Functional level, physical activity and wellbeing in nursing home residents in three Nordic countries

Helena Grönstedt[1], Karin Hellström[2], Astrid Bergland[3], Jorunn L. Helbostad[4], Lis Puggaard[5], Mette Andresen[6], Randi Granbo[7] and Kerstin Frändin[1]

[1]Karolinska Institutet, Department of Neurobiology, Care Sciences and Society, Stockholm, Sweden, [2]Uppsala University, Department of Neuroscience, Uppsala, Sweden, [3]Oslo University College, Faculty of Health Science, Oslo, Norway, [4]Norwegian University of Science and Technology, Department of Neuroscience and St. Olav University Hospital, Department of Geriatrics, Trondheim, Norway, [5]University of Southern Denmark, Odense, Denmark, [6]University College, Sjaelland, Naestved, Denmark, [7]Sør-Trøndelag University College, Faculty of Health Education and Social Work, Trondheim, Norway

ABSTRACT. ***Background and aims:*** *The main aim of this study was to describe physical and cognitive function and wellbeing among nursing home residents in three Nordic countries. A second aim was to compare groups of differing ages, levels of dependency in daily life activities (ADL), degree of fall-related self-efficacy, wellbeing and cognitive function.* ***Methods:*** *322 residents from nursing homes in Sweden, Norway and Denmark were included. Physical and cognitive function, level of physical activity and wellbeing were assessed by means of reliable and valid instruments.* ***Results:*** *The mean age of participants was 85 years. Sixty percent could rise from a chair and 64% could walk independently. Men were younger and more physically active than women. Participants with a high level of dependency in ADL had lower physical and cognitive functions, were less physically active, and had lower fall-related self-efficacy than participants less dependent in ADL. Participants with low cognitive function had high fall-related self-efficacy.* ***Conclusions:*** *These data demonstrate that elderly residents in nursing homes in Sweden, Norway and Denmark are frail but heterogeneous. Significant differences in physical activity, physical function and dependency in ADL were seen in relation to age, fall-related self-efficacy, wellbeing and cognitive function.*
(Aging Clin Exp Res 2011; 23: ###-###)

INTRODUCTION

A nursing home is defined as an establishment which accommodates chronically ill, usually frail, elderly persons and provides long-term nursing care, rehabilitation and other services (1). Physical frailty may be used to define the population at high risk of disability onset or progression (2). Frailty is not specific to the elderly, but the prevalence of disabilities increases with aging, particularly after 85 years (3).

Loss of independence in Activities of Daily Living (ADL) is closely associated with institutionalization, caregiver burden, higher resource use, and death (4). Functional status affects the quality of life in old age (2). Older people who are physically active and spend less time sitting down, have higher levels of self-rated mental health and well-being than those who are less active (5). In addition, in old age subjective health is more important than objective health when it comes to morale (6). One's belief in one's own ability, such as self-efficacy, can serve to impair or enhance performance. The relationship between self-regulatory factors and performance may be especially important for older adults (7).

Long-stay nursing home residents and those over age 85 are groups which have been little studied in the rehabilitation literature (8, 9). The present study forms part of a Nordic multi-center study, describing the impact of an individually tailored intervention program for residents in a nursing home setting on physical functioning and daily activities (10). The specific aim of the present study was to describe the residents' physical and cognitive function, dependency in ADL, and degree of wellbeing at baseline. A second aim was to compare groups of differing ages, levels of dependency in daily life activities (ADL), degree of fall-related self-efficacy, wellbeing and cognitive function.

Key words: Elderly, functional level, Nordic countries, nursing home, wellbeing.

Correspondence: Kerstin Frändin, PhD, Department of Neurobiology, Care Sciences and Society, Division of Physiotherapy, Karolinska Institutet, 231 00 SE 141 83 Huddinge, Sweden.
E-mail: Kerstin.Frandin@ki.se

Received March 3, 2009; accepted in revised form October 25, 2010.
First published ahead of print February 10, 2011 as DOI: 10.3275/7507

METHODS

Design and sample

The study design was fully described in a previous article (10) but a short summary is given here. The present study is cross-sectional and based on baseline data from a randomized controlled clinical trial. Baseline data were collected from 322 elderly nursing home residents in Sweden, Norway and Denmark. The study was approved by the Ethics Committee of the Faculty of Medicine, Karolinska Institutet, Stockholm and Uppsala University, Uppsala, the Regional Ethics Committees of the Nordic centers involved, and also by the Data Inspectorate in Norway and Denmark.

Procedure

Research physiotherapists or occupational therapists carried out examinations.

Measurements

Background variables such as gender, age and length of stay in the nursing home were collected from medical records.

Physical activity was described according to Nursing Home Life Space Diameter (NHLSD) (11). Physical function was described by several measurements (see below).

Walking and wheelchair (WC) propulsion at self-selected and maximum speeds (m/s) were tested for 10 m indoors (12, 13). Grip strength was tested with a Jamar dynamometer (Sammons Preston) in Sweden and Norway (14-16). In Denmark, the Collin handheld dynamometer was used (17, 18). Leg muscle strength was evaluated with the Timed Chair Stand Test (19).

Balance was evaluated with the Berg Balance Scale (20). In order to include as many test protocols as possible, we replaced missing values on item 3 (=seated without support) in empty protocols according to participants' results on COVS item 3 (see below). If participants had 3 points ("able to perform movements seated within the support surface") on COVS, they received 3 points on Berg, if they had 5-7 points ("able to perform movements seated beyond the support surface") on COVS they received 4 points on Berg.

Performance in Activities of Daily Living (ADL) was described according to the Functional Independence Measure (FIM) (21). Participants with results from less than 75% of the FIM items (>3 items on FIM a-m and >1 item on FIM n-r) were excluded. If one, two or three items on FIM a-m and one item on FIM n-r were missing, the individual median score on the rest of the items in that scale was used to replace them, and the total sum was recalculated from that (22).

In addition, the Physiotherapy Clinical Outcome Variables (COVS) was used (23). Participants were excluded from calculations if more than three items were missing on the scale. If up to three items on COVS were missing, the individual median score on the scale was used to replace them and the total sum was recalculated from that (22).

The Swedish version of the Falls Efficacy Scale (FES(S)) is divided into three subscales (P-ADL, I-ADL, FES total) (24, 25). Participants with more than one item missing on a subscale were excluded from calculations. When only one item was missing, it was replaced by the individual median on that subscale and the total sum was recalculated from that (22).

A single question regarding fear of falling (response alternatives yes or no) was also included (26). The question was not used for the Danish population.

Wellbeing was evaluated with the Philadelphia Geriatric Centre Morale Scale (PGCMS). Missing answers were considered as zero (27, 28).

Cognitive function was estimated according to the Mini-Mental State Examination (MMSE) (29). In Denmark, test results below 16 points were added as extra exclusion criteria, according to the decision of the Regional Ethics Committee in Denmark.

Statistical analysis

Outcome measurements represent mostly ordinal data. Descriptive statistics were used to compute frequencies, central tendency and variability. Group comparisons of non-parametric data for two groups were made with the Mann-Whitney U-test. Student's *t*-test was used for group comparisons of parametric data. Based on the median within the study population regarding COVS, PGCMS, MMSE and FES P-ADL, respectively, participants were subdivided into two groups of either high (above the median) or low (below the median) values. The scores of these groups were then analyzed for differences. Calculations were also carried out exclusively for participants with MMSE results of ≥16 points as all the Danish participants had an MMSE of 16 points or more. The level of significance was set at $p<0.05$. Missing data were handled as described under *Measurements*.

RESULTS

The mean age of the study population was 85 years (SD±7.7), and the age range was 64 to 102 years. Seventy-four percent were women. Men were younger than women ($p\leq0.005$). The mean length of stay was 24.8 months (SD±31.1), with a range of 0-252 months and no gender differences. Sixty-four percent of the study population was able to walk with or without walking aids, and 23% were dependent on a wheelchair (WC) for indoor mobility. Men were more dependent on wheelchairs than women (Table 1). The mean number of diagnoses for 216 participants (106 unknown) was 3.04 (range 1-8). There was no significant difference ($p>0.05$) between men (mean 2.76) and women (mean 3.14). The mean number of drugs (210 participants,

Table 1 - *Background characteristics of study population.*

Variables	Total n=322	Women n=237	Men n=85	*p*
Age, n=322				
mean (±SD)	85 (7.7)	86 (7.3)	82 (7.8)	**
Length of stay (months),				
n=300, 220 women and 80 men				
mean (±SD)	24.8 (31.1)	26.5 (34.1)	19.9 (19.8)	ns
Indoor mobility				
Able to walk (n)	205	154	51	**
Dependent on wheelchair (n)	75	49	26	**

*$p \leq 0.05$; **$p \leq 0.005$.

112 unknown) was 6.35 (range 0-18). No significant differences ($p>0.05$) were seen between men (mean 6.02) and women (mean 6.46).

Participation in the tests was >70% (71-97%), except for the 10 m Walking/Wheeling propulsion at maximum speed and the Timed Chair Stand Test (Fig. 1).

The results of outcome variables for the entire population and by gender are listed in Table 2. Gender differences, in favor of men, were seen regarding physical activity ($p \leq 0.005$) and grip strength ($p \leq 0.005$) (Table 2).

The Timed Chair Stand Test was completed five times in a row by 45.7% of participants. Of the others, 8.7% could rise once, 2.2% twice, 1.6% three times, and 1.2% four times, whereas 38.5% were unable to rise.

The question regarding fear of falling was answered by 228 participants, of whom 120 (47%) stated "Yes".

Group differences

Age. Participants over age 85 showed significantly lower cognitive function ($p \leq 0.05$), a lower level of phys-

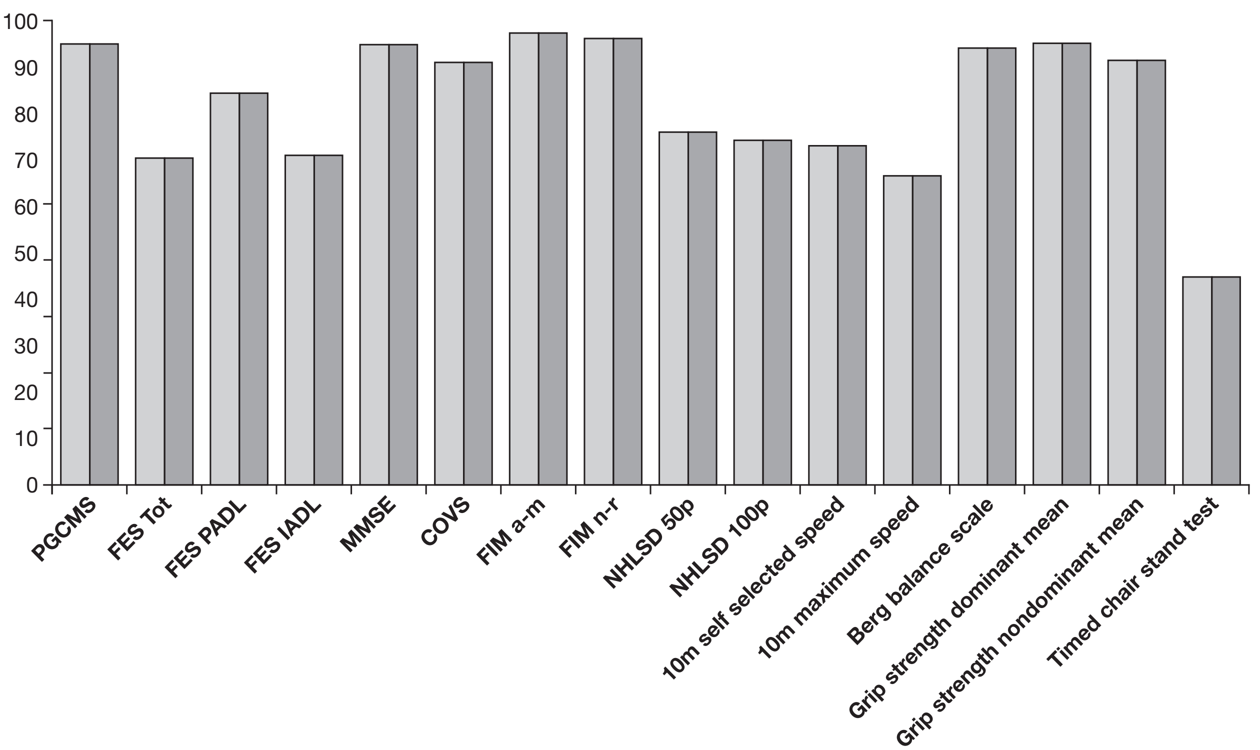

Fig. 1 - *Proportion (%) of residents who took part in tests.*

Table 2 - *Results of outcome variables for entire study population divided by gender respectively.*

Variables§	Total - n=322			Women - n=237			Men - n=85			*p*
	n	Median (Q1-Q3)	Mean (±SD)	n	Median (Q1-Q3)	Mean (±SD)	n	Median (Q1-Q3)	Mean (±SD)	
NHLSD area#	244	24 (18-33)		181	22 (17-30)		63	28 (20-37)		**
NHLSD dependence#	239	36 (24-52)		176	34 (22-51)		63	43 (31-69)		**
Self-selected gait/WC speed	235		0.45 (0.28)	171		0.44 (0.2)	64		0.47 (0.43)	ns
Maximum gait/WC speed	214		0.63 (0.32)	155		0.62 (0.28)	59		0.63 (0.4)	ns
Grip strength dom.¤	250		13.6 (8.65)	189		11.1 (6.7)	61		21.3 (9.6)	**
Grip strength non dom.¤	239		11.8 (7.83)	181		9.9 (6.2)	58		17.8 (9.36)	**
Timed Chair Stand Test	144		35.6 (28.9)	111		34.9 (23.5)	33		38 (42.8)	ns
Berg Balance Scale	302	16 (4-33)		220	19.5 (5-35.5)		82	105 (3-32)		ns
FIM a-m	313	47 (27-71)		231	48 (29-71.5)		86	44 (23-71)		ns
FIM n-r	309	25 (16-32)		227	25 (16.5-32)		82	25 (15-32)		ns
COVS	292	58 (35-72)		216	61.5 (35-72.5)		76	52.5 (34.5-69.5)		ns
FES P-ADL	271	40 (20-55)		199	40 (20-55)		72	35.5 (24-50)		ns
FES I-ADL	228	31 (10.9-52)		171	30 (9.8-52.5)		57	40 (17-50)		ns
FES Total	226	75 (38-110)		169	72 (38-112)		57	79 (44-107)		ns
PGCMS	305	11 (8-13)		225	11 (7-13)		80	11 (8-14)		ns
MMSE	305	19 (13-25)		228	19 (12-24)		77	20 (15-26)		ns

#NHLSD area: extension of physical activity; NHLSD dependence: dependency in physical activity. *p≤0.05, **p≤0.005. ¤Denmark excluded, Grip strength dom.= dominant hand mean, Grip strength non dom.= non dominant hand mean. §High scores on NHLSD indicate high physical activity level and more independence in mobility. High scores on Berg Balance Scale indicate better balance function. High scores on FIM or COVS indicate high degree of independence in ADL. High scores on FES(S) indicate high degree of fall-related self-efficacy. High scores on PGCMS indicate high degree of psychological wellbeing. High scores on MMSE indicate better cognitive function.

ical activity (p≤0.005) and lower grip strength (p≤0.005) (except in Denmark) than the younger group (Table 3).

Dependency in ADL. Participants with scores below 58 points on COVS (high dependency in ADL) had a significantly longer length of stay (p≤0.005), lower fall-related self-efficacy (p≤0.005) and a lower level of cognitive function (p≤0.005) than those with higher scores. A lower level of physical activity (p≤0.005), worse physical function (p≤0.05) and a higher level of dependency in ADL described by means of FIM (p≤0.005) were also demonstrated (Table 3).

Fall-related self-efficacy. The group with low FES P-ADL scores had lower levels of wellbeing (p≤0.005) and physical activity (p≤0.05) and different dimensions of physical function (p≤0.05) than the group with high values. In addition, a higher degree of dependency in ADL (p≤0.005) and lower fall-related self-efficacy in FES I-ADL (p≤0.005) were demonstrated (Table 3).

Wellbeing. Participants with low PGCMS scores showed lower fall-related self-efficacy (p≤0.005) and a slower self-selected gait/WC speed (p≤0.05) than the group with higher scores.

Cognitive function. Participants with low MMSE scores were older (p≤0.05), showed higher fall-related self-efficacy (p≤0.05) and were less physically active (p<0.05) than participants with higher scores. They also performed worse in certain dimensions of physical function, i.e; grip strength, leg muscle strength and balance (p≤0.05) and showed a higher degree of dependency in ADL (p≤0.005) (Table 4).

Participants with MMSE ≥16 points vs *lower scores*

When we excluded participants with MMSE<16 points from the analysis, the difference between age groups regarding cognitive function and grip strength disappeared. Instead, a difference (p≤0.05) between length of stay (<85 yr - mean 19.3 months, ≥85 yr - mean 23.5) and FES I-ADL (<85 yr - median 27 p, ≥85 yr - median 25 p) appeared. All other results regarding group differences remained unchanged.

DISCUSSION

The above data indicate that elderly nursing home residents in Sweden, Norway and Denmark form a heterogeneous group. There are large ranges in the degree or level of almost every characteristic and function measured. Variations in the physical and cognitive abilities among institutional residents have also been reported by other authors (30-33).

High age (>85 yrs) did not have any significant impact on functional level or wellbeing. However, participants over 85 had lower cognitive function than younger ones, and advanced age is known to be a risk factor for dementia (34). The age effect disappeared when participants

Table 3 - *Group differences regarding high and low scores in variables Age, COVS and FES P-ADL.*

Variables§	Age<85 yrs		Age≥85 yrs			COVS<58 p		COVS≥58 p			FES P-ADL<40 p		FES P-ADL≥40 p		
	n	Median (Q1-Q3)	n	Median (Q1-Q3)	*p*	n	Median (Q1-Q3)	n	Median (Q1-Q3)	*p*	n	Median (Q1-Q3)	n	Median (Q1-Q3)	*p*
Age	-	-	-	-	-	147	86 (80.5-90.5)	145	86 (81-90)	ns	133	85 (80-89)	137	85 (81-90)	ns
Length of stay	129	13 (16-27)	170	16 (8-35)	ns	143	18 (9.5-36.5)	129	12 (4.5-22)	**	123	13 (6-24.5)	125	13 (7-28)	ns
NHLSD area#	109	27 (20-34)	134	22 (15-30)	**	102	22 (16-28)	121	27 (19-35)	ns	107	23 (16.5-28.5)	106	28 (19-36)	*
NHLSD dependence#	108	40 (30-56)	130	32.5 (22-48)	**	100	29.5 (21-40)	118	43.5 (30-65)	**	106	32 (22-47)	106	44 (30-66)	**
Self-selected gait/WC speed	106	0.4 (0.29-0.56)	129	0.42 (0.29-0.59)	ns	81	0.29 (0.19-0.38)	136	0.5 (0.37-0.66)	**	99	0.36 (0.24-0.46)	117	0.5 (0.36-0.67)	**
Maximum gait/WC speed	97	0.53 (0.38-0.83)	117	0.63 (0.38-0.83)	ns	66	0.42 (0.27-0.55)	132	0.68 (0.5-0.9)	**	94	0.49 (0.36-0.67)	108	0.69 (0.5-0.9)	**
Grip strength dom.¤	101	14.3 (8-20.7)	149	14.3 (8-20.7)	ns	129	11.7 (6.7-16)	110	14.15 (9-20)	*	99	12.3 (7.5-18.2)	105	14.7 (8.7-20)	ns
Grip strength non dom.¤	98	11.7 (6.3-19.7)	141	10 (6-14.7)	*	120	8.5 (4.3-15)	110	12 (8.3-16.7)	**	95	10 (5-15.5)	104	11.8 (8.3-17.2)	*
Timed Chair Stand Test	63	25 (18.5-44.4)	81	29.2 (19.5-44.3)	ns	20	39.2 (29-56)	118	25 (18.3-42.3)	ns	43	41.6 (28-58.5)	96	23.4 (18-34.5)	**
Berg Balance Scale	132	16 (4-33.5)	169	17 (4-33)	ns	132	4 (2-10)	145	33 (23-42)	**	127	10 (4-27)	136	27.5 (12.5-41)	**
FIM a-m	136	48 (28.5-74.5)	176	46.5 (26-68.5)	ns	144	28.5 (20-42)	142	69.5 (55-81)	**	130	42.5 (30-65)	134	65 (42-81)	**
FIM n-r	133	26 (16-32)	175	25 (16-32)	ns	143	22 (13-32)	141	28 (20-32)	**	127	29 (20-33)	133	25 (17-32)	ns
COVS	124	60 (39-73)	167	56 (32.5-70.5)	ns	-	-	-	-	-	118	53 (34-65)	128	70 (54-77)	**
FES P-ADL	122	40 (25-53)	148	40 (19.5-55)	ns	110	30 (12-45)	137	49 (30-60)	**	-	-	-	-	-
FES I-ADL	102	32.5 (14-50)	125	30 (9-53)	ns	90	25.5 (2-44.6)	124	36 (17-56)	**	109	15 (1-30)	115	50 (35.5-60)	**
PGCMS	137	11 (7-14)	167	11 (8-13)	ns	138	11 (6-13)	141	11 (9-13)	ns	132	10 (7-12)	136	12 (9-15)	*
MMSE	135	20 (14-25)	169	18 (12-24)	*	136	18 (10.5-23.5)	142	21 (13-26)	**	133	20 (14-25)	135	21 (13-25)	ns

#NHLSD area: extension of physical activity, NHLSD dependence: dependency in physical activity. *$p \leq 0.05$, **$p \leq 0.005$. ¤Denmark excluded, Grip strength dom.= dominant hand mean, Grip strength non dom.= non dominant hand mean. §High scores on NHLSD indicate high physical activity level and more independence in mobility. High scores on Berg Balance Scale indicate better balance function. High scores on FIM or COVS indicate high degree of independence in ADL. High scores on FES(S) indicate high degree of fall-related self-efficacy. High scores on PGCMS indicate high degree of psychological wellbeing. High scores on MMSE indicate better cognitive with MMSE scores <16 points were excluded from the analyses, reflecting the fact that severe dementia develops over years and that cognitive decline is one of the main reasons for being admitted to a nursing home, independent of age (35, 36).

According to the FIM scores, the majority of our participants required supervision or personal help in 25-50% of activities, and those with a high degree of dependency in ADL also showed low physical functions and were less physically active. Future analyses regarding the effects of the intervention may reveal how low physical function causes high dependency in ADL. It is also possible that the lack of opportunities for participants to be physically active and perform ADL regularly results in a low physical function.

Low fall-related self-efficacy went together with low physical function, physical activity and wellbeing. Similar relationships have previously been recognized in both stroke patients and nursing home residents (37-39). One interesting result was that participants with low cognitive function showed a significantly higher degree of fall-related self-efficacy than others. Our results probably reflect a decreased ability in persons with dementia to judge their own current abilities adequately, something that may imply an increased risk of falling.

Participants with a low level of wellbeing had a slower self-selected gait/WC speed than those with a high level, and depressive symptoms have previously been demonstrated to be more closely associated with gait speed than with muscle function (40). Baseline data from this study cannot conclude on the causality between depression and gait speed, but it will be interesting to see if our intervention, aimed at increasing activity and physical function, also results in improved morale.

The finding that participants with low MMSE scores were to a higher degree less physically active than those with a higher MMSE is in line with Eggermont et al. (41), who showed that differences in physical activity patterns between active and sedentary nursing home residents were more pronounced in persons with more severe dementia than in persons with mild-to-moderate dementia. This is an important finding, indicating that persons with the most severe dementia need more support and adapted activity organized by the nursing staff than

Table 4 - *Group differences regarding high and low scores in variables PGCMS and MMSE.*

Variables§	**PGCMS<11 p**		**PGCMS≥11 p**			**MMSE<19 p**		**MMSE≥19 p**		
	n	**Median (Q1-Q3)**	**n**	**Median (Q1-Q3)**	***p***	**n**	**Median (Q1-Q3)**	**n**	**Median (Q1-Q3)**	***p***
Age	136	86 (80.5-92)	168	85 (80-89)	ns	143	87 (81-90)	162	84 (79-90)	*
Length of stay	126	13 (8-31)	156	15 (6-27)	ns	141	15 (7-31)	142	12.5 (7-27)	ns
NHLSD area#	109	22 (17-30)	128	25 (19-34)	ns	90	22 (18-28)	146	26.5 (18-34)	*
NHLSD dependence#	106	34 (25-53)	126	37 (25-58)	ns	88	31 (23-40)	143	40 (27.5-64)	**
Self-selected gait/WC speed	102	0.37 (0.26-0.54)	126	0.43 (0.32-0.6)	*	99	0.38 (0.28-0.55)	131	0.42 (0.30-0.60)	ns
Maximum gait/WC speed	92	0.55 (0.39-0.77)	118	0.59 (0.43-0.83)	ns	91	0.55 (0.41-0.71)	120	0.62 (0.42-0.83)	ns
Grip strength dom.*	107	11.3 (6-17.7)	130	13 (8.7-19.3)	ns	132	10 (5.7-15)	103	15 (10.5-20.4)	**
Grip strength non dom.*	101	9 (4.7-16.3)	128	11.2 (7.3-17.6)	ns	127	9 (5-14.4)	101	12.7 (7.7-17.3)	**
Timed Chair Stand Test	57	30.6 (21-50)	85	26 (18-39.3)	ns	53	34.6 (20-50)	89	25 (19-39.3)	*
Berg Balance Scale	125	15 (4-32)	164	18 (4-35)	ns	133	13 (4-28)	158	22 (6-38)	**
FIM a-m	133	45 (28-71)	165	50 (31-76)	ns	140	39.5 (23-59)	159	61 (37.5-80.5)	**
FIM n-r	130	25 (18-32)	164	26.5 (17-33)	ns	140	18 (12-25)	155	32 (26.5-34)	**
COVS	123	56 (39-69.5)	155	62 (35-74)	ns	132	51.5 (31-69)	46	64 (49-75)	**
FES P-ADL	117	32 (16-48)	151	44 (26-57)	**	114	40 (20-55)	155	39 (20-53.5)	ns
FES I-ADL	96	26 (5-44)	129	39 (16-55)	**	102	40 (17-55)	124	27.5 (7-46)	*
PGCMS	-	-	-	-	ns	137	11 (7-13)	162	11 (8-13)	ns
MMSE	132	19 (13-25)	166	20 (13-25)	ns	-	-	-	-	-

#NHLSD area: extension of physical activity; NHLSD dependence: dependency in physical activity. *$p \leq 0.05$, **$p \leq 0.005$. *Denmark excluded, Grip strength dom.= dominant hand mean, Grip strength non dom.= non dominant hand mean. §High scores on NHLSD indicate high physical activity level and more independence in mobility. High scores on Berg Balance Scale indicate better balance function. High scores on FIM or COVS indicate high degree of independence in ADL. High scores on FES(S) indicate high degree of fall- related self-efficacy. High scores on PGCMS indicate high degree of psychological wellbeing. High scores on MMSE indicate better cognitive function.

Ready for press

Signature ....

the others, in order to prevent the negative effects of inactivity.

The study used a mixture of objective performance-based measures and subjective reports. This was also recommended by the Frailty Working Group (2) studying frail older persons who often have complex functional loss. To be able to capture even small differences within frail elderly participants with multifaceted loss of functions, we used a broad selection of instruments. Participation in each test was on average 82%, which we considered to be acceptable. A recent review regarding the effectiveness of physical rehabilitation for nursing home residents showed an overall mean participation rate of 86% (42).

A commonly used statistical way of handling data missing by imputation is to replace a missing value in a scale by the individual median score (22). We decided that, if at least 75% of the scale was completed, it would be fair to count it in (with imputations) as a result, in order to avoid too many drop-outs.

This study raises several methodological concerns. It is possible that other tests should have been used, i.e. ones which those who were not able to perform our tests could have managed. Poor cognitive function was not originally considered to be an exclusion criterion. In general, cognitively impaired persons are able to participate in exercise programs, and the Frailty Working Group recommends that exclusion of cognitively frail persons should be minimized in research studies (2). In Nordic countries, dementia is the most common reason (compared with other chronic diseases in 2003 and 2007) for admission to nursing home care (35, 36). In our study, 40% had ≤16 on MMSE score, which indicates severe dementia (43). In order to be adaptable to the clinic, it was decided to include also persons with severe dementia.

However, the broad inclusion criteria, which enabled enrolment of participants with a broad range of mental and functional capacities, are one of the strengths of this study in terms of implementation of the results in other settings. The study population seems to be representative of nursing home residents with respect to age and gender (44-47), walking ability and grip strength (48), as well as NHLSD (11) and fear of falling (44). General conclusions must be drawn with caution and only within a nursing home setting.

CONCLUSIONS

These data demonstrate that elderly residents in nursing homes in Sweden, Norway and Denmark form a frail but heterogeneous group with respect to most functions. Low physical activity, physical function and dependency in ADL were related to poor wellbeing, cognitive function and fall-related self-efficacy. The next step of the project will reveal if the intervention focusing on physical activity and function has an influence on physical functioning as well as wellbeing, cognitive function and fall-related self-efficacy.

ACKNOWLEDGEMENTS

This work was supported by the National Society for Research on Aging; Swedish Research Council; Centre for Caring Sciences at Karolinska Institutet; Swedish Order of St. John; King Gustaf V's and Queen Victoria's Foundation, Ageing and Health; Stockholms Sjukhem Foundation; Norwegian Center for Research, Education and Service Development; Teaching Nursing Home, Soebstad; Norwegian Directorate for Health and Social Affairs; VELUX-Fondene; Occupational Therapy Education at the University College, Sjaeland; and Health Faculty at the University of Southern Denmark. The founders played no role in the production of this research.

REFERENCES

1. http://medical-dictionary.thefreedictionary.com.
2. Ferrucci L, Guralnik JM, Studenski S, Fried LP, Cutler GB Jr, Walston JD. Designing randomized, controlled trials aimed at preventing or delaying functional decline and disability in frail, older persons: a consensus report. J Am Geriatr Soc 2004; 52: 625-34.
3. Guralnik JM, LaCroix AZ, Abbott RD et al. Maintaining mobility in late life. I. Demographic characteristics and chronic conditions. Am J Epidemiol 1993; 137: 845-57.
4. Covinsky KE, Palmer RM, Fortinsky RH et al. Loss of independence in activities of daily living in older adults hospitalized with medical illnesses: increased vulnerability with age. J Am Geriatr Soc 2003; 51: 451-8.
5. Fox KR, Stathi A, McKenna J, Davis MG. Physical activity and mental well-being in older people participating in the Better Ageing Project. Eur J Appl Physiol 2007; 100: 591-602.
6. Sullivan MD. Maintaining good morale in old age. West J Med 1997; 167: 276-84.
7. West RL, Yassuda MS. Aging and memory control beliefs: performance in relation to goal setting and memory self-evaluation. J Gerontol 2004; 59: P56-65.
8. Berg K, Sherwood S, Murphy K, Carpenter GI, Gilgen R, Phillips CD. Rehabilitation in nursing homes: a cross-national comparison of recipients. Age Ageing 1997; 26 (Suppl 2): 37-42.
9. Heyn P, Abreu BC, Ottenbacher KJ. The effects of exercise training on elderly persons with cognitive impairment and dementia: a meta-analysis. Arch Phys Med Rehabil 2004; 85: 1694-704.
10. Frandin K, Borell L, Gronstedt H et al. A Nordic multi-center study on physical and daily activities for residents in nursing home settings: design of a randomized, controlled trial. Aging Clin Exp Res 2009; 21: 314-22.
11. Tinetti ME, Ginter SF. The nursing home life-space diameter. A measure of extent and frequency of mobility among nursing home residents. J Am Geriatr Soc 1990; 38: 1311-5.
12. Connelly DM ST, Vandervoort AA. Between- and within-rater reliability of walking tests in a frail elderly population. Physiother Can 1996; 41: 304-11.
13. Finch E, Brooks D, Stratford PW, Mayo NE. Physical rehabilitation outcome measures, 2nd ed. Canadian Physiotherapy Association, Toronto ON, 2002.
14. Hamilton A, Balnave R, Adams R. Grip strength testing reliability. J Hand Ther 1994; 7: 163-70.
15. Peolsson A, Hedlund R, Oberg B. Intra- and inter-tester reliability and reference values for hand strength. J Rehabil Med 2001; 33: 36-41.
16. Bellace JV, Healy D, Besser MP, Byron T, Hohman L. Validity of the Dexter Evaluation System's Jamar dynamometer attachment for assessment of hand grip strength in a normal population. J Hand Ther 2000; 13: 46-51.

17. Chau N, Petry D, Bourgkard E, Huguenin P, Remy E, Andre JM. Comparison between estimates of hand volume and hand strengths with sex and age with and without anthropometric data in healthy working people. Eur J Epidemiol 1997; 13: 309-16.
18. Chau N, Remy E, Petry D, Huguenin P, Bourgkard E, Andre JM. Asymmetry correction equations for hand volume, grip and pinch strengths in healthy working people. Eur J Epidemiol 1998; 14: 71-7.
19. Guralnik JM, Simonsick EM, Ferrucci L et al. A short physical performance battery assessing lower extremity function: association with self-reported disability and prediction of mortality and nursing home admission. J Gerontol 1994; 49: M85-94.
20. Berg K, Wood-Dauphinee S, Williams JI, Gayton D. Measuring balance in elderly: preliminary development of an instrument. Physiother Can 1989; 41: 304-31.
21. Buffalo SUoNYa. Guide for the uniform data set for medical rehabilitation (adult FIM). 4.0 Swedish version 1994 (ed 1993).
22. Twisk J, de Vente W. Attrition in longitudinal studies. How to deal with missing data. J Clin Epidemiol 2002; 55: 329-37.
23. Seaby L. Reliability of a physiotherapy functional assessment used in a rehabilitation setting. Physiother Can 1989; 41: 264-70.
24. Hellstrom K, Lindmark B. Fear of falling in patients with stroke: a reliability study. Clin Rehabil 1999; 13: 509-17.
25. Tinetti ME, Richman D, Powell L. Falls efficacy as a measure of fear of falling. J Gerontol 1990; 45: P239-43.
26. Vellas BJ, Wayne SJ, Romero LJ, Baumgartner RN, Garry PJ. Fear of falling and restriction of mobility in elderly fallers. Age Ageing 1997; 26: 189-93.
27. Lawton MP. The Philadelphia Geriatric Center Morale Scale: a revision. J Gerontol 1975; 30: 85-9.
28. Lofgren B, Gustafson Y, Nyberg L. Psychological well-being 3 years after severe stroke. Stroke 1999; 30: 567-72.
29. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975; 12: 189-98.
30. Kolanowski A, Buettner L, Litaker M, Yu F. Factors that relate to activity engagement in nursing home residents. Am J Alzheimers Dis Other Demen 2006; 21: 15-22.
31. Lazowski DA, Ecclestone NA, Myers AM et al. A randomized outcome evaluation of group exercise programs in long-term care institutions. J Gerontol 1999; 54: M621-8.
32. Leemrijse CJ, de Boer ME, van den Ende CH, Ribbe MW, Dekker J. Factors associated with physiotherapy provision in a population of elderly nursing home residents; a cross sectional study. BMC Geriatr 2007; 7: 7.
33. Lindelöf N. Effects and experiences of high-intensity functional exercise programmes among older people with physical or cognitive impairment (Doctoral thesis) 2008.
34. Chen JH, Lin KP, Chen YC. Risk factors for dementia. J Formos Med Assoc 2009; 108: 754-64.
35. Selbaek G, Kirkevold O, Engedal K. The prevalence of psychiatric symptoms and behavioural disturbances and the use of psychotropic drugs in Norwegian nursing homes. Int J Geriatr Psychiatry 2007; 22: 843-9.
36. The National Board of Health and Welfare. Vad är särskilt i särskilt boende för äldre? En kartläggning. ISBN 91-7201-576-4.
37. Andersson AG, Kamwendo K, Appelros P. Fear of falling in stroke patients: relationship with previous falls and functional characteristics. Int J Rehabil Res 2008; 31: 261-4.
38. Hellstrom K, Vahlberg B, Urell C, Emtner M. Fear of falling, fall-related self-efficacy, anxiety and depression in individuals with chronic obstructive pulmonary disease. Clin Rehabil 2009; 23: 1136-44.
39. Von Heideken Wagert P, Ronnmark B, Rosendahl E et al. Morale in the oldest old: the Umea 85+ study. Age Ageing 2005; 34: 249-55.
40. Hausdorff JM, Nelson ME, Kaliton D et al. Etiology and modification of gait instability in older adults: a randomized controlled trial of exercise. J Appl Physiol 2001; 90: 2117-29.
41. Eggermont LH, Scherder EJ. Ambulatory but sedentary: impact on cognition and the rest-activity rhythm in nursing home residents with dementia. J Gerontol 2008; 63: P279-87.
42. Forster A, Lambley R, Young JB. Is physical rehabilitation for older people in long-term care effective? Findings from a systematic review. Age Ageing 2010; 39: 169-75.
43. Bokde AL, Teipel SJ, Drzezga A et al. Association between cognitive performance and cortical glucose metabolism in patients with mild Alzheimer's disease. Dement Geriatr Cogn Disord 2005; 20: 352-7.
44. Blanchard RA, Myers AM, Pearce NJ. Reliability, construct validity, and clinical feasibility of the activities-specific fall caution scale for residential living seniors. Arch Phys Med Rehabil 2007; 88: 732-9.
45. Kirkevold O, Engedal K. The quality of care in Norwegian nursing homes. Scand J Caring Sci 2006; 20: 177-83.
46. Resnick B. Reliability and validity of the Outcome Expectations for Exercise Scale-2. J Aging Phys Act 2005; 13: 382-94.
47. Wolter LL, Studentski SA. A clinical synthesis of falls intervention trials. Topics Ger Rehabil 1996; 11: 9-19.
48. Giuliani CA, Gruber-Baldini AL, Park NS et al. Physical performance characteristics of assisted living residents and risk for adverse health outcomes. Gerontologist 2008; 48: 203-12.