

# Onset of mobility disability among community-dwelling old men and women. The role of tiredness in daily activities

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## Abstract

**Background:** in the primary prevention of disability among older adults it might be useful to identify individuals at high risk for functional decline before it occurs.

**Objective:** to examine whether tiredness in daily activities is an independent determinant of onset of mobility disability at 1½-year follow-up among non-disabled older men and women.

**Design:** a prospective study with 1½-year follow-up.

**Setting:** 34 communities in four counties in Denmark.

**Subjects:** 1396 older non-disabled adults (74–75 and 80 years old) living in 17 of the participating communities.

**Methods:** questionnaire surveys at baseline and at 1½-year follow-up. Tiredness in daily activities was measured by questions about tiredness in six mobility activities. Onset of mobility disability was measured as onset of need for help in one to six mobility activities.

**Results:** men and women who felt tired in their daily activities at baseline had a higher risk of onset of mobility disability at 1½-year follow-up, when adjusted by the covariates. In addition, low social participation, poor psychological function, and physical inactivity were independent risk factors of onset of mobility disability among men, and home help, low sense of coherence and physical inactivity were independent risk factors of onset of mobility disability among women.

**Conclusion:** older people who complain about tiredness are at higher risk of becoming disabled than others. This highlights the need for alertness and management of this early sign of functional decline in a preventive perspective.

**Keywords:** *tiredness, disability, mobility, functional decline, ageing*

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## Introduction

Persons approaching old age wish to preserve autonomy. At the same time disability has important consequences for society because it is associated with excess health care utilisation, nursing home placement and large burdens for the families.

A major obstacle to preventing disability is its multifactorial nature, including physiological, psychological and social risk factors [1]. Consequently, targeting one single risk factor may have little value [2]. An alternative approach could be to target directly common factors that increase the risk of disability, regardless of specific causes. In primary prevention of disability among non-disabled older people it might be useful to identify individuals at high risk for functional decline before it actually occurs by characterising

an early functional state that is associated with later disability.

Longitudinal studies from Denmark and Finland have shown that self-reported tiredness in daily activities is associated with onset of disability at five-year follow-up when adjusted by various health factors, socio-demographic factors, social relations, health behaviour, and depressive symptoms [3, 4]. However, it is not known whether tiredness influences disability over shorter follow-up periods, or whether the results are influenced by the use of medication or by psychological factors, such as feelings of control and sense of coherence.

The purpose of this article is to examine whether self-reported tiredness in daily activities is an independent determinant of onset of mobility disability at 1½-year follow-up among non-disabled elderly men and women.

## Methods

### Study population

The data are from The Danish Intervention Study on Preventive Home Visits, the main aim of which was to examine whether preventive home visits to elderly people enhance active life expectancy if carried out in a systematic and standardised way [5]. The study is a randomised controlled intervention study with randomisation and intervention at community level and outcome measured among the elderly people living in those communities.

The baseline study, performed October 1998–January 1999, included all non-institutionalised citizens born in 1918 (80 years old) or 1923/1924 (74–75 years old) in 34 communities in four counties in Denmark ( $n = 4060$ ). Follow-up data were collected after 1½ and 3 years. The present analyses are restricted to data from the baseline and the 1½-year follow-up study in the control communities ( $n = 1956$ ). To select an initially non-disabled cohort, we excluded 458 persons who reported needing help with transferring, walking indoors, going outdoors, walking outdoors in nice weather and poor weather, and climbing stairs ( $n = 1498$ ). At 1½-year follow-up 38 persons had died and 64 surviving subjects did not want to participate. After exclusions, the study population for this investigation consisted of 1396 older adults (participation rate among survivors: 96%).

### Variables

The outcome measure, *onset of mobility disability*, was measured by the Mobility-Help (Mob-H) Scale. We asked whether the participants were in need of help to transfer, walk indoors, go outdoors, walk outdoors in nice weather, walk outdoors in poor weather, and climb stairs [6]. The scale counts the number of activities managed without help. High scale value thus describes better function. Onset of disability is defined as incidence of need of help in one or more activities during 1½-year follow-up. This cut-off point was chosen because of the clinical relevance for the older people being able to manage without help. The key determinant, *tiredness in daily activities*, was measured by The Mobility-Tiredness (Mob-T) Scale, which includes the same six mobility activities. We asked whether the participant felt tired after performing the activities. The scale counts the number of activities where the participants reported no tiredness. High scale score thus describes better function. In the present analyses we combine persons who feel tired in 4–6 and 1–3 activities, because of fewer persons in some of the categories.

Reliability tests on the Mob-H Scale showed agreement percents from 98.1 to 1.0 and kappa values from 0.94 to 1.0 for the included items on intra-rater and inter-rater tests [7]. With regard to the Mob-T Scale reliability tests showed agreement percents from 88.9 to 1.0 and kappa values from 0.55 to 0.96 for the included items on intra-rater and inter-rater tests [7]. The construct validity

of the included items has been tested by the Rasch model of item analysis on data from the 70-year-old study in Glostrup [8] and on data from the 75-year study in Glostrup [6]. Analyses of criterion-related validity concluded that mobility as measured by the scales was strongly associated with diagnosed disease [9], isometric muscle strength [10], simple function tests [10] and postural balance [11].

### Covariates

The following factors known to influence both the determinant and the outcome measures are included as potential confounders, all measured at baseline:

*Age:* 80 versus 74–75 years old.

*Health factors:* *Disability* in Activities of Daily Living measured by the PADL-H Scale (which includes comb hair, wash upper body, use the toilet, dress upper body, dress lower body, wash lower body, take shoes/stockings on/off, cut fingernails, cut toenails [6]): need help in one or more activities versus no help. *Falls* measured by a question about falls within the last 6 months: yes/no. *Home help* at the moment: yes/no.

*Use of medication* measured by registration at the pharmacy of prescribed reimbursable drugs during the first year of the study period. The drugs are listed in accordance with the international anatomical-therapeutic-chemical (ATC) classification system.

*Social relations:* *Diversity in social relations:* number of categories with whom you have personal contact at least once a week: children, grandchildren/great-grandchildren, siblings, other relatives, friends/acquaintances (range 0–5): high (4–5) versus low (0–3) different network categories every week. *Social participation:* three items about 1) paying weekly visits to others, 2) receiving weekly visits at home, and 3) participating in weekly social activities outside the home (range 0–3): low (0–1 points) versus high (2–3 points). Studies of reliability and validity revealed satisfactory results for the used measures of social relations [12, 13].

*Psychological resources:* *Psychological function* measured by three questions about 1) feeling down, 2) being aggressive, and 3) feeling tired – without specific reason: often or sometimes versus seldom or never. *Sense of coherence* by three questions about sense of manageability, meaningfulness and comprehensibility: usually versus sometimes or not [14]. *Self-rated control over own life:* most often versus sometimes or never.

*Physical activity by two questions:* 1) Do you practise any kinds of light physical activity (e.g. light garden work, short walks, short bicycle trips, housework)? 2) Do you practise any kinds of heavy physical activity (e.g. sports, exercises, dance, long bicycle trips, long walks)? There were five response categories from ‘no, never’ to ‘yes, several times per week’. We distinguish persons with 1) heavy physical activity several times per week, 2) only light physical activity several times per week, and 3) not physically active several times weekly.

**Ethics**

The Ethical Committee of the regions involved approved the study. Written informed consent was obtained from all participants.

**Statistical analysis**

The analyses included chi-square test and multivariate logistic regression analysis. The SAS procedure PROBIT was used for all logistic regression analyses.

**Results**

Table 1 shows that the majority of non-disabled persons did not feel tired in any activities at baseline, with a gender difference in favour of men. With regard to the other factors women had higher rates of disability in ADL, more falls, poorer psychological resources, and less strenuous physical activity compared to men, while the men had lower social participation and less light physical activity compared to women.

Table 2 shows the associations between tiredness in daily activities at baseline and onset of mobility disability, death and non-participation at 1½-year follow-up. Tiredness was significantly related to onset of disability among both men and women.

**Table 1.** Tiredness in daily activities (measured by the Mob-T Scale) and other characteristics at baseline among non-disabled men and women

	Men (n = 648)	Women (n = 748)	P
Tired in 4–6 activities	5%	7%	
Tired in 1–3 activities	13%	18%	
Not tired	82%	76%	0.011
80 years	75%	76%	
74–75 years	25%	24%	0.874
Disability in ADL	15%	24%	0.001
Home help	8%	12%	0.012
Falls the last 6 months	9%	14%	0.002
Use of medicine			
>4 prescribed drugs	36%	39%	0.241
1–4 prescribed drugs	47%	47%	
No drugs	16%	14%	
Low social diversity	45%	43%	0.387
Low social participation	55%	43%	0.001
Poor psychological function	34%	41%	0.007
Low sense of coherence	53%	49%	0.096
Low control over own life	2%	4%	0.008
Physical activity			
No activity	22%	17%	0.001
Light activity	42%	54%	
Strenuous activity	36%	30%	

P = Pearson's chi-square test for equal distribution between men and women.

**Table 2.** Onset of mobility disability, death and non-participation from baseline to 1½-year follow-up among non-disabled men and women by tiredness in daily activities at baseline

	Tired in 4–6 activities (n) %	Tired in 1–3 activities (n) %	Not tired (n) %	P-value
Men				
Sustained no disability	(22) 56%	(64) 70%	(502) 86%	
Onset of disability	(11) 28%	(18) 20%	(31) 5%	0.001
Dead	(3) 8%	(3) 3%	(20) 3%	
Non-participants	(3) 8%	(7) 8%	(29) 5%	
Women				
Sustained no disability	(33) 63%	(94) 68%	(520) 88%	
Onset of disability	(16) 31%	(39) 28%	(46) 8%	0.001
Dead	(1) 2%	(2) 1%	(9) 2%	
Non-participants	(2) 4%	(4) 3%	(19) 3%	

P describes Pearson's chi-square tests for equal distribution of tiredness at baseline and onset of disability at follow-up. Chi-square test has not been performed with death and non-participation as outcome because of small numbers in many of the cells.

**Onset of mobility disability**

Table 3 shows the results of the logistic regression analyses among men and women. The crude analyses showed that for men the odds ratios of tiredness in 4–6 activities was 8.1 (3.6–18.2) and of tiredness in 1–3 activities 4.6 (2.4–8.6). The results were adjusted by the covariates, one by one (not in table). The final model included only the variables which influenced the association between tiredness and onset of disability, or which were independently associated with onset of disability (P < 0.20). The result of this was that men who felt tired in their daily activities still had a larger risk of becoming disabled compared to non-tired men. In addition, low social participation, poor psychological function, and physical inactivity were independent risk factors of onset of mobility disability.

For women the crude analyses showed that the odds ratios of tiredness in 4–6 activities were 5.5 (2.8–10.7) and of tiredness in 1–3 activities, 4.7 (2.9–7.6). The odds ratios were not influenced by age and use of medication, but they decreased when adjusted by the other factors. The final model showed that women who felt tired in their daily activities had a much larger risk of becoming disabled compared to non-tired persons. In addition, receiving home help, low sense of coherence and physical inactivity were independent risk factors of onset of mobility disability.

It did not change the results when the covariates were entered in the model without dichotomisation.

**Discussion**

The major finding is that tiredness in daily activities among old people is an independent determinant of

**Table 3.** Odd ratios (95% confidence intervals) of onset of mobility disability at 1½-year follow-up by logistic regression analysis

	Men ( <i>n</i> = 648)		Women ( <i>n</i> = 748)	
	Crude	Final model <sup>a</sup>	Crude	Final model <sup>a</sup>
Tired in 4–6 activities	<b>8.1 (3.6–18.2)</b>	2.3 (0.9–6.0)	<b>5.5 (2.8–10.7)</b>	<b>3.1 (1.5–6.5)</b>
Tired in 1–3 activities	<b>4.6 (2.4–8.6)</b>	<b>2.2 (1.1–4.4)</b>	<b>4.7 (2.9–7.6)</b>	<b>3.9 (2.3–6.6)</b>
80 years/74–75 years	1.5 (0.9–2.7)	–	<b>1.7 (1.1–2.7)</b>	–
Disability in ADL/no disability	<b>2.3 (1.2–4.3)</b>	1.5 (0.7–3.0)	<b>2.9 (1.9–4.5)</b>	1.6 (0.95–2.7)
Home help: yes/no	<b>2.4 (1.1–5.2)</b>	1.0 (0.4–2.4)	<b>4.0 (2.4–6.8)</b>	<b>1.9 (1.0–3.6)</b>
Falls/no falls	2.1 (0.99–4.6)	1.9 (0.8–4.6)	<b>2.3 (1.4–3.9)</b>	1.7 (0.96–3.2)
Use of medicine				
>4 prescribed drugs/no drugs	<b>4.2 (1.6–10.9)</b>	2.4 (0.9–6.8)	<b>3.0 (1.3–6.8)</b>	1.9 (0.8–4.5)
1–4 prescribed drugs/no drugs	1.2 (0.4–3.2)	0.9 (0.3–2.6)	1.6 (0.7–3.7)	1.6 (0.6–3.8)
Social diversity:				
Low/high	1.7 (0.97–2.8)	–	1.3 (0.8–1.9)	–
Social participation:				
Low/high	<b>2.4 (1.3–4.3)</b>	<b>1.9 (1.0–3.7)</b>	1.3 (0.8–2.0)	–
Psychological function:				
poor/good	<b>4.1 (2.4–7.2)</b>	<b>2.4 (1.3–4.4)</b>	<b>1.7 (1.1–2.6)</b>	–
Sense of coherence:				
Low/high	<b>2.1 (1.2–3.7)</b>	1.4 (0.8–2.6)	<b>2.3 (1.5–3.6)</b>	<b>1.7 (1.0–2.7)</b>
Control over own life:				
Low/high	3.4 (0.9–12.8)	0.7 (0.1–3.9)	<b>3.0 (1.3–7.0)</b>	1.2 (0.4–3.3)
Physical activity				
No activity/strenuous activity	<b>5.0 (2.4–10.8)</b>	<b>2.9 (1.2–6.7)</b>	<b>5.8 (3.0–11.3)</b>	<b>4.2 (2.0–8.7)</b>
Light activity/strenuous activity	<b>2.2 (1.0–4.7)</b>	1.6 (0.7–3.6)	<b>2.2 (1.2–4.1)</b>	1.6 (0.8–3.0)

<sup>a</sup>Adjusted by the variables which in the intermediate models were related to the outcome ( $P < 0.20$ ) or which attenuated the association between tiredness and onset of mobility disability.

Significant associations ( $P < 0.05$ ) are shown with bold type.

onset of mobility disability at 1½-year follow-up. These tired persons represent a vulnerable subpopulation of older people who are at larger risk of onset of disability. In other study populations we have shown that tiredness in daily activities is a strong determinant of onset of disability at five-year follow-up [4], hospitalisation [15], home help [15] and mortality [16]. Thus we have identified a subgroup of independent elderly people who are at risk of becoming disabled and thereby confirmed earlier findings.

These findings support the concept of pre-clinical disability [17], an early state characterised by the development of early functional limitations that are not clinically evident. A few studies have demonstrated that poor performance on tests of physical skills is strongly associated with subsequent disability among old adults [18,19], that self-reported difficulty with ADL is predictive of onset of dependence [20, 21], and that self-report of modification of method of doing a task is an independent and strong risk factor of incident mobility disability [17]. The questions of tiredness in daily activities may represent an alternative basis for identifying those at risk of functional decline.

If tiredness in daily activities is used as an early ‘trigger’ in prevention of disability, it is important to be aware that causes of tiredness are multi-factorial, including

physiological, psychological and social risk factors [1]. General fatigue may occur as a result of disease progression and/or as a result of aging-related biologic changes, e.g. immunological abnormalities [22], aerobic work capacity [23], loss of potassium from muscle cells [24], pulmonary function [25]. But it has become evident that general fatigue has also emotional, behavioural and cognitive components [26]. More specifically, with regard to the present measure of tiredness, we have found that tiredness in daily activities is related to 1) physiological factors, e.g. chronic diseases [9]; high blood pressure [9]; glucose intolerance [9]; poor aerobic work capacity [27]; poor muscle strength [10]; poor balance [11]; functional limitations [10]; 2) psychological factors, e.g. cognitive function [28]; depressed mood and poor well-being [29], 3) social position [3, 29]; weak social relations [29]; and 4) behavioural factors, e.g. no physical activity [10, 29]. All these factors should be considered when a person reports tiredness in daily activities.

It is of special interest that women had higher prevalence of tiredness in daily activities and higher incidence of disability than men. This is in agreement with other studies [30, 31] and may have several explanations. It is possible that sex differences in the underlying disablement

process play a role. It is known that, compared to men, women have higher rates of disabling, non-fatal chronic diseases. Contrary to this, men have higher rates of common fatal diseases, and thus are more likely to die from these diseases before disabling chronic conditions can progress to disability in old age [32]. It is also possible that sex differences in co-morbidity rates and in constitutional factors related to body composition play a role in explaining the gender differences in early and actual disability. Body compositional factors may also explain why women who feel tired seem to have higher risks of onset of disability compared to men. Many common tasks that are critical for independence such as walking and climbing stairs, require the same amount of reserve capacities across gender and women are typically closer to the threshold levels of onset of disability than men [33].

The study has both strengths and limitations. The analyses are based on a large, representative community-based sample of older people and the participation rate was very high at follow-up. The results were the same when we repeated the analyses with the subjects who died as part of the outcome measure, hereby taking the possible selection bias due to deaths into account [34].

The strength of the study is that the analyses included well-validated measures of tiredness in daily activities, actual disability and of social relations [6–11,13]. In a couple of years we will be able to obtain register data on diagnosed diseases in the study population, but at present it is not possible to adjust the findings by actual diseases. However, we do think that the information about actual disability in ADL, home help, falls, and use of medication captures most of the possible diseases in the study population. The variable of prescribed medicine is unique in that it is based on precise and detailed information from a pharmaceutical register on a community-based sample of elders. However, with the present data, it is not possible to sort out the reasons why use of more than four prescribed drugs influences the association between tiredness and onset of mobility disability. This may be because of the severity of the underlying diseases and/or because of side effects of the medicine.

### Implications

The present findings indicate that tiredness in daily activities is an important risk factor for onset of mobility disability. Consequently questions about tiredness in daily activities may be used to identify non-disabled individuals at high risk of functional decline. This group may have the largest benefits from preventive interventions, as persons with mild disability are more likely to improve than persons with substantial disability [35, 36]. Such interventions might take the form of identifying the underlying causes, justifying rehabilitation, treatment of a possible underlying disease, and promoting empowering strategies.

### Key points

- Tiredness in daily activities is an important risk factor for onset of mobility disability.
- Questions about tiredness in daily activities may be used to identify non-disabled individuals at high risk of functional decline.

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