in the elderly, 5-10%. Some earlier studies have also reported the effect of depressive symptoms on the risk of institutionalization in the elderly (e.g. Nuotio, Tammela, Luukkaala, & Jylha, 2003). As far as we know, the strong effect of diabetes on institutionalization has not been reported previously in general older population.

This study indicates that income differences in institutionalization can partly be attributed to the low-income elderly being disadvantaged in other socio-economic aspects, having more deficient housing conditions, possessing less often a car, and having certain illnesses. Low-income elderly women are disadvantaged in having more often diabetes and psychotic symptoms and men in having psychotic symptoms. Low-income elderly men are also disadvantaged in being more often never married, divorced, living alone, and having no children in the household that raise their risk of institutionalization. Disadvantageous family characteristics were markedly important in explaining the excess institutionalization rate in the two lowest income quintiles in men. Our results indicate that separate adjustment for socio-economic characteristics produced a larger attenuation in the income differences among women, and separate adjustment for family characteristics and living arrangements among men. However, income differences in institutionalization can not entirely be attributed to income differences in family, socio-economic, and health characteristics. Our study indicates that income is an independent determinant of long-term institutionalization. This can mean that elderly with higher household disposable income can better afford home help services which delay or prevent entrance into institution. However, this possibility could not at present be assessed directly from our data.

Methodological considerations

This study confirms previous results on the strong relationship between age and institutionalization. (e.g. Shapiro & Tate, 1988; Tomiak et al., 2003). In our study the relationship between chronological age and institutionalization could not entirely be attributed to presence of illnesses and other socioeconomic factors. This means that fragility, and functional dependency related to ageing could not entirely be measured with our variables. The effect of age is probably mostly effect of unmeasured functional age, not effect of chronological age as such. However, the advantage of using drug registers, besides hospital diagnoses, for assessing illnesses is that they better cover the health status of persons who do not stay in hospitals. Because the Finnish drug purchase register and medication reimbursement system do not recognise any special groups according to wealth or age for example, we believe that the problem of selection to these registers is relatively small. However, elderly who do not use medical help for their diseases in form of medicines or hospital stays are not in these registers.

We believe that some of the most disadvantaged elderly men in the lowest income quintile do not use so often medications for less severe diseases (prevalences of certain illnesses in the lowest income quintile seem to be too low). Because of this, the analyses of the contribution of health status on income differences in institutionalization are more reliable for women.

However, large population-based data that link different administrative registers provide several advantages. The data used in this study covered also residential home and hospital stays that start and end during the same year. In this study, we could also link several shorter stays in different institutions that follow each other into longer periods of institutionalization. This is useful because elderly people often move from institution to institution, e.g. from hospital to residential home and vice versa. In addition, information on disposable income that comes from the Tax Administration can be seen more reliable than self-reported income based on questionnaires. Non-reliance on questionnaire data can be seen as an advantage with regards to the validity and reliability of other socio-economic variables as well. Furthermore, in these data missing information and loss due to follow-up is minimal.

Policy implications

It is well known that functional dependency, cognitive impairment, and having no spouse raise the risk of institutionalization in the elderly (e.g. Shaphiro & Tate, 1988). In addition, current evidence partially indicates that absence of living children is associated with increased risk (e.g. Freedman 1996). However, these are individual or family characteristics that are often hard or impossible to change. In contrast, poorly equipped dwellings, and income are more amenable for policy interventions. This study indicates that the more poorly a dwelling is equipped the higher is the risk of institutionalization. Renovations of the very poorly equipped dwellings, lacking piped water or sewer, could possible help elderly with disabilities to live longer in the community and prevent some of the premature institutionalizations. Our results indicate that the effects of income on institutionalization were partly mediated through other socio-economic characteristics, housing conditions, and presence of certain illnesses, especially psychotic symptoms in both men and women, and diabetes in women. Overall, these results show that the future demand of institutional care does not only depend on population ageing but also on the development of elderly income and other socio-demographic factors. Further research is needed to test the effects of different housing conditions and income on institutionalization. The effect of income could be studied further using information on the use of home help services and home nursing.

Our results indicate that having diabetes, one of the most frequent national diseases in Finland, was relatively strongly associated with increased risk of long-tem institutionalization.

This can be seen as a major economic burden to the future society because of the raising prevalences of diabetes (e.g. Klaukka, 2003). Further research is needed to distinguish how diabetes and other frequent chronic diseases are associated with long-tem institutionalization among older people in different living arrangements. In addition, further work is needed to study in depth the interactions between different diseases and income.

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Appendix 1.

Classification of the diseases used in this study based on prior hospital use diagnoses (ICD10), the right of reimbursement for drug costs under the Special Refund categories by certain chronic diseases (Finnish classification), and prescription drug purchases (ATC)

DISEASE IN OUR STUDY	PRIOR HOSPITAL USE (Principal diagnosis) IDC10 code:	SPECIAL REFUND CATEGORY FOR DRUG COSTS Disease:	Finnish codes:	PRESCRIPTION DRUG PURCHASES Medication for the following:	ATC code:
1) Cancer	C00-C97	Cancers*	115,116,128,130,180	Cancers	L
2) Diabetes	E10-E14	Diabetes	103	Diabetes	A10
3) Dementia	F00-F03, G30	-	-	-	-
4) Psychotic symptoms		Psychosis	112	Psychosis	N05A
schizophrenic disorders	F20-F29	-	-	-	-
psychotic depressions	F30.2, F31.2, F31.5, F32.3, F33.3	-	-	-	-
5) Parkinson's disease	G20	Parkinson's disease	110	Parkinsonism	N04
6) Other mental health disorders	other F00-F99	-		Depression	N06A
7) Other neurological diseases	other G00-G99	Epilepsy and some other neurological diseases**	111, 109, 108, 119	Epilepsy	N03
8) Cerebrovascular diseases	I60-I69	-		-	-
9) Other serious circulatory diseases	other I00-I99	-		-	-
10) Other circulatory diseases	-	Circulatory diseases***	201, 205, 206, 207	-	-
11) Asthma	J40-J45	Asthma	203	Asthma	R03
12) Other respiratory diseases	other J00-J99	-		-	-
13) Arthritis or rheumatism	M05-M06	Rheumatoid arthritis	202	Rheumatism specificly	M01C
14) Arthrosis	M15-M19	-		-	-
15) Other musculoskeletal diseases	other M00-M99	-		-	-
16) Hip fracture	S72	-		-	-
17) Other accidents or violence	other S00-T98	-		-	-
18) Other hospital diagnoses	other A00-Z99	-		-	-
19) Other chronic diseases under the Special Refund Categories		Other diseases****	other 101-601		

*Cancers: breast, prostatic, gynecological cancers, other malignant tumors, and melanoma and renal cancer

**Some neurological diseases: epilepsy, multiple sclerosis, some apoplectic symptoms, trigeminus- or glossofaryngikusneuralgia,

***Circulatory diseases: cardiac insufficiency, hypertension, coronary heart disease, arrhythmia

****Several chronic diseases that were not translated to English