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DIFFERENCES IN PREDICTORS OF 5-YEAR SURVIVAL OVER A TEN- YEAR PERIOD IN TWO COHORTS OF ELDERLY NURSING HOME RESIDENTS IN SWEDEN

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AUTHOR CONTRIBUTION

Marta Sund Levander collected data. All authors have contributed to statistical analysis, and critical revisions and drafting of the manuscript.

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ETHICAL APPROVAL

The Regional Ethical Review Board at Linköping University approved the studies of cohort 2000 (Dnr: M-990302) and 2007 (Dnr: M-8206).

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ABSTRACT

AIM: The aim was to compare 5-year survival in two included cohorts (from year 2000 and year 2007) of 249 nursing home residents (NHR) in this retrospective, comparative study. **METHODS:** The cohorts were compared regarding chronic diseases, medication, physical/cognitive/nutritional status, body mass index, body temperature, and 5 year mortality. Factors correlated with 5 years survival were determined using Cox regression analysis.

RESULTS: In average cohort 2007 survived 31 ± 16 months and cohort 2000, 38 ± 13 months, $p < 0.001$. Dementia, ageing and circulatory failure were more common as cause of death 2007, while stroke, chronic obstructive pulmonary disease (COPD) and pneumonia were less common, compared to 2000. NHR 2007 were significantly older when admitted to NH, more dependent in ADL, had dementia, stroke, autoimmune disease and treatment with antidepressants, while malnutrition and treatment with paracetamol were more common 2000. In 2000, medication with antidepressants, the presence of stroke and diabetes, irrespective of gender, and in women cardiovascular disease, two to threefold significantly increased survival, while autoimmune disease, influenza vaccination and dependency in ADL decreased survival. In 2007, maintaining BMI, irrespective of gender, and autoimmune disease and COPD in women significantly increased survival, while malnutrition, influenza vaccination, dependency in ADL, and medication with sedatives/tranquillizers or paracetamol severely reduced survival.

CONCLUSIONS: The present results indicate a trend that individuals are older and frailer when admitted to NH, and that survival time after admission has been shortened. Hence, the need of daily support and care has increased, irrespective of housing. Also, predictors of survival, possible to influence, have changed.

Keywords: Frail elderly, gender, survival

INTRODUCTION

The increasing number of older people facing the unavoidable consequence of chronic diseases, together with less social support demands the need for long-term care services (1). Hence, in most developed countries, nursing homes (NH) for the frail and elderly have been set up to offer this service (2). However, from 2000 until 2008, the number of elderly people in senior living has increased threefold in Sweden, from 11 000 to almost 33 000 (3). Simultaneously, according to the Swedish National Board of Health and Welfare, (4) during 2001 to 2012, the number of beds in NHs was reduced with approximately 30 000, while the extent of home care and daytime activities increased, so that elderly people could stay in their own accommodation.

Moving to community dwellings is often a consequence of a change in functional and/or cognitive condition, disability (2), old age, high chronic illness burden, and sociodemographic factors (5). This group of elderly people can be described as frail, defined as most ill elderly, 65 years and older, who have substantial impairments in their functional status as a result of aging, injury, or disease (4). A recently conducted study in Sweden reported that a majority of elderly people in community dwellings had cognitive impairment, a mean of three diseases, and seven prescribed drugs. In addition, frailty in this studied population was related to the risk of malnutrition, falling and developing pressure ulcers (5). Aging and

frailty also entail an increased risk of acquiring infectious diseases, which are often presented with atypical signs and symptoms, while specific ones can be missing (6), causing a delay in diagnosis and treatment (7), and mortality (8, 9). In an earlier study we found that pneumonia was as common as cerebral vascular insult and heart failure as cause of death in NH residents (NHR) (10).

In a US study of survival (11), half of the residents with dementia and more than half of those without dementia diagnosis, died within 2 years of moving to a NH. The mean time of survival for newly admitted NHR in England has been reported to be 76 days for men and 134 days for women (12), or 5.9 years for both genders (13). In Iceland, the median survival time was 31 months, with health preserved and ADL performance as strong predictors for survival (14). Matusik et al. (15) found that the prediction of mortality in NHR over a 12-month follow-up was best achieved when physical and cognitive functions were assessed jointly, and not separately. When studying predicting factors possible to modify in nursing care for 3-year survival in Swedish NHR, we found a difference between genders (10). It was important to improve the ability to perform daily functions and nutritional status, especially in women, and to prevent anxiety, particularly in men. The impression was also that the survival time in NHR has decreased after admission to NH. Therefore, we found it valuable to study if predictors of survival have changed in cohorts of elderly NHR over a decade. The aim of the present study was to compare 5-year survival in two cohorts of Swedish NHR.

METHODS

The study had a retrospective, descriptive design, comparing two cohorts of frail elderly.

Sample

The sample consisted of elderly NHR from two cohorts, *cohort 2000* and *cohort 2007*. In both cohorts the inclusion criteria were seniors ≥ 65 years of age, living in five municipalities non-profit NHs in south of Sweden. Two NHR with a severe psychiatric diagnosis and/or ongoing infectious disease were excluded.

After 5-year follow-up for the cohorts, respectively, mortality rate and data on cause of death were obtained from death certificates. In addition, retrospective information about the date when home-care started managing activities of daily living (ADL), or the elderly person took up occupancy of the NH, were collected from residents' records or social care notes. These data were used as a start for the estimation of 5-year survival. According to the Social Services Act, only selected individual data are saved after 5 years. Such data were available for 149/ 235 (63%) individuals from cohort 2000, and for all individuals in cohort 2007.

Cohort 2000

The data collection was carried out between 2000 and 2004 in three municipalities (10). Three hundred and nine elderly, or their next of kin, were invited to join. Of these, 262 gave informed consent, of which 17 residents died, 5 were admitted to hospital, 3 were in terminal stage and two residents were excluded as they had lived in an institution due to psychiatric disorder, since adolescence before the base line data collection. Of 235 residents, 149 were included in the present study, 109 women (73 %), 66 to 99 years. Women were older than men, 85.5 ± 6.3 vs. 81.6 ± 7.6 , $p < 0.01$, more dependent in ADL status, 8 ± 5 vs. 6 ± 3 , $p < 0.05$, while chronic obstructive pulmonary disease (COPD) was more common in men, 10.0% vs. 0.01%, $p < 0.05$. Residents without dementia were more frequently diagnosed with chronic heart disease, 57/82 (69.5 %) vs. 30/67

(45%), $p < 0.001$, while residents with dementia showed higher dependency in ADL, compared to residents without dementia, 8 ± 3 vs. 6 ± 6 , $p < 0.05$. The risk of malnutrition was higher among individuals with dementia, 16/67 (24 %) vs 15/82 (17%). For more details, see Table 1.

Cohort 2007

The study was carried out in 2007-2009, in two municipalities. Three hundred and seventy-eight NHR, or their next of kin, were invited to participate. Of these, 210 (65%) gave informed consent to participate in the study. Five of the 210 included subjects dropped out before the data collection was started, and five died. Of the 200 participants finally included, 139 (70%) were women, aged 66 to 101 years. All residents needed daily care and support, of whom 6 % managed personal ADL with minor assistance. They were all living in group housing for the elderly. Women were older than men, 86.7 ± 5.7 years vs. 83.1 ± 8.5 years, $p < 0.01$. ADL status was 8 ± 2 , irrespective of gender. COPD was more common in men compared to women, 11.5 vs. 3.6 %, $p < 0.05$. Chronic heart disease was more frequently diagnosed among residents without dementia compared to residents with dementia (49/70 (70%) vs. 65/130 (50%), $p < 0.01$). ADL status was 7 ± 2 , irrespective of presence of dementia or not. The risk for, or being assessed for malnutrition, was more common in individuals with dementia, 68/130 (52 %) vs. 25/70 (36 %), $p < 0.05$. For more details, see Table 1.

Table I. Comparison of frequency of chronic diseases, medication and malnutrition in two cohorts of elderly nursing-home residents. Student's t-test two-tailed and χ^2 test were used.

^a Activities of daily living. ^b Body mass index. ^c Such as rheumatoid arthritis, muscular rheumatism

Variable	2000 n = 149 m $\pm$ SD	2007 n = 200 m $\pm$ SD
Age	84.4 ± 6.9	85.6 ± 6.9
Age when need of support in ADL ^a	80.1 ± 7.3	$82.3 \pm 7.6^{**}$
BMI ^b	25.5 ± 5.2	26.0 ± 4.7
Ear	36.9 ± 0.6	$36.3 \pm 0.5^{\circ C***}$
Rectal	36.8 ± 0.4	$36.9 \pm 0.3^{\circ C}$
	n (%)	n (%)
≥ 86 years	72 (48)	115 (56)*
ADL ≥ 5	108 (73)	188 (94)***
Dementia	67 (45)	130 (65)***
Cardio-vascular disease	87 (58)	114 (57)
Chronic obstructive pulmonary disease	5 (3)	12 (6)
Stroke	37 (25)	71 (36)*
Diabetes	22 (15)	36 (18)
Autoimmune disease ^b	7 (5)	27 (14)**
Thyroid disease	0 (0)	6 (3)
Malnutrition	31 (21)	93 (47)***
Cortisone ≥ 5 mg per dag	5 (3)	12 (6)
Sedatives/tranquillizers	50 (36)	76 (38)
Anti-depressants	56 (38)	107 (54)**
Paracetamol ≥ 3 g daily	113 (48)	61 (31)***
Influenza vaccination	55 (37)	162 (81)***
Pneumococcal vaccination	8 (5)	76 (38)***

Measurements

For both cohorts, data on chronic diseases and medication were collected from medical records. Dementia diagnoses were established by specialists and evidenced in medical records. Physical status was assessed through interviews with the resident or the nursing assistants, using Katz personal (P) and instrumental (I) ADL-index. The P-ADL consists of 6 categories; bathing, dressing, toileting, transfer, continence, and feeding, and the I-ADL consists of cooking, transportation, shopping, and cleaning. The residents were graded from 0 to 10, where 0= independency in all variables and 10= dependency in all variables. Grade 5 means dependency in all I-ADL and in one P-ADL activity (16, 17). In cohort 2000, height, weight index, mid-arm circumference, triceps skinfold thickness, arm muscle circumference, serum albumin and transthyretin were used to assess nutritional status. Malnutrition was declared if two or more of the nutritional variables were subnormal, including one anthropometrical and one biochemical measurement (18). In cohort 2007, the Mini Nutritional Assessment (MNA) was used to assess nutritional status (19). Body mass index (BMI), i.e., kg/m^2 , was calculated in both cohorts (20).

Statistical analysis

In order to explore predictors of survival, a Cox hazard regression analysis, using the forward conditional method, was performed. Follow-up in months, starting with the date of homecare services or occupancy of the NH until 5 years survival, as the time outcome consisted the dependent variable, and baseline data the independent variable. In cohort 2000, malnutrition was assessed as either not present or present, while it was assessed as not present, risk of, or present in cohort 2007. In the statistical analysis, only not present or present were compared. In the Cox regression, several regression analyses were performed due to inter-correlations, such as between dementia, ADL, malnutrition, paracetamol, and BMI. Pearson's correlation coefficient and Spearman's rho were calculated for parametric or non-parametric inter-correlations tests, and Student's t-test two-tailed or χ^2 test for comparing frequencies between the two cohorts. Mann Whitney U-test was used to calculate the cause of death between the two cohorts (21) (SPSS 21 for Windows). Level of significance was set at $p < 0.05$.

Ethics

The Regional Ethical Review Board at Linköping University approved the studies of cohort 2000 (Dnr: M-990302) and 2007 (Dnr: M-8206).

RESULTS

Overall, the mean time for survival was 57.4 ± 36 months in cohort 2000 and 44.5 ± 31 months in cohort 2007, $p < 0.01$. The rate of 5-year survival was 42/149 (28%) in cohort 2000 and 46/200 (23%) in cohort 2007. Allocated to gender, the survival rate in women was 37/109 (34%) in cohort 2000 and 36/139 (26%) in cohort 2007. The corresponding figures in men were 5/40 (16%) and 12/61 (20%), respectively (Figure 1). The causes of death was distributed the same in Cohort 2000 and Cohort 2007 (Figure 2).

Figure 1. Five years of survival in two cohorts of nursing home residents:

A: Cohort 2000 $n = 149$ and cohort 2007 $n = 200$.

B: Women; cohort 2000 $n = 109$ and cohort 2007 $n = 139$.

C: Men; cohort 2000 $n = 40$ and cohort 2007 $n = 61$.

Figure 2. Cause of death in two cohorts of nursing home resident; Cohort 2000 n= 149, Cohort 2007 n= 200.

The regression analysis revealed that NHR belonging to cohort 2007 was at a significant risk of shorter survival, Exp (B)1.086, $p < 0.01$, with a shorter survival time compared to cohort 2000, 31 ± 16 months and 38 ± 13 months respectively, $p < 0.001$. In cohort 2000, the survival time was significantly shorter for men compared to women, 48 ± 27 months vs. 61 ± 39 months, $p < 0.05$. In cohort 2007, the survival time was equal in men and women, 44 ± 36 months and 45 ± 28 months, respectively.

When comparing the two cohorts, the 2007 cohort were older and significantly frailer, with increased dependency in ADL ($p < 0.001$), presence of dementia ($p < 0.001$), stroke ($p < 0.05$), and autoimmune disease ($p < 0.01$) such as rheumatoid arthritis or muscular rheumatism, more often treated with anti-depressants ($p < 0.01$), and malnourished ($p < 0.001$), while medication with paracetamol > 3 g/day ($p < 0.001$) were less common in cohort 2007 compared to cohort 2000. The frequency of vaccination against influenza and pneumonia had increased from 2000 to 2007 ($p < 0.001$). The residents in cohort 2007 were also significantly older when they started receiving home care services /took up occupancy of a NH ($p < 0.01$) (Table I).

In cohort 2000, the presence of stroke or diabetes was related to a two to threefold hazard ratio to

survive 5 years, respectively, while the presence of autoimmune disease decreased 5-year survival with 8 %, influenza vaccination with 54 %, and each increase in ADL with 16 %. When allocating to gender, medication with antidepressants was related to a two to threefold hazard ratio to survive 5 years in both men and women. In women, the presence of diabetes also increased the hazard ratio of 5-year survival fourfold, while cardiovascular disease and stroke doubled the chance to survive (Table II and III).

Table II. Cox hazard regression forward stepwise analysis of prediction of survival with 5-year follow-up in cohort 2000; 149 nursing home residents (66 to 101 years), presented as the hazard ratio (HR) and 95 % confidence interval (95 % CI).

Factor	HR (42/149)	95 % CI
Diabetes	3.587 (p<0.01)	1.633 – 7.878
Autoimmune disease ^a	0.079 (p<0.05)	0.009 – 0.685
Stroke	Factor 2.308 (p<0.05)	1.162 – 4.584
Influenza vaccination	0.455 (p<0.05)	0.237 – 0.872
ADL ^b	0,844 (p<0.01)	0,766 – 0,930

The number of survivors/sample size is given in brackets.

^a Such as rheumatoid arthritis, muscular rheumatism. ^b Activities of daily living.

Table III. Cox hazard regression forward stepwise analysis of prediction of survival with 5-year follow-up in cohort 2000, 109 women and 40 men (66 to 101 years), presented as the hazard ratio (HR) and 95 % confidence interval (95 % CI).

Factor	Women (37/109)		Men (5/40)	
	HR	95 % CI	HR	95 % CI
Antidepressants	2.198 (p<0.05)	1.134 – 4.260	3.104*	1.144 – 8.419
Influenza vaccination	0.354 (p<0.01)	0.180 – 0.696		
Age	0.931 (p<0.05)	0.881 – 0.984		
Diabetes	4.433 (p<0.01)	1.831 – 10.730		
Cardio-vascular disease	2.352 (p<0.05)	1.132 – 4.887		
Stroke	2.254 (p<0.05)	1.020 – 4.983		

* p<0.05. The number of survivors/sample size is given in brackets.

In cohort 2007, 5-year survival was related to a 6 % hazard ratio to survive for each increase in BMI, while malnutrition reduced the hazard ratio of survival with 75%, and influenza vaccination, dependency in ADL, and medication with sedatives/tranquillizers or paracetamol with 56%, 30%, 53% and 60%, respectively. When allocating to gender, dependency in ADL reduced 5-year survival with approximately 25 to 30% for both men and women, while malnutrition reduced survival in women with 65%, and each increase in body temperature with 70% in men. In women, the presence of autoimmune disease and COPD increased the hazard ratio to survive 5 years twofold and fivefold, respectively (Table IV and V).

Table IV. Cox hazard regression forward stepwise analysis of prediction of survival with 5-year follow-up in cohort 2007; 200 nursing home residents (66 to 101 years), presented as the hazard ratio (HR) and 95 % confidence interval (95 % CI).

Factor	HR (46/200)	95 % CI
Malnutrition	0.252 (p<0.001)	0.127 – 0.498
Influenza vaccination	0.439 (p<0.05)	0.208 – 0.924
Activities of daily living	0.718 (p<0.001)	0.644 – 0.801
Sedatives/tranquillizers	0.473 (p<0.05)	0.256 – 0.873
Paracetamol	0.409 (p<0.05)	0.207 – 0.808
Body mass index	1.058 (p<0.05)	1.000 – 1.119

The number of survivors/sample size is given in brackets.

Table V. Cox hazard regression forward stepwise analysis of prediction of survival with 5-year follow-up in cohort 2007, 139 women and 61 men (66 to 101 years), presented as the hazard ratio (HR) and 95 % confidence interval (95 % CI).

	Women (34/139)		Men (12/61)	
Factor	HR	95 % CI	HR	95 % CI
ADL ^a	0.709***	0.622 – 0.809	0.749*	0.596 – 0.940
Ear temp.			0.314*	0.104 – 0.949
Malnutrition	0.354**	0.180 – 0.697		
Autoimmune disease ^b	2.400*	1.035 – 5.566		
COPD ^c	5.167*	1.172 – 22.779		

^a Activities of daily living. ^b Such as rheumatoid arthritis, muscular rheumatism. ^c Chronic obstructive pulmonary disease. * p < 0.05 ** p < 0.01. *** p < 0.001. The number of survivors/sample size is given in brackets.

DISCUSSION

In Sweden, the different levels of housing and services for the elderly are defined as senior living, security living, and NH. These are primarily intended for older people who need care and attention around the clock, at a total cost of 4% of the Gross National Product (22). This is a high figure compared to other OECD countries (Organisation for Economic Co-operation and Development), i.e., Spain, Luxembourg, USA, Australia, Germany, and the Netherlands (23), especially as the number of beds in NHs, and hence national costs, reduced during the last 10 years (4).

Although more elderly people today manage daily living with less support and care, the number of older people with extensive need for support in terms of service and personal care also increases (4). Moving to a NH is often a consequence of a change in condition or disability (2). Both cohort 2000 and cohort 2007 can be assessed as frail, according to the definition suggested by Ernsth Bravell et al. (5), and the Swedish National Board of Health and Welfare (4). The difference between the cohorts is more a matter of increased age, with accompanying functional and cognitive decline, in combination with increased waiting time for moving to a NH. Hence, this study illuminates the increased physical and cognitive

disability in individuals living in NHs in Sweden, which is in accordance with studies in other countries (8, 24). We also found that NHR today are older when they start receiving home care or take up occupancy of a NH, and that the survival time i.e the date of homecare services or occupancy of the NH started until 5 years survival, has decreased compared to 10 years ago. Without attaching any values, this can be interpreted as an effect of the recent years' government policy of restructuring from NH to support in ordinary accommodation. However, clinically, this is important because it means greater demands for health care staff to meet the frail elderly people's needs for care and attention.

Our study also showed that medication with anti-depressants is more frequent today, which is supported in a recent national survey in Sweden, showing that antidepressants, tranquilizers and anti-anxiety drugs are prescribed twice as often to elderly individuals in NHs compared to those living in ordinary accommodation. The reason for this might be the increased number of NHR suffering from dementia with disruptive behavior, such as walking, crying and aggression (4). On the contrary, in cohort 2007, medication with paracetamol was lower, probably due to the introduction of adhesive analgesics plasters. A positive finding was also that malnutrition was less common in cohort 2007 compared to cohort 2000, which contradicts the results of Ernsth Bravell et al. (5). Another positive finding was that the prevention of pneumonia and influenza by vaccination had markedly increased, although the latter did not seem to increase survival.

The shorter survival in cohort 2007 compared to cohort 2000 is in line with NHR in Iceland (14). In the present population, the decreased survival time can probably be largely explained by the increased rate of mortality in individuals with severe dementia, as well as increased age when moving to the NH. In cohort 2000, medication with antidepressants was a main factor predicting survival, independent of gender. Interestingly, the presence of diabetes and stroke positively strongly affected survival, especially in women, while autoimmune disease, dependency in ADL, influenza vaccination shortened survival, irrespective of gender. The positive effects on survival related to the presence of diabetes and stroke is somewhat difficult to understand, but might be related to optimal medical regime together with misjudgement of residents with severe dementia. Surprisingly, influenza vaccination did not increase survival in either the 2000 or 2007 cohort. One explanation may be that the most fragile and vulnerable are prioritized for vaccination due to the risk of pneumonia.

In cohort 2007, one important factor predicting survival was to maintain a BMI > 20. Otherwise, malnutrition, the presence of pain (paracetamol) and sedatives/tranquillizers dominated as factors related to decreased survival. This could be due to the increased number of residents with dementia. Surprisingly, autoimmune disease and COPD strongly increased the chance of survival in women. Nevertheless, it seems as our previous findings about predicting factors possible to modify in nursing care, for 3-year survival in Swedish NHR, have changed (Sund-Levander, Grodzinsky et al. 2007). To improve survival in NHR today it seems important to maintain the ability to perform daily functions and prevent depression irrespective of gender, while nutritional status still concerns mainly women and anxiety mainly men. As suggested by others, it appears that survival in NHR is best achieved when physical and cognitive function are assessed jointly, and not separately (15).

Swedish legislation states that the goal of elderly care is to "work for the possibilities for elderly to live and inhabit independently with safe conditions and have an active and meaningful being in community with others" (25). Most households seem satisfied with their current housing situation, at least until they are 80 years old. When people come closer to 80,

they seem to be more worried about having to move to another neighborhood and find it more difficult to contact real estate agents for advice (26). One interesting suggestion is to build a national information service for elderly people regarding housing.

A limitation of the present study is the retrospective design, especially concerning data about receiving homecare services or take up occupancy of a NH, which may have affected the result credibility and generalizability. However, in conclusion the present results showed that individuals in Sweden today are older when they start receiving home care services or take up occupancy of a NH. Therefore, it is reasonable to believe that the need for daily support and care have increased, irrespective of housing. This highlights the importance for Swedish policy about how to meet this increased need for care in an increasing elderly population, such as education of the care givers and the development of the NHs, based on individual needs. The cohorts in the present study are representative in a Swedish context, but it might be difficult to generalize to other countries due to different systems for elderly care. However, it is not unreasonable to assume a similar development in other countries with similar economic development.

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