

Functional Status and Self-Rated Health in 2,262 Nonagenarians –

The Danish 1905-Cohort Survey

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Running head: Functional capacity in nonagenarians.

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OBJECTIVE: To describe the functional capacity and self-rated health of a large cohort of nonagenarians.

DESIGN: A cross-sectional survey of all Danes born in 1905 (92-93 years of age), carried out in the period August – October 1998.

PARTICIPANTS: A total of 2262 nonagenarians, corresponding to a participation rate of 63% (of these 20% participated by proxy).

MEASUREMENTS: Activity of Daily Living (ADL) and self-rated health were assessed by interview. Five items from Katz's ADL (bathing, dressing, transfer, toileting and eating) were used to construct a three-level 5-item ADL scale (not disabled (no disabilities), moderately disabled (1-2 disabilities), severely disabled (3-5 disabilities)). From responses to a more extensive list of questions on ADL (26 items), we identified scales of Strength and Agility by means of factor analysis. Furthermore, a 26-item ADL scale was made. Physical performance tests (chair stand, timed walk, lifting a 2.7 kg box, maximum grip-strength, and flexibility tests) were performed among non-proxy responders.

RESULTS: According to the 5-item ADL scale, 50% of the men and 41% of the women were categorised as not disabled, while 19% and 22% respectively were categorised as severely disabled. The 5-item ADL scale correlated highly with the 26-item ADL scale ($r = 0.83$). The ADL scales showed moderate to good correlation with each other ($r=0.74-0.83$), and with the physical performance tests ($r = 0.31-0.58$). Only 3.7% of the women and 6.3% of the men walked

(normal pace) with a speed of at least 1 m/s, which is the minimum walking speed required to cross signalled intersections in Denmark. A total of 56% considered their health to be excellent or good. Of the participants 74% were always or almost always satisfied with their lives even though only 45% reported they "felt well enough to do what they wanted". The analyses showed that no single ADL item seemed to be of particular importance for how the participants rated their health.

CONCLUSION: The Danish 1905-cohort survey is the largest and the only nationwide survey of a whole birth-cohort of nonagenarians. A total of 2,262 fairly non-selected nonagenarians participated. The level of both self-reported disability and functional limitations measured by physical performance tests among nonagenarians was high. Despite their lower mortality females were more disabled than males and did not perform as well as males in the physical performance tests. However, the majority of the participants considered their health to be good and was satisfied with their lives.

Keywords: functional status, nonagenarians, oldest-old, ADL, physical performance test

BACKGROUND/ INTRODUCTION

Octogenarians and centenarians are by now relatively well described but nonagenarians represent an age group whose cognitive and physical features have yet to be investigated systematically. One of the important questions posed in aging research is whether the additional years in life expectancy, caused by the reduction in mortality among the oldest-old¹, are characterised by severe disability or by independent disability-free living. It is well established that the level of institutionalization, disability and morbidity increases with age. In Denmark about 10% of the octogenarians² and more than 55% of the centenarians³⁻⁵ live in nursing homes while dependency in ADL rises from approximately 30% to 70%⁴, and the prevalence of dementia rises from approximately 15%^{6,7} to 50%^{5,8}. But we do not know if dependency increases gradually with advancing age or is compressed in the last years of life among elderly who reach very high ages.

There is a gap in our knowledge as only a limited number of surveys including nonagenarians⁹⁻¹⁴ have been conducted, and sample sizes for this age group have generally been small. We therefore conducted *The Danish 1905-Cohort Survey*, which intends to bridge the gap between the surveys of the younger elderly and the centenarian studies. This survey is a nationwide survey of all Danes born in 1905 and includes 2,226 nonagenarians. The overall goal of the survey was to establish a genetic-epidemiological database on a large cohort of nonagenarians in order to elucidate the aging process in the very old, with special focus on physical and cognitive functioning. The large number of participants, of whom approximately five percent are expected to live to a hundred years, will provide sufficient power to allow detailed future studies of predictive factors for disability, morbidity and mortality among nonagenarians.

The objective of this paper is to describe the functional capabilities and health of nonagenarians by using three different sets of measurements: Self-reported measures of Activity of Daily Living (ADL), objective tests of physical performance, and self-rated health. Furthermore, we compare results on these measures in order to investigate whether the good association between self-perceived and performance-based measures of physical function, which is shown in surveys of younger elderly¹⁵⁻¹⁹, can also be found among the very old. Finally, the association between self-rated health and ADL function is examined.

METHODS

Study population

The survey has previously been described in detail²⁰. In brief, the study includes all Danes born in 1905 living in Denmark. No exclusion criteria were used. The cohort members were traced through the Danish Civil Registration System, which covers all inhabitants in Denmark through their unique personal identification number. Members of the 1905-cohort received a letter explaining the study and asking permission for an interviewer to come to their residency to conduct a health-related face-to-face interview and test their mental and physical functioning. They were also asked to give a sample of cells from which DNA could be extracted. If the person was unable to participate due to physical or mental impairment, a proxy-responder was encouraged to participate in the interview instead, or together with the nonagenarian. Pretesting of the participants was not feasible. The decision whether to use a proxy-responder or not was taken by the interviewer together with the family and caregivers at the initial contact to obtain consent to participate in the interview. The reasons for using a proxy-responder were: dementia (57%), severe sensory deficits (14%), unwillingness to participate personally (14%), and illnesses (14%). Proxy responders were most frequently children (70%) followed by other relatives (12%), caregivers (9%), spouses (6%), and others (3%). The nonagenarians were contacted within 14 days after they received the letter by the interviewer, either by personal contact or by phone, to obtain consent to participate in the survey. The nonagenarians were considered non-participants if they did not wish to participate in person or by proxy, or if at least three attempts to contact them, at different times, were unsuccessful. The regional Scientific Ethical Committees of Denmark approved the survey (19980073 PMC).

A total of 3,600 persons born in 1905 (92–93 years of age at the time of the survey) were alive at the beginning of the survey, and of these 2,262 (62.8%) participated, 1,814 (80.2%) in person and 448 (19.8%) by a proxy-responder. We compared participants and non-participants by using population-based registry information and found that the participants represented a fairly non-selected group of the 1905-cohort (described in detail in Nybo et al.²⁰).

Data collection and methods

Following a pilot study comprising 200 persons, 93 interviewers from the Danish National Institute of Social Research carried out the survey during a 3 months period in 1998 (August–October).

The questionnaire included questions on socio-economic factors, self-rated health, diseases diagnosed by a physician, symptoms of pulmonary and heart diseases, incontinence, pain, fall incidents, fractures, use of medicine, sensory deficits, depression²¹, Activity of Daily Living (ADL), life-style habits, family history, and social life. The questionnaire, with minor changes, has previously been used in The Longitudinal Survey of Aging Danish Twins (LSADT)^{21–24}.

ADL was assessed by an expansion of a comprehensive well-validated Danish ADL-scale (Avlund's PADL)^{24,25}, covering both basic ADL's and more demanding tasks, (e.g. walking outside for half an hour in bad weather). The scale refers to the ability on the day of the interview. To enhance the discrimination between participants, questions about tiredness due to the activities were asked. Furthermore, we added questions on bathing and feeding from Katz's ADL index²⁶ and questions about functional limitations from the Nagi-scheme²⁷ (run 100 m, carry 5 kg, chew hard food, walk 400 m, and walk up the stairs to the second floor).

Five items covering Katz's ADL index - bathing, dressing, toileting, transfer and feeding (continence was not included, in accordance with the recommendations in the literature²⁸) were used to construct a three-level 5-item ADL scale. 'Not disabled' was defined as independent in all items, 'moderately disabled' as dependent in one or two items and 'severely disabled' as dependent in three or more items. These cut-off scores defined three sizeable groups, which ranged from a group capable of doing the most basic activities independently to a group which was dependent on the majority of the 5 basic activities.

All ADL items previously used in The Longitudinal Survey of Aging Danish Twins (LSADT) were included in the present survey. All items were rated 1 to 4 with the response options being: 1 = cannot do, 2 = can do with aid or major difficulties, 3 = can do with fatigue or minor difficulties, 4 = can do without fatigue. A factor analysis based on LSADT revealed that the 26 ADL items used reflected 2 subscales. The first factor loaded highest on items dealing with ability to walk, go upstairs, and carry weights and was interpreted to reflect a dimension of strength and endurance (Strength scale, 11-items). The second factor loaded highest on items dealing with ability to dress and wash oneself and get in and out of bed and was interpreted to reflect a dimension of agility (Agility scale, 11-items). Finally a 26-item ADL scale comprising all items was constructed. (For further details see Christensen et al. 2000²⁴). These 3 scales, which we named "Functional ability scales" are used in the present paper as almost identical factor loadings were found when applying these scales to the data from the 1905-cohort, suggesting that the dimensions are also very reliable in a large sample of very old persons.

Taking account of the age and expected functional capacity of the study population we composed

tests of physical performance. The intention was to cover performance domains important to physical functional independence (e.g., flexibility and strength in upper and lower body). Included were: ability to bring hands to neck, loin, and toes of the opposite foot (Flexibility tests), single chair stand with or without the use of arms, and ability to lift a box weighting 2.7 kg above the head (Strength tests) (for scoring see Table 1), and timed walk over a distance of 3 meters (normal pace). Two trials were done and the fastest one was used for the analyses. The subject was allowed to use a walking aid, if necessary. These tests were, with minor changes, performed according to the protocol from the Women's Health and Aging Study²⁹. Handgrip was tested using a handheld dynamometer (SMEDLEY'S dynamometer TTM), for three performances with the strongest hand.

RESULTS

The basic characteristics of the cohort are shown in Table 2.

For all ADL-items the frequencies of persons who “can do without fatigue”, “can do with fatigue or minor difficulties”, “can do with aid or major difficulties”, or “cannot do”, respectively, are shown in Table 3. Furthermore, mean scores for the items and for the three functional ability scales (Strength, Agility and 26-item ADL scale) are shown. Males from the 1905-cohort managed on average all ADL activities better than females and scored higher than females on the functional ability scales (ANOVA $p < .001$). Activities in the Strength scale represented the most difficult tasks. On this scale the participants were on average categorized as “can do with aids or major difficulties” (mean score male = 2.08, female = 1.73) and according to the Agility scale on average as “can perform the activity with fatigue or minor difficulties” (mean score male = 2.99, female = 2.63).

According to the 5-item ADL scale, 50.1% of the males and 40.7% of the females were classified as not disabled (Table 4). Proportionately fewer males were dependent in each ADL item. In all items except feeding and going to the toilet the difference was highly significant (chi-square test, $p < .001$). Among proxy-responders there were no sex differences in the ADL pattern. The task in which most of the respondents were dependent was bathing (women = 52%, men = 46%) followed by dressing, toileting, transfer and feeding.

In Table 5 the physical performance test results are shown together with the 5-item ADL scale. There is a substantial decline in mean test performance with increasing level of disability, along

with an increasing proportion of persons who were unable to complete the tests. We used a one-way ANOVA to test if there was a significant difference between means (e.g. between the not disabled and severely disabled) for the four tests of physical performance. As the one-way ANOVA tests were highly significant ($p < .001$) "multiple comparisons" were performed in order to test if there were also significant differences between all three disability levels in the 5-item scale and the tests. We found there were significant differences in means along all three disability levels for handgrip measurements, flexibility tests and strength tests. For walking-speed we found no significant difference between the severely disabled and the two other groups (Dunnet C- test, $P > 0.05$). The trend was linear for handgrip and walking speed while there was a non-linear relationship for the flexibility and strength tests (Table 5). Males performed better than females in all tests (Chi-square test, $p < 0.001$) except in the flexibility tests (Chi-square test, $p = 0.15$).

The walking speed ranged from 0.06 m/s to 1.5 m/s, and for both sexes the severely disabled walked approximately half as fast as the not disabled. A total of 3.7% of the females and 6.3% of the males had a normal walking of at least 1 m/s, which is the minimum walking speed required for crossing signalled intersections in Denmark. Walking aid was used by 45% of the participants who completed the test. Walking was the most demanding test as 406 (22.5%) of the nonagenarians were unable to complete the test; either because they could not walk at all ($n = 199$), or for other reasons (illness, sensory deficits, the participant or the interviewer felt it was too not secure). Less than 7% of the subjects were unable to attempt/complete the remaining tests.

Correlation analyses of the relation between the 5-item ADL scale and the physical performance tests showed that the correlation between the 5-item ADL scale and the objective measures of

physical function ranged between 0.31 and 0.58 (handgrip $r=0.31$, walking speed $r=0.39$, flexibility tests $r=0.47$, and strength tests $r=0.58$). By using the 26-item ADL scale instead of the 5-item ADL scale the correlations increased to a range of 0.46 to 0.68 (handgrip $r=0.46$, walking speed $r=0.63$, flexibility tests $r=0.57$, and strength tests $r=0.68$).

There is a significant difference (chi-square test, $p<0.001$) between the disability groups rating of health, life satisfaction, and ability to do what they want (Table 6). However, even among the severely disabled a large proportion of the respondents stated their health as 'excellent or good' (men=39.0%, women=36.0%), and in this group 52.5% of the men and 55.0% of the women were 'always or mostly' satisfied with their lives, even though only 20.3% and 14.0%, respectively, reported that they "felt well enough to do what they wanted". Males who reported their health as poor/very poor were almost equally distributed in the 3 disability groups (not disabled 30%, moderately disabled 36%, and severely disabled 34%), while among females the largest proportion could be categorized as "moderately disabled" (not disabled 21%, moderately disabled 54%, and severely disabled 25%).

To elucidate whether any specific ADL items was important for how the participants rated their health we calculated mean scores for the ADL items dividing participants into 3 groups according to their self-rated health (excellent/good, acceptable, and poor/very poor). The analyses showed that no single ADL item seems to be of particular importance for how the participants rated their health. For the majority of items there was a decline in mean score of approximately 0.8 to 1 between persons who rated their health as excellent/good and persons who rated their health as poor/very poor. However, the difference in mean score was very small (0.12 to 0.25) both for the items that were the most difficult to perform (do hard exercise, walk outside in good or bad

weather for half an hour, and run 100 meters) and for items which were very easy to perform (eat and comb one's hair). The highest differences in mean score were found for the ability to walk 400 m (1.38), and the ability to climb the stairs to the second floor (1.22).

DISCUSSION

The level of disability and functional limitations are high among the nonagenarians. More than half (49.9% of the males and 60.3% of the females) were disabled with regard to at least one of the most basic activities covering Katz's ADL. Considering the higher mortality rates for male nonagenarians it is striking that men on average manage the ADL-items as well as the tasks in the physical performance test battery much better than women. Only 3.7% of the women and 6.3% of the men walked (normal pace) with a speed of at least 1 m/s, which is the minimum walking speed required to cross signalled intersections in Denmark. Despite this, the majority of the participants in general considered their health to be good and were satisfied with their lives. No single ADL item seemed to be of particular importance for the rating of health.

In the present survey, disability was among others measured with a modified Katz's ADL scale. In general, we found the proportion of not disabled subjects in the lower end (50.1% of the males and 40.7% of the females were not disabled) compared to other surveys including nonagenarians which use Katz's ADL scale. This may be due in part to the small sample sizes and exclusion of e.g. demented persons and persons living in nursing homes in the comparable surveys. In the EPSE surveys, where only non-institutionalized persons were included³⁰, the percentage of not disabled persons varied between the study centers from 46% to 63% for males and between 43% and 63% for females. In the Leiden survey with 105 participants aged 85 or more (mean age 89)³¹ 60% were found not disabled. In this sample only 5% lived in nursing homes, while the corresponding figure in our survey was 31%. Among 183 90+ year-olds in the Kungsholmen project³² 40% were categorized as not disabled. An Italian survey⁹ of centenarians and nonagenarians free of major health-related diseases found that 35% (n=13) of the males and 6%

(n=3) of the females could be categorized as not disabled. However, the functional ability scores in the present survey were highly comparable to the scores obtained from the nonagenarians in LSADT (n=144)²⁴, a Danish study using virtually the same instrument as the present.

The substantial difference in ADL performance between the sexes is well known from the literature. Studies have shown that sex differences become progressively larger with age, which is in sharp contrast to the higher survival rate of women^{4,24,30,33-35}. This remains to be explained. It could be due to the physiological and psychological differences in functional capacity, (e.g. body composition and exercise tolerance³⁶) between the sexes, or to the fact that men represent a more selected group, considering their higher mortality rate. It is also likely that the underlying causes of disability and the relationship between disease severity and disability severity may be different in men and women³⁷. Finally, nonagenarian men tend still to be living in the social context that characterized most of their adult lives, as a larger proportion of the males lived independently and were still married and thus had the responsibility for doing some of the more demanding tasks in the household (e.g. cut the grass and the hedge). Even if these tasks in absolute terms are fairly easy they may have a training effect, thus maintaining strength at a higher level, as old people may need to use almost their maximal strength while performing such tasks³⁸.

Physical performance measures were included in the present study in order to provide objective and detailed information about functional capacity. However, the presumed high prevalence of disabilities and sensory deficits prevented many of the instrument batteries developed for studies of younger elderly from being suitable for use in a cohort of very old^{3,9}. We therefore selected the physical performance tests carefully in consideration of the age and expected functional capacity of the study population. We believe that the tests were well chosen, as the majority of

the participants were able to complete the tests. Furthermore, identifying inability to perform a test also provides meaningful information on individual functioning²⁹. The test in which most subjects could not participate was, not surprisingly, the walking test. Walking requires the coordinated function of a number of subsystems, including muscular strength, joint mobility, coordination, proprioception, reflex control, and balance²⁹, and many different kinds of pathology such as stroke, fractures, arthritis, Parkinson's disease, etc. contribute to walking impairment.

The walking speed (normal pace) in the 1905-cohort survey was on average 0.64 m/s among males and 0.52 m/s among females. Figures for 85+ year olds in the Cardiovascular Health Study³⁹ were 0.75 m/s and 0.6 m/s, respectively, but in that survey only community-dwelling persons were included. In WHAS⁴⁰ females aged 85+ (n=303) were on average able to walk with a velocity of 0.4 m/s. Only a very small minority of the participants in the present survey walked with a velocity which allowed them to cross the street while the green light was on. This as well as sensory deficits makes it very difficult for these very old people to manage in the traffic as they would have to increase their normal walking pace substantially.

Handgrip performance among the nonagenarians (mean values: males 22.8 kg, females 13.4 kg) was, as expected, lower compared to the performance in surveys of younger persons. In a survey of 4,223 Danish middle-aged twins (born in 1931-1952) who used the same instruments and logistics as in the present survey, the mean handgrip among males was 48 kg and among females 28 kg⁴¹. Among the 85+ year-olds in the Cardiovascular Health Study³⁹, the males (n=102) had a maximum handgrip of approximately 29 kg and females (n=91) of 18 kg.

The correlation analyses showed a poor correlation between handgrip, walking time, and the 5-

item ADL scale ($r=0.31$ and $r=0.39$). Using the 26-item ADL scale the correlation was moderate ($r=0.46$ and $r=0.63$). This indicates that handgrip and walking speed measure a dimension of functional ability among the very old, which is not represented to any major extent in the 5 item-ADL scale. This also indicates, as expected, that no single measure fully characterizes the functional ability of the 1905-cohort; the self-reported and performance-based measures are to some extent complementary.

It is noticeable, how positively the nonagenarians rate their health. However, this is also found in other surveys of the oldest-old. In the Canadian Health and Aging Study^{42,43} approximately 21% of the 90 to 95 year-olds rated their health as very good and 55% as pretty good, with a significant increase in positive rating with increasing age. The latter is also found in the Cambridge Project for Later Life⁴⁴. In this survey 39% of the 90+ year-olds ($n=76$) rate their health as very good compared to other persons of the same age. In The Kungsholmen Longitudinal Survey³², 66% of the 90+ year olds ($n=196$) regarded themselves as healthy and 20% as not healthy. The figures for the 1905-cohort are 16% (very good) and 39% (good).

Even the severely disabled rate their health very positively. This lack of relation between self-assessed health, life satisfaction, and functional status is striking. These findings parallel those described by Covinsky et al⁴⁵ in a study of 80+ year olds patients. The authors found that disagreement between the patients' reported health status and their perception of global quality of life was common. There may be several explanations for this discrepancy; the meaning of the above questions differs for very old people compared to younger elderly. Also, very old persons who expect some degree of disability may rate their health and life satisfaction by comparing their health status with what they expect, rather than with "perfect health". Furthermore, the

capacity to adapt to declines in health status may vary, depending on personal traits, psychological status, social support, and characteristics of the external environment⁴⁵. Also, there may be differences in co-morbidity at the same disability level which are associated with self-rated health. Finally, only 5% (2.3% of the males and 7.3% of the females) of the original 1905-birth-cohort were alive at the beginning of the survey, and this background may introduce a positive view on even a severely disabled life for a 1905-cohort member.

What is also remarkable is that the differences between the sexes regarding level of disability and physical performance did not seem to be reflected in their self-rated health, (i.e. men were not more positive about their health than women). This suggests that in measuring well-being of very old people it is important not only to measure functional ability, but also to take into account the participants' own perception of health and life satisfaction. It also has implications for how we take care of the elderly, as life satisfaction depends not only on health or functional status.

A number of methodological issues in the 1905-cohort survey need to be addressed. The non-participation rate was relatively high, and could be related to functional status. It has been suggested that non-response is correlated with severity of disability^{46,47}. We do, however, believe that the use of proxies in the survey ensured that even the most impaired individuals were able to participate, and the analysis shows, as expected, that participants interviewed by proxy were much more disabled than non-proxy participants. A register-based analysis of the relationship between participants and non-participants (for details²⁰) showed no differences between the two groups with regard to residence type, marital status, or hospitalization patterns in 1998, when the survey was conducted, nor in the previous 26 years. Men and residents of rural areas were more likely to participate, which is often seen in surveys among the elderly^{22,47,48}. However, the

mortality rate 6 months after the start of the survey was significantly higher among the non-participants compared with the participants, indicating that terminal illness was one of the reasons for non-participation.

In conclusion, the level of both self-reported disability and functional limitations measured by physical performance tests among nonagenarians was high. Despite their lower mortality females were more disabled than males and did not perform as well as males on the physical performance tests. However, the majority of the participants considered their health to be good and were satisfied with their lives.

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Table 1. Scoring of the physical performance tests

Physical performance tests	Score
<i>Strength tests composed of the sum of the following two tests*</i>	
Upper extremity strength - lift of 2.7 kg box over the head	
Able to lift over head	3
Able to lift to eye level	2
Able to lift a few centimetres	1
Unable	0
Lower extremity strength – chair stand	
Able to stand without use of arms	2
Able to stand with use of arms	1
Unable	0
<i>Flexibility tests composed of the sum of the following three tests †</i>	
External shoulder rotation – arms to neck	
Able to complete fully	2
Able to complete partially	1
Unable	0
Internal shoulder rotation- arms to loin	
Able to complete fully	2
Able to complete partially	1
Unable	0
Hip flexion – hands to opposite big toe or ankle or knee	
Able to reach opposite big toe	2
Able to reach opposite ankle	1
Able to reach opposite knee	0

* Minimum score = 0, maximum score = 5

† Minimum score = 0, maximum score = 12

Right and left arms scored separately

Table 2. Type of interview and demographic characteristics of subjects in the Danish 1905-cohort survey conducted in 1998

	Males n=584	Females n=1678	Total n=2262
<i>Interview type</i>			
In person	494 (84.6%)	1320 (78.7%)	1814 (80.2%)
By proxy	90 (15.4%)	358 (21.3%)	448 (19.8%)
<i>Type of residency</i>			
House/apartment	339 (58.0%)	846 (50.4%)	1185 (52.4%)
Sheltered housing/nursing home	245 (42.0%)	832 (49.6%)	1077 (47.6%)
<i>Marital status</i>			
Married	171 (29.3%)	56 (3.3%)	227 (10.0%)
Widow/widower	372 (63.7%)	1365 (81.3%)	1737 (76.8%)
Divorced	12 (2.1%)	67 (4.0%)	79 (3.5%)
Single	29 (5.0%)	190 (11.3%)	219 (9.7%)
<i>Education</i>			
<7 years	136 (23.3%)	373 (22.2%)	509 (22.5%)
7-8 years	330 (56.5%)	999 (59.5%)	1329 (58.8%)
9-10 years	67 (11.5%)	214 (12.8%)	281 (12.4%)
11+ years	39 (6.7%)	45 (2.7%)	84 (3.7%)
Unknown	12 (2.1%)	47 (2.8%)	59 (2.6%)

Table 3. Functional abilities in the Danish 1905-cohort survey

	Males					Females				
	Can do without fatigue %	Can do with minor difficulty or fatigue %	Can do with aid * or major difficulty %	Cannot do %	Mean score	Can do without fatigue %	Can do with minor difficulty or fatigue %	Can do with aid * or major difficulty %	Cannot do %	Mean score
<i>Strength scale</i>										
1. Walk around in the house ¹	50.6	7.9	29.8 (1.7)	11.7	2.97	36.3	8.7	40.9 (2.3)	14.1	2.77
2. Walk up and down stairs one floor ²	35.5	23.2	8.7	32.6	2.62	24.6	20.2	10.3	44.9	2.25
3. Walk up stairs to the 2 nd floor ¹	25.0	15.8	20.7 (5.8)	38.5	2.27	16.7	11.3	20.0	52.0	1.93
4. Able to get outdoors ¹	33.8	7.4	38.6 (5.7)	20.2	2.55	20.7	5.8	41.8 (11.4)	31.7	2.15
5. Able to walk 400 meters without resting ²	38.7	14.7	4.7	42.0	2.50	23.8	14.9	5.0	56.4	2.06
6. Do light exercise ³	31.8	11.1	1.4	55.7	2.19	18.3	9.6	1.3	70.8	1.75
7. Do hard exercise ³	6.1	6.4	1.2	86.3	1.32	2.4	2.8	0.4	94.3	1.13
8. Walk in nice weather for ½-1 hour ¹	9.3	1.4	2.9 (0.9)	86.4	1.33	3.2	0.9	1.4 (1.0)	94.5	1.13
9. Walk in bad weather for ½-1 hour ¹	8.1	1.6	2.9 (0.9)	87.4	1.30	2.7	0.8	1.1	95.3	1.11
10. Run 100 meters ²	1.9	1.7	0.7	95.7	1.10	0.8	0.7	0.1	98.4	10.4
11. Carry 5 kilos ²	45.4	13.0	6.6	35.3	2.68	13.8	14.4	6.0	65.7	1.76
<i>Strength scale score</i>					2.08	1.73				

Agility scale

12. Get up from chair ¹	60.0	7.4	26.8 (5.0)	5.8	3.12	49.3	9.3	33.0 (5.9)	8.4	2.99
Get up from bed ¹	62.5	5.2	26.1 (8.6)	6.2	3.24	50.5	8.6	31.7 (9.4)	9.2	3.00
13. Able to go to the toilet ¹	59.1	7.2	26.4 (10.8)	7.4	3.12	48.9	8.0	34.0 (11.5)	9.0	2.91
14. Wash upper part of body ¹	55.7	8.4	23.1 (14.7)	12.8	3.07	47.5	13.7	23.8 (13.1)	14.9	2.94
15. Wash lower part of body ¹	48.4	7.2	24.1 (17.1)	20.2	2.84	43.2	11.1	23.3 (16.5)	22.5	2.75
16. Wash hair ⁴	52.9	6.9	-	40.1	2.73	23.7	6.9	-	69.4	1.85
17. Dress upper part of body ⁵	65.1	9.0	15.1 (15.1)	10.8	2.28	54.9	15.9	14.4	14.9	3.19
18. Dress lower part of body ⁵	61.3	8.8	16.5 (16.5)	13.4	3.16	50.5	14.1	16.7	18.7	2.96
19. Take socks and shoes on and off ⁶	55.3	11.7	8.1	24.9	2.97	45.9	13.4	8.6	32.1	2.73
20. Comb hair ⁴	83.4	5.5	-	11.1	3.61	69.0	11.1	-	20.0	3.29
21. Cut toenails ⁴	19.1	6.3	-	74.7	1.70	13.7	4.7	-	81.5	1.15
22. Cut fingernails ⁴	57.8	1.7	-	40.5	2.77	48.4	4.9	-	46.8	2.55
<i>Agility scale score</i>					2.99					2.73

26-item scale (remaining items)

23. Chew hard food ²	40.8	29.9	13.1	16.2	2.95	35.3	30.4	13.1	21.2	2.80
24. Eat without help ⁷	83.7	12.5	-	3.8	3.76	80.5	14.5	-	5.0	3.71
25. Can read ordinary newspaper text ²	55.3	13.3	10.2	21.3	3.03	48.9	15.2	8.4	27.6	2.85
26. Hear conversation between 3 or more persons ²	22.2	29.7	18.6	29.5	2.45	23.6	27.7	17.3	31.4	2.43
<i>26-item scale score</i>					2.61					2.34

Additional item

27. Take a bath ⁸	45.2	-	8.8	46.0	2.44	32.5	-	15.5	52.0	2.13
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Because response options were not the same for all ADL items we recoded all items into 4 categories (original categories below) and rated them 1 to 4 with the response options being: 1= cannot do, 2= can do with aid or major difficulties, 3= can do with fatigue or minor difficulties, 4= can do without fatigue. The table indicates to which of the 3 functional ability scales the items belonged. We furthermore calculated mean scores for the individual items and for the 3 functional ability scales by taking the average response of the items.

Response categories:

¹1: yes, 2: yes, with fatigue, 3: yes, with aid or with help from a person, 4: no

²1: yes, 2: yes, with minor difficulty, 3: yes, with major difficulty, 4: no

³1: yes, 2: yes, daily or more times a week, 3: one time a week or 2-3 times a month or one time a month, 4: no

⁴1: yes, 2: yes, with fatigue, 4: no

⁵1: yes, 2: yes, with fatigue, 3: yes, help from a person, 4: no

⁶1: yes, 2: yes, with fatigue, 3: yes, with aid, 4: no

⁷1: yes, without help, 2: help to cut bread, 4: no

⁸1: yes, without help, 2: yes, with help to one part of the body, 3: yes, with help to more than one part of the body, 4: no

* Aid is defined as helping equipments or help from a person. Figures in the parentheses states percentage of persons who needs help from another person

Table 4. Percentage of dependent nonagenarians and distribution on the 5-item ADL scale in the Danish 1905-cohort survey*

	Males	Females	Total
<i>Bathing (n=2242)</i>			
All	46.0	52.0	50.4
Non-proxy / Proxy	38.5 / 87.6	42.8 / 85.9	41.6 / 86.2
<i>Dressing (n=2247)</i>			
All	33.2	41.2	39.2
Non-proxy / Proxy	24.4 / 83.1	31.3 / 78.8	29.3 / 79.1
<i>Going to the toilet (n=2262)</i>			
All	18.2	20.5	19.9
Non-proxy / Proxy	11.5 / 54.4	10.8 / 56.4	11.0 / 56.0
<i>Transfer (n=2250)</i>			
All	15.5	19.2	18.3
Non-proxy / Proxy	10.3 / 43.8	10.5 / 51.5	10.5 / 50.0
<i>Feeding (n=2247)</i>			
All	3.8	5.0	4.7
Non-proxy / Proxy	1.0 / 18.9	1.0 / 19.9	1.0 / 19.6
<i>5-item ADL scale (n=2244)</i>			
All			
Not disabled	50.1	40.7	43.1
Moderately disabled	31.3	37.8	36.1
Severely disabled	18.6	21.5	20.8
<i>5-item ADL scale (n=1792/446)</i>			
Non-proxy / Proxy			
Not disabled	57.8 / 7.8	49.0 / 10.1	51.4 / 9.6
Moderately disabled	30.1 / 37.8	39.5 / 31.5	36.9 / 32.7
Severely disabled	12.0 / 54.4	11.5 / 58.4	11.6 / 57.6

* The 5-item ADL scale is formed from the following items in table 3: item 12 (transfer- independent: no help/uses aids, dependent: needs help from a person/cannot perform the task), 13 (toileting- independent: no help/uses aids, dependent: needs help from a person/cannot perform the task), 17, 18,19 (dressing- independent: no help in all 3 items, dependent: needs help from a person/cannot perform the task), 24 (feeding- independent: no help/help to cut the food or butter a slice of bread, dependent: needs help from a person) and item 28 (bathing-independent: no help/help to one part of the body, dependent: needs help from a person or does not take a bath). Definitions of disability level: Not disabled = independent in all items, Moderately disabled = dependent in 1 or 2 items, Severely disabled = dependent in 3,4 or 5 items. Number of persons differs due to missing values.

Table 5. Physical performance tests according to status on the 5- item ADL scale in the Danish 1905-cohort Survey*

	Males				Females			
	Not disabled (n=284)	Moderately disabled (n=148)	Severely disabled (n=59)	All (n=491)	Not disabled (n=641)	Moderately disabled (n=516)	Severely disabled (n=150)	All (n=1307)
Max. handgrip (kg)-mean (SD)	24.6 (6.1)	21.3 (6.0)	16.1 (5.1)	22.8 (6.5)	14.8 (4.2)	12.3 (4.4)	10.0 (4.1)	13.4 (4.5)
Unable to complete test	1.8%	8.1%	16.9%	5.5%	3.6%	10.5%	30.7%	9.4%
Walking speed (m/sec)-mean (SD)	0.71 (0.27)	0.50 (0.21)	0.40 (0.28)	0.64 (0.28)	0.60 (0.25)	0.42 (0.20)	0.29(0.14)	0.52 (0.25)
Unable to complete test	6.3%	23.0%	88.1%	21.2%	9.4%	22.3%	82.7%	22.9%
Flexibility-tests (score) [†] -mean (SD)	11.0 (1.9)	9.4 (2.8)	6.5 (3.7)	10.1 (2.7)	10.9 (1.9)	8.9 (3.2)	5.8 (3.8)	9.7 (3.1)
Unable to complete tests	1.1%	6.7%	30.5%	6.3%	2.8%	7.1%	29.3%	7.5%
Strength-tests (score) [‡] - mean (SD)	4.7 (0.5)	4.1 (0.9)	2.6 (1.3)	4.3 (1.0)	4.4 (0.9)	3.5 (1.2)	1.8 (1.4)	3.7 (1.3)
Unable to complete tests	1.1%	4.7%	8.4%	3.1%	1.2%	3.2%	8.6%	2.9%

* Missing data on 18 persons

† 0 = No points in any item, 12 = maximal points in all items; see Table 1

‡ 0 = No points in any item, 5 = maximal points in all items; see Table 1

Table 6. Subjective health variables according to status on the 5- item ADL scale in the Danish 1905-cohort survey*

	Males				Females			
	Not disabled (n=284) %	Moderately disabled (n=148) %	Severely disabled (n=59) %	All (n=491) %	Not disabled (n=641) %	Moderately disabled (n=516) %	Severely disabled (n=150) %	All (n=1307) %
<i>How do you consider your health in general?</i> [†]								
Excellent/good	64.4	48.6	39.0	56.6	67.2	46.5	36.0	55.4
Acceptable	30.3	39.2	32.2	33.2	27.9	37.8	39.3	33.1
Poor/very poor	5.3	12.2	28.8	10.2	4.9	15.7	24.7	11.4
<i>Are you satisfied with life at present?</i> [‡]								
Always/mostly	78.9	67.3	52.5	72.2	82.8	70.2	55.0	74.6
Now and then	13.7	21.8	23.7	17.3	10.8	19.5	24.8	15.8
No	7.4	10.9	23.7	10.4	6.4	10.3	20.1	9.5
<i>Do you feel well enough to do what you want?</i> [§]								
Always/mostly	66.5	35.8	20.3	51.7	58.7	32.0	14.0	43.0
Now and then	17.3	25.0	13.6	19.1	24.0	25.4	19.3	24.0
No	16.2	39.2	66.1	29.1	17.3	42.6	66.7	33.0

*Only non-proxy data included

[†]Missing data on 12 persons[‡]Missing data on 16 persons[§]Missing data on 13 persons